VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Draft Environmental Impact Report/ Environmental Impact Statement
SCH No. 2013032001

Prepared for
City of Daly City
National Park Service

April 2016

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D207036.01

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Draft EIR/EIS

Vista Grande Drainage Basin Improvement Project

The City of Daly City (Daly City), as the Lead Agency under the California Environmental Quality Act (CEQA), and the National Park Service (NPS), as the Lead Agency under the National Environmental Policy Act (NEPA) have prepared a Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) evaluating the environmental impacts of, and alternatives to, the proposed Vista Grande Drainage Basin Improvement Project (Project).

The proposed Project would improve stormwater drainage and minimize flooding risk, provide a water source for Lake Merced management, improve recreational access and reduce litter deposition at the beach below Fort Funston, and maximize the use of existing infrastructure and rights-of-way. The Project has the following components:

- Improvements within the Vista Grande Basin storm drain system upstream of the Vista Grande Canal (Canal);
- Partial replacement of the existing Canal to incorporate a gross solid screening device, a constructed treatment wetland, and diversion and discharge structures to route some stormwater (and authorized non-stormwater) flows from the Canal to Lake Merced and to allow lake water to be used for summer treatment wetland maintenance;
- Modification of the existing effluent gravity pipeline so that it may be used year round to convey treated effluent from the nearby North San Mateo County Sanitation District Wastewater Treatment Plant (WWTP) to the existing outlet and diffuser by gravity, and abandoning the force main pipeline;
- Modification of the existing lake overflow structure to include an adjustable weir and siphon that allows water from the lake to flow into the Canal and Vista Grande Tunnel (Tunnel);
- Replacement of the existing Tunnel to expand its hydraulic capacity and extend its operating lifetime and replacement of the Lake Merced Portal to the Tunnel; and
- Replacement of the existing Ocean Outlet structure and a portion of the existing 33-inch submarine outfall pipeline that crosses the beach at Fort Funston.

Operational components of the Project would include management of water surface elevations in Lake Merced and a Lake Management Plan that includes operations and water quality monitoring protocols. In addition, the Project includes NPS execution of a special use permit for construction activities within Golden Gate National Recreation Area (GGNRA) lands and the expansion of the right-of-way to accommodate the replacement Ocean Outlet structure.

In addition to the proposed Project, this EIR/EIS considers two action alternatives consisting of variations of the design and siting of Project components, and one No Project/No Action alternative.

- The Tunnel Alignment Alternative would replace the proposed Project's Tunnel improvement and Lake Merced (East) Portal components with an entirely new tunnel approximately up to 50 feet to the south of the existing Tunnel in an alignment to be determined following additional geotechnical investigation, and a different east portal at a location that would be determined by the final alignment. The new tunnel would run west from a new east portal at the existing Canal to a new or rehabilitated Ocean Outlet structure. The components of the Tunnel Alignment Alternative could be paired with the proposed Canal components, or could be paired with the alternative Canal components described for the Canal Configuration Alternative.
- The Canal Configuration Alternative would minimize changes to the existing Canal while still allowing for some discharges to Lake Merced. This alternative would relocate the diversion structure described for the proposed Project to the southern (upstream) end of the Canal and relocate the box culvert close to the southern end of Impound Lake. The diversion structure would replace the first approximately 350 feet of the Canal, and the rest of the Canal would be unchanged except as needed for the Lake Merced Tunnel Portal. Furthermore, the wetland cell size would be reduced compared to the proposed Project design. The components of the Canal Configuration Alternative could be paired with the proposed Tunnel or with the alternative Tunnel and East Portal components described for the Tunnel Alignment Alternative.

- The No Project/No Action Alternative would not construct any physical component of the proposed Project and none of the proposed operational changes to stormwater routing would be made. The Lake Management Plan would not be implemented, and the NPS would not grant a special use permit.

Analysis of environmental impacts associated with the proposed Project identified potentially significant impacts in the following areas: aesthetics, air quality, biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrology and water quality, noise and vibration, paleontological resources, and transportation and traffic. Growth inducement potential and cumulative impacts are also addressed in the Draft EIR/EIS. For environmental impacts determined to be significant or potentially significant, mitigation measures have been identified to reduce those impacts. No mitigation would reduce significant and unavoidable impacts to the historic Canal and Tunnel.

The Draft EIR/EIS, prepared pursuant to CEQA and NEPA, is available for public review at the Daly City Office of the City Clerk, and at the Westlake Branch of the Daly City Public Library (275 Southgate Avenue, Daly City) and the Merced Branch of the San Francisco Public Library (155 Winston Drive, San Francisco).

PUBLIC MEETING: Daly City will hold a Public Meeting to provide an opportunity for the public and regulatory agencies to learn about the Project and be informed about how to submit comments on the adequacy and accuracy of the Draft EIR/EIS on May 26, 2016: 7:00 p.m. to 9:00 p.m. at the City Council Chambers, 333 90th Street, Daly City, CA.

PUBLIC REVIEW PERIOD: All comments on the Draft EIR/EIS must be received by July 1, 2016 to receive written responses from the lead agencies in the Final EIR/EIS. Submit comments in writing to:

City of Daly City, Department of Water and Wastewater Resources
Attention: Patrick Sweetland, Director
153 Lake Merced Blvd.
Daly City, CA 94015
E-mail: psweetland@dalycity.org

DECISION PROCESS: Following the public review period and responses to comments on the Draft EIR/EIS, Daly City will issue a Notice of Availability (NOA) of the Final EIR/EIS and publish the Final EIR/EIS. Daly City then will consider whether to certify the EIR and approve the Project. It is noted that Daly City may consider approval of the Project, or an alternative to the Project within the range of alternatives considered. Concurrently, the NPS will submit the Final EIR/EIS to the USEPA and publish a NOA in the Federal Register. No fewer than 30 days after publication of that NOA, the NPS will issue a Record of Decision (ROD) for the Project.

EXECUTIVE SUMMARY

ES.1 Project Overview and Background

The City of Daly City (Daly City) is proposing the Vista Grande Drainage Basin Improvement Project (Project) to address storm-related flooding in the Vista Grande Drainage Basin (Basin) while providing the additional benefit of augmenting the water level of Lake Merced. The Vista Grande storm drain system drains the northwestern portion of Daly City and an unincorporated portion of San Mateo County – areas originally within the watershed of Lake Merced. In the 1890s, the Vista Grande Canal and Tunnel were built to divert stormwater away from the lake to an outlet at the Pacific Ocean. The Ocean Outlet and a portion of the Tunnel are located within Fort Funston, part of the Golden Gate National Recreation Area (GGNRA), which is operated under the authority of the National Park Service (NPS). The existing Canal and Tunnel do not have adequate hydraulic capacity to convey peak storm flows, and this periodically causes backup of Tunnel flows into the Canal and flooding during peak storm events in adjacent low-lying residential areas and along John Muir Drive.

As noted, the proposed Project has two primary, mutually supporting objectives: to address storm-related flooding that periodically occurs as a result of inadequate storm drainage capacity in Daly City's Vista Grande Canal and Tunnel, and to augment water surface levels and manage water quality in San Francisco's Lake Merced. Both Daly City and San Francisco independently are proposing to address these respective issues. The proposed Project and alternatives meeting these objectives represent an approach that would jointly address both jurisdictions' proposed improvements while minimizing disturbance, maximizing the beneficial reuse of stormwater, and reconnecting a significant portion of the Lake Merced watershed to Lake Merced.

ES.2 Agency Roles and Objectives

ES.2.1 CEQA Project Objectives

Daly City has identified the following objectives for the proposed Project:

- Improve stormwater drainage of the lower Vista Grande Basin to accommodate peak flows generated by the 25-year design storm;
- Provide a sustainable source of stormwater, establish a target maximum water surface elevation, and implement a Lake Management Plan (see Appendix A) for management of Lake Merced water quality, groundwater, and surface water elevation;

- Improve recreational access and reduce litter transfer and deposition along the beach below Fort Funston; and
- Maximize use of existing rights-of-way (ROWs), easements, and infrastructure to minimize construction-related costs, habitat disturbance, and disruption to recreational users.

ES.2.2 National Park Service Federal Action

The federal action NPS is considering is whether to approve, approve with conditions, or deny Daly City's application for a special use permit for construction of the Tunnel and associated structures (e.g., Ocean Outlet and wing walls), and staging areas within NPS land; whether to amend existing easement(s) to accommodate the proposed expanded Tunnel and associated structures within the easement(s) and to clarify the rights and obligations of the parties to the easement(s); and possibly whether to issue a right-of-way permit or other authorization to accommodate any portions of the Project that lie outside of the easement(s) (e.g., wing walls).

The purpose and need for the Project is to alleviate flooding in the Vista Grande Drainage Basin and Canal and provide a sustainable source of water for management of Lake Merced water levels and quality, and to ensure that the portion of the Project within federally managed lands, if authorized, is constructed, operated, and maintained in a manner that is consistent with the protection and enhancement of resources, values, and uses of lands and waters under federal jurisdiction. In considering whether to authorize such activities, the federal government needs to engage in transparent, integrated, and informed decision-making and ensure that any final decision conforms to applicable laws and regulations. In achieving the purpose and need for the Project, NPS's objectives for implementation of the Project include the following:

- Avoid, minimize, or mitigate environmental impacts to park natural and cultural resources;
- During construction, ensure the health and safety of park visitors and staff, maintain access to and through Fort Funston, and minimize impacts to the visitor experience;
- Permanently improve public access along the beach below Fort Funston; and
- Minimize impacts on park assets and sustain or restore all park assets (e.g., facilities, features, grounds) to pre-construction or better conditions.

ES.3 Proposed Project and Alternatives

ES.3.1 Comparison of Alternatives

In addition to the proposed Project, this EIR/EIS considers two action alternatives consisting of variations on the design and siting of Project components, and one No Project/No Action alternative. Each of the following is described in detail in Chapter 2, *Project and Alternatives*:

Proposed Project. The proposed Project would consist of improvements within the Vista Grande Basin storm drain system upstream of the Vista Grande Canal; partial replacement of the existing Canal to incorporate a gross solid screening device, an approximately 2.6-acre constructed treatment wetland, and diversion and discharge structures to route some stormwater (and authorized non-stormwater) flows from the Canal to Lake Merced and to allow lake water to be used for summer treatment wetland maintenance; modification of the existing effluent gravity pipeline so that it may be used year round to convey treated effluent from the nearby North San Mateo County Sanitation District Wastewater Treatment Plant (WWTP) to the existing outlet and diffuser by gravity, and abandoning the force main pipeline; modification of the existing lake overflow structure to include an adjustable weir and siphon that allows water from the lake to flow into the Canal and Vista Grande Tunnel; replacement of the existing Tunnel to expand its hydraulic capacity and extend its operating lifetime and replacement of the Lake Merced Portal to the Tunnel; and replacement of the existing Ocean Outlet structure and a portion of the existing 33-inch submarine outfall pipeline that crosses the beach at Fort Funston. Operational components of the Project would include management of water surface elevations in Lake Merced and a Lake Management Plan that would include water quality best management practices, including upstream improvements in the Basin and additional actions, the implementation of which may be triggered during post-Project monitoring. In addition, the Project includes NPS execution of a special use permit for construction activities within GGNRA lands and the expansion of the ROW to accommodate the replacement Ocean Outlet structure.

Tunnel Alignment Alternative. The Tunnel Alignment Alternative would replace the proposed Project's Tunnel improvement and Lake Merced (East) Portal components with an entirely new tunnel up to approximately 50 feet to the south of the existing Tunnel in an alignment to be determined following additional geotechnical investigation, and a different east portal at a location that would be determined by the final alignment. The new tunnel would run west from a new east portal at the existing Canal to a new or rehabilitated Ocean Outlet structure. The components of the Tunnel Alignment Alternative could be paired with the proposed Canal components, or could be paired with the alternative Canal components described for the Canal Configuration Alternative.

Canal Configuration Alternative. The Canal Configuration Alternative would minimize changes to the existing Canal while still allowing for some discharges to Lake Merced. This alternative would not construct the box culvert replacing the first 1,000 feet of the Canal; rather, the diversion structure described for the proposed Project would be relocated to the southern (upstream) end of the Canal. The box culvert under John Muir Drive also would be relocated and would cross under John Muir Drive close to the southern end of the Canal. The design of the diversion structure, box culvert under John Muir Drive, and Lake Merced Outlet would be approximately the same as for the proposed Project. The diversion structure would replace the first approximately 350 feet of the Canal, and the rest of the Canal would be unchanged except as needed for the Lake Merced Tunnel Portal. Under the Canal Configuration Alternative, one wetland cell of approximately 1.7 acres would be constructed, providing a reduced water treatment capacity compared to the Project. The components of the Canal Configuration Alternative could be paired with the proposed Tunnel or could be paired with the alternative Tunnel and East Portal components described for the Tunnel Alignment Alternative.

No Project/No Action Alternative. Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and none of the proposed operational changes to stormwater routing would be made. The Lake Management Plan would not be implemented. The NPS would not grant the special use permit, and no construction could occur within NPS-managed lands. Annual Canal sediment removal activities would continue, as well as as-needed maintenance activities. Because Canal and Tunnel capacity would not be improved, occasional flooding of the Canal and associated flooding of John Muir Drive into Lake Merced and in local neighborhoods would continue.

ES.3.2 CEQA Environmentally Superior Alternative and NEPA Lead Agency Preferred Alternative

CEQA Guidelines Section 15126.6(e)(2) requires an EIR to identify an environmentally superior alternative. If the environmentally superior alternative is the No Project/No Action Alternative, the EIR also must identify an environmentally superior alternative from among the other alternatives. In general, the environmentally superior alternative is defined as that alternative with the least adverse impacts to the project area and its surrounding environment.

The No Project/No Action Alternative would avoid all impacts of the Project and would not create any new significant impacts of its own. However, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Basin would continue to flood during storm events, resulting in flooding of residential areas along John Muir Drive. The CEQA Guidelines define the environmentally superior alternative as that alternative with the least adverse impacts to the project area and its surrounding environment. Determining an environmentally superior alternative is difficult because of the many factors that must be balanced. Although this Draft EIR/EIS preliminarily identifies an environmentally superior alternative, it is possible that, with additional information received in or developed during the project approval process, Daly City could choose to balance the importance of each impact area differently or reach a different conclusion. Daly City preliminarily has identified the proposed Project as the environmentally superior alternative.

Under NEPA, the “preferred alternative” is a preliminary indication of the Lead Agency’s preference of action among the Proposed Action and alternatives. A NEPA Lead Agency may select a preferred alternative for a variety of reasons, including the agency’s priorities, in addition to the environmental considerations discussed in the EIS. Although the Lead Agency may identify a preferred alternative in the Draft EIS, the NPS has not yet identified its preference of action among the Proposed Action and alternatives, and will identify the preferred alternative in the Final EIR/EIS in accordance with NEPA (40 CFR 1502.14(e)).

ES.4 Environmental Analysis

Table ES-1 summarizes the environmental impacts of the alternatives compared to those of the proposed Project under CEQA. This table presents the significant impacts of the proposed Project as well as less-than-significant impacts whose severity would be different under the alternatives than under the proposed Project. Table ES-1 does not include less-than-significant impacts of the proposed Project that would have the same significance determination and/or impact severity as those of the Canal Configuration Alternative or Tunnel Alignment Alternative. Similarly, **Table ES-2** summarizes the environmental impacts that would occur as a result of the proposed Project and alternatives by environmental impact under NEPA. The focus of the table is on moderate to major adverse effects, but also lists some minor and negligible effects as well.

ES.5 Areas of Controversy

Comments were received during the scoping process for the Project. The scoping process is described and public input received during that process is provided in Appendix B, *Scoping Memorandum*. Based on input received from agencies, members of the public and others, areas of controversy related to the Project include:

Aesthetics: Concerns related to changes in views from the beach at Fort Funston associated with the Ocean Outlet structure. The long-term visual effects of the rehabilitated Ocean Outlet structure are expected be beneficial as described in Section 3.2, Aesthetics.

Biological Resources: Concerns related to impacts on fish in Lake Merced and on special-status plants and wildlife, and impacts associated with raising lake water levels. See Section 3.4, Biological Resources.

Cultural Resources: Concerns associated with the loss of historic structures (e.g., Vista Grande Canal and Tunnel system). See Section 3.5, Cultural Resources.

Hydrology and Water Quality: Concerns associated with water quality in Lake Merced, and with maintaining Lake Merced surface water levels. See Section 3.9, Hydrology and Water Quality. In addition, concerns with maintaining Lake Merced surface water levels under the proposed project, while the SFPUC's San Francisco Groundwater Supply Project and Groundwater Storage and Recovery Project are under operation, influencing the underlying groundwater basin. See Section 3.9.6.4, discussing the cumulative operational effects of these projects on lake levels.

Recreation: Concerns related to public uses of the Project area, particularly Fort Funston and Lake Merced, and the potential impacts of the Project on public uses such as boating, swimming, surfing, and bird watching. See Section 3.13, Recreation.

TABLE ES-1
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Aesthetics				
Day and Nighttime Views	**Impact AES-3:** Project construction could result in a new source of substantial light or glare that would adversely affect day or nighttime views in the area. It is anticipated that tunneling activities could occur 24 hours per day in two to three shifts, and construction of the replacement pipe section and piers on the beach would necessitate 24-hour work over a period of several days to one week. Construction would create a new temporary source of nighttime lighting in the immediate area and the light and glare effects from Project construction could be substantial. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would include the same types of temporary aboveground components and activities during construction as the proposed Project, and the methods and duration required to construct the Tunnel Alignment Alternative would be similar to the Tunnel portion of the proposed Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct the Canal Configuration Alternative would not change compared to the proposed Project. (Less than Significant with Mitigation)	**No Impact** No physical component of the proposed Project would be constructed, and there would be no impacts to aesthetic resources. (No Impact)
Scenic Vista, Scenic Resource, Visual Character, and Visual Quality	**Impact AES-2:** Project operation would not result in a substantial adverse impact on a scenic vista, scenic resource, or on the visual character or quality of the site or its surroundings. The design character of the treatment wetland cells would integrate the treatment wetlands and associated infrastructure with the existing visual environment of the Project site. The Project would reduce the contrast of the Ocean Outlet and the surrounding scenery to a moderately low level by reducing the size of the structure and would provide better views of the area. Approximately every 25 years, the Ocean Outlet would be reconstructed and appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure. (Less than Significant)	**Increased** If a new ocean outlet location is selected, a third outlet structure (in addition to the existing Ocean Outlet structure and SFPUC's outlet structure) would be present along the beach and toe of the cliff below Fort Funston within an area of approximately 150 feet or less. This would increase the overall level of visual contrast in this location and would not provide the benefit of removing an obstruction to views. Visual conditions would remain similar to existing conditions in the vicinity of the existing outlet structure; with an additional outlet that would be moved as bluff erosion continues, as under the proposed Project. (Less than Significant)	**Similar** The design character of the treatment wetland cell would integrate the treatment wetland and associated infrastructure with the existing visual environment of the Project site. (Less than Significant)	**No Impact** Ongoing periodic maintenance activities would not be noticeable or intrude on the visual character and quality of the Project area. Future uncontrolled flood events could damage public facilities and private properties in the vicinity of Lake Merced, which could degrade the visual character and quality of the area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Air Quality				
Air Quality Standards	**Impact AIR-1:** The Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Without appropriate dust controls, dust emissions generated within federally administered areas could contribute to the SFBAAB's existing PM10 and PM2.5 non-attainment status, a potentially significant impact. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would have similar construction characteristics of the Project. The construction methods and duration to construct this alternative would not change compared to the Tunnel portion of the Project, except that a micro tunnel boring machine would be used in place of a mini excavator. (Less than Significant with Mitigation)	**Decreased** The Canal Configuration Alternative would have many similar construction characteristics of the Project. The construction methods for Canal Configuration Alternative would not change compared to the Project, except that the collection box and box culvert would not be constructed. (Less than Significant with Mitigation)	**No Impact** No construction emissions would be generated by this alternative. Regarding operational emissions, there would be no changes to the existing operations of the project site. (No Impact)
Cumulative Emissions Impacts	**Impact AIR-2:** The Project could result in a cumulatively considerable net increase of ozone, PM10, or PM2.5 (for which the SFBAAB is in non-attainment), including releasing emissions which exceed quantitative thresholds for ozone precursors. Construction activities would result in cumulatively significant fugitive dust emissions. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would have similar construction characteristics of the Project. (Less than Significant with Mitigation)	**Similar** The Canal Configuration Alternative would have many similar construction characteristics and nearly identical methods as the Project. (Less than Significant with Mitigation)	**No Impact** No construction emissions would be generated and operational emissions would not change. (No Impact)
Biological Resources				
Special-Status Plant Species	**Impact BIO-1:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on plant species identified as sensitive or special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Project construction activities including materials and equipment staging at multiple sites within at Fort Funston associated with the Vista Grande Tunnel and Ocean Outlet replacement, maintenance on and use of the Avalon Canyon Road beach access route, and construction of the Impound Lake discharge structure could result in impacts to special-status plant populations and their supporting vegetation communities. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive and special-status plant species and sensitive vegetation communities are expected. Similar to the Project, potential impacts to special-status plants and the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status plant species and sensitive vegetation communities are expected. Like with the Project, potential impacts to special-status plants and the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to sensitive natural and special-status plants in the study area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Special-Status Reptile Species	**Impact BIO-2:** Project construction could have a substantial adverse effect either directly or through habitat modifications, on reptile species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could adversely affect the western pond turtle by direct mortality, should it be present, which would be a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status animal species are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status animal species are expected. Like the Project, construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could adversely affect western pond turtle. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status reptile species in the study area. (No Impact)
Migratory Bird Species and Special-Status Bird Species	**Impact BIO-3:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on migratory birds and/or on bird species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Construction activities could disrupt birds attempting to nest in the vicinity of the Project site, disrupt parental foraging activity, or displace mated pairs with territories in the Project vicinity. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on migratory and special-status bird species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to this alternative would not change substantially compared to the proposed Project, and similar impacts on migratory and special-status bird species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status bird species in the study area. (No Impact)
Special-Status Bat Species	**Impact BIO-4:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on bats identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Clearing vegetation (including trees) and removing structures in support of Project construction could result in direct mortality of special-status bats roosting in tree cavities, under bark, and in structures within the	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on bat species are expected. Adverse effects on special status bats associated with tree removal and structure modification would be similar to the Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on bat species are expected. Adverse effects on special-status bats associated with tree removal and structure modification would be similar to the Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status bat species in the study area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Special-Status Bat Species (cont.)	Project site. Direct mortality of special-status bats would be a significant impact. Additionally, common bats may establish maternity roosts in these same locations which are protected under CEQA. (Less than Significant with Mitigation)			
Central Dune Scrub	**Impact BIO-5:** Project construction could have a substantial adverse effect on central dune scrub, a sensitive natural community identified by the CDFW. Impacts to central dune scrub are expected to occur during Project-related improvements to the Avalon Canyon access road and through use of the proposed staging area at Fort Funston where approximately 0.497-acre of central dune scrub is present on the eastern and southern boundaries. In addition, restored central dune scrub has been established near Impound Lake where the outlet structure is proposed; however, the Project facilities are not located in areas where central dune scrub has been mapped. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Similar to the Project, removal of central dune scrub vegetation would be considered a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Like with the Project, potential impacts to the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to a sensitive natural community in the study area. (No Impact)
Upland Vegetation Communities	**Impact BIO-6:** Project construction would not have a substantial adverse effect on upland vegetation communities identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. Trees that may be impacted by the Project during construction occur in an area managed by the San Francisco Department of Public Works (SFDPW) or located on San Francisco owned land. Such areas are subject to Article 16, Section 808 of the Public Works Code as designated street or significant trees. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on upland vegetation communities are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on upland vegetation communities are expected. During construction, trees could be removed within the Project area during construction. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to an upland vegetation community in the study area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Sensitive Communities	**Impact BIO-7:** Construction of the Project would have a substantial adverse effect on sensitive communities identified in local or regional plans, policies, regulations, or by CDFW or USFWS through the introduction or spread of invasive plants. Project construction activities could contribute to the spread of invasive plants and introduce new invasive plants to the study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events which would be a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Like with the Project, work areas, staging areas, and access roads cleared of non-sensitive upland vegetation could contribute to the spread of invasive plants and introduce new invasive plants to the Project study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to a sensitive community in the study area. (No Impact)
Wetlands and Other Jurisdictional Waters	**Impact BIO-8:** Project construction could have a substantial adverse effect on wetlands and other jurisdictional waters. Project impacts to these potential jurisdictional features would involve temporary and permanent discharges of structures and/or fill within waters and wetlands, and/or alterations of the bed and/or banks of a lake or stream, to accommodate Project activities. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on potential federally jurisdictional wetlands and other waters are expected. As under the Project, there are no impacts to potential jurisdictional features from the tunnel component itself. Impacts to potential jurisdictional waters associated with rehabilitating the existing Ocean Outlet would not exceed those described under the Project. (Less than Significant with Mitigation)	**Decreased** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on potential federally jurisdictional wetlands and other waters are expected. Impacts to potential jurisdictional wetlands and waters associated with constructing the new facilities at Lake Merced would be less than those described under the Project due to the reduced modifications to the Canal. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to wetlands and other jurisdictional waters in the study area. (No Impact)
Native Resident Fish Species	**Impact BIO-9:** Construction of the Project could impede movement of native resident fish species. A variety of common fish species reside in Lake Merced and could be adversely affected by in-water work at the lake associated with the Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on fish species are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on fish species are expected. Like the Project, construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could adversely affect common fish species. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to fish species in the study area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Native Resident or Migratory Species	**Impact BIO-10:** Construction of the Project could interfere substantially with the movement of native resident or migratory species or with established native resident or migratory corridors, or impede the use of nursery sites. Construction activities associated with the Ocean Outlet and the submarine outfall on Ocean Beach and those associated with the Fort Funston tunnel shaft staging and work area could adversely impact birds migrating along the Pacific Flyway and nearby resident wildlife with the introduction of night lighting into an otherwise dark environment. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on resident and migratory species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on resident species, migratory species, and wildlife nursery sites are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding bird season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to resident species, migratory species, and wildlife nursery sites in the study area. (No Impact)
Lake Merced Plant Species	**Impact BIO-12:** Project operation could adversely affect central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrub, and Vancouver rye grassland associated with Lake Merced. Loss of central dune scrub would be less than 1 percent under the Project and canyon live oak would be unaffected. Wax myrtle scrub would be unaffected by increased lake levels up to 9 feet City Datum but would incur a 12.50 percent loss at a 10 feet City Datum WSE, which would be considered significant. Thimbleberry scrub occurs above 13 feet City Datum and would not be inundated by rising water surface elevations under any scenario. Vancouver rye grassland would incur losses below 10 percent with an increase in lake levels up through 9 feet City Datum but would experience significant impacts at 10 feet where there would be a 46.15 percent loss (i.e., if the target maximum of 9.5 WSE was selected). (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would not change operational impacts on special-status plant species associated with Project implementation. (Less than Significant with Mitigation)	**Similar** Operation of the Canal Configuration Alternative would result in similar impacts on special-status plant species as the proposed Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status plant species in the study area. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Lake Merced Wildlife	**Impact BIO-15:** Project operation could adversely affect native wildlife nursery sites associated with Lake Merced. Water level increases above 9 feet City Datum under the Project that persist for more than one month (i.e., with a target maximum WSE of 9.5 feet) would result in the change in habitat attributed to the Project in excess of 10 percent which would be considered a significant impact on these wildlife nursery sites. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would not change operational impacts on wildlife nursery sites associated with Project implementation. (Less than Significant with Mitigation)	**Increased** Operation of the Canal Configuration Alternative would result in similar impacts on wildlife nursery sites as the proposed Project. A smaller treatment wetland would offer 0.4 acre less habitat to wildlife than the treatment wetlands proposed under the Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to wildlife nursery sites in the study area. (No Impact)
Cultural and Paleontological Resources				
Historical Resource	**Impact CUL-1:** The Project would cause a substantial adverse change in the significance of a historical resource because it would demolish the majority of the historic Vista Grande Canal and Tunnel. Construction would substantially affect the vast majority of the historic Vista Grande Canal and Tunnel as an entire drainage system. (Significant and Unavoidable)	**Decreased** The Canal improvements under the proposed Project paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel system as a whole, though less than the proposed Project. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel as a whole. (Significant and Unavoidable)	**Decreased** The Tunnel improvements under the proposed Project paired with the Canal Configuration Alternative would have an adverse impact on most of the Vista Grande Canal and Tunnel system as a whole, though less than the proposed Project. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel as a whole. (Significant and Unavoidable)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)
Archaeological Resource	**Impact CUL-2:** The Project could cause a substantial adverse change in the significance of an archaeological resource, including shipwrecks. While unlikely, ground-disturbing activities could expose and cause impacts on unknown archaeological resources or shipwrecks, which would be a potentially significant impact. The existing outlet is approximately 900 feet north of the shipwreck remains. (Less than Significant with Mitigation)	**Increased** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown archaeological resources. The Ocean Outlet structure associated with the Tunnel Alignment Alternative could be slightly closer to the 1882 schooner Neptune that wrecked in 1900 than the proposed Project. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown archaeological resources. (Less than Significant with Mitigation)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Cultural and Paleontological Resources (cont.)				
Human Remains	**Impact CUL-3:** Project construction could disturb human remains. Project construction could result in direct impacts to previously undiscovered human remains during earthmoving activities. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover human remains. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover human remains. (Less than Significant with Mitigation)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)
Geology and Soils				
People and Structures	**Impact GEO-1:** Construction, operation, and maintenance of the Project could expose people or structures to potential substantial adverse effects involving strong seismic ground shaking and/or seismic-related ground failure. Holocene slip was observed in trench exposures of the Serra Fault and geotechnical investigation concluded there is a high potential for rupture as a result of faulting within the proposed tunnels alignment. Groundshaking during an earthquake in the Project area has the potential to be strong, with peak ground acceleration around 0.6 g, which could result in significant groundshaking effects on the proposed facilities. Also, seismic damage due to liquefaction and related phenomena could occur along the pipeline and at other facilities. In particular, the new tunnel portal and Lake Merced overflow inlet are planned in an area of potentially liquefiable soil. (Less than Significant with Mitigation)	**Similar** As with the Project, structural damage to facilities could occur as a result of strong seismic groundshaking. As with the Project, the Tunnel Alignment Alternative also has the potential for seismic-related ground failure resulting from liquefaction and lateral spreading. (Less than Significant with Mitigation)	**Similar** Structural damage to facilities could occur as a result of strong seismic groundshaking and/or seismic-related ground failure. As with the Project, the Canal Configuration Alternative has the potential to encounter liquefaction and lateral spreading. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Soil Erosion and Loss of Topsoil	**Impact GEO-2:** The Project could result in substantial soil erosion or the loss of topsoil. Construction activities such as excavating, trenching, and grading can remove stabilizing vegetation and expose areas of loose soil that, if not properly stabilized during construction, can be subject to erosion by wind and stormwater runoff, potentially	**Similar** As with the Project, the Tunnel Alignment Alternative construction could result in erosion from wind and stormwater runoff. (Less than Significant with Mitigation)	**Similar** As with the Project, the Canal Configuration Alternative construction could result in erosion from wind and stormwater runoff. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. Daly City would continue to use the existing ocean outlet structure at Fort Funston which would continue to contribute to erosion of the cliff

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Geology and Soils (cont.)				
Soil Erosion and Loss of Topsoil (cont.)	resulting in a significant impact with respect to soils. Also, during operation of the project, erosion and improper water flow could occur within the retaining wall backdrain systems if they are not properly maintained. (Less than Significant with Mitigation)			face where it is located. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Unstable Soil	**Impact GEO-3:** The Project may be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project. The outlet structure is in an area where the potential for shallow or wedge failures up to about 10 to 15 feet thick under static conditions is moderate to high. During large seismic events, the potential for relatively large-scale landsliding is high. In addition, there is landslide potential at Avalon Canyon which would provide beach access during construction of the outlet structure. (Less than Significant with Mitigation)	**Similar** As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. (Less than Significant with Mitigation)	**Similar** As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Life and Property	**Impact GEO-4:** The proposed Project would not create substantial risks to life or property due to expansive or corrosive soils. Project area soils have a mild to moderate corrosion potential which could corrode the micropiles. (Less than Significant with Mitigation)	**Similar** Like with the Project, the area soils have a mild to moderate corrosion potential. (Less than Significant with Mitigation)	**Similar** As with the Project, the area soils have a mild to moderate corrosion potential. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Hazards and Hazardous Materials				
Public and Environment	**Impact HAZ-2:** Project construction could result in a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Lead is a known contaminant within 0.25 mile of the Project site. During construction, ground-disturbing activities could unearth UXO, which would pose a safety risk to workers on-site. (Less than Significant with Mitigation)	**Similar** Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils or groundwater or to UXO. (Less than Significant with Mitigation)	**Similar** Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils, or groundwater. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hazards and Hazardous Materials (cont.)				
Emergency Response Plan and Emergency Evacuation Plan	**Impact HAZ-3:** Project construction would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Construction could affect the availability of travel lanes when construction occurs within or adjacent to John Muir Drive, due to the presence of large, slow-moving trucks that may cause delays. These delays could interfere with implementation of the Emergency Response Plan, which would be a significant impact. (Less than Significant with Mitigation)	**Similar** Construction activities associated with the Tunnel Alignment Alternative would result in impacts on emergency access similar to those identified for the Project. (Less than Significant with Mitigation)	**Similar** Like the Project, construction could interfere or disrupt the evacuation route along John Muir Drive, as identified in San Francisco's Emergency Response Plan, due to the presence of large, slow-moving trucks that may cause delays. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards. (No Impact)
Hydrology and Water Quality				
Water Quality Standards	**Impact HYD-1:** Project construction could violate water quality standards and/or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality. Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake and of the Lake Merced overflow structure in South Lake could result in discharges of pollutants to Lake Merced directly, resulting in substantial water quality effects. (Less than Significant with Mitigation)	**Similar** The construction methods and duration to construct this alternative would not substantially differ as compared to the Tunnel portion of the proposed Project, and impacts associated with the Canal portion would either be identical to the proposed Project or the Canal Configuration Alternative. (Less than Significant with Mitigation)	**Similar** As with the proposed Project, construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no construction related water quality impacts would occur. (No Impact)
Alteration of Coastal Landforms or Processes	**Impact HYD-9:** The Project could conflict with plans, policies, or regulations related to alteration of coastal landforms or processes adopted for the purpose of avoiding or mitigating an environmental effect. The alteration of coastal processes would result in a potentially significant impact relating to coastal processes such as bluff retreat and alterations to the beach profile. In addition, the proposed Project could conflict with California Coastal Act Sections 30235 and 30253 and/or NPS Management Policies (described in Section 3.9.2.1) should bluff erosion rates an patterns alter as a result of the proposed d Project, including a local decrease of the	**Similar** Under this alternative, the new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to connect to the existing Ocean Outlet location is selected, construction and long-term maintenance of the Ocean Outlet structure would be as described for the proposed Project. However, under this alternative, a new tunnel would be constructed to meet the terminus of the existing tunnel at the current extent of the bluff face. As the bluff recedes, both the existing abandoned-	**Similar** Impacts associated with the Canal portion would either be identical to the proposed Project or the Tunnel Alignment Alternative. (Significant and Unavoidable)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no alteration of coastal processes or conflicts with plans, policies, or regulations would occur. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hydrology and Water Quality (cont.)				
Alteration of Coastal Landforms or Processes (cont.)	sediment availability at the site due to diminished sand supply. (Significant and Unavoidable)	in-place tunnel and the new tunnel would become exposed, resulting in an adverse effect related to alterations of coastal landforms and coastal processes. Also, the exposure and rehabilitation of structures under this alternative could conflict with the California Coastal Act Section 30235 and 30253 and/or NPS Management Policies. (Significant and Unavoidable)		
Land Use				
Land Use Policies	**Impact LU-1:** The Project could be inconsistent with some of the sub-policies of the Coastal Act and with portions of the NPS Management Policies regarding coastal processes. (Significant and Unavoidable)	**Increased** The development of a new tunnel and potentially a new Ocean Outlet to the south of the existing structures may conflict with NPS Management Policies for coastal processes by introducing new developments in an area subject to wave erosion or active shoreline processes when a practicable alternative. (Significant and Unavoidable)	**Similar** Impacts associated with the Canal portion would either be identical to the proposed Project or the Tunnel Alignment Alternative. (Significant and Unavoidable)	**No Impact** Because the Project would not be implemented, no potential conflict with the Coastal Act or NPS Management Policies would occur. (No Impact)
Noise and Vibration				
Temporary Noise	**Impact NOI-1:** Project construction could temporarily expose persons to or generate noise levels in excess of local noise ordinances or create a substantial temporary increase in ambient noise levels. (Less than Significant with Mitigation)	**Similar** The location of the tunnel shaft would be somewhat farther from the nearest sensitive receptor compared to Tunnel portion of the Project. However, the location of the Lake Merced Portal would be farther from the nearest residential receiver than under the proposed Project. (Less than Significant with Mitigation)	**Increased** **Impact ALT-NOI-1:** This alternative would not construct a collection box and box culvert, which would reduce the duration of construction activity. However, it would decrease the distance between the location of impact pile driving and the nearest residential receptors, resulting in noise levels up to 82 dBA and exceeding the 70 dBA Leq speech interference threshold for greater than two weeks. A noise reduction of at least 12 dBA may not be achieved with mitigation, and, therefore noise impacts associated with construction-related activities could remain significant. (Potentially Significant and Unavoidable)	**No Impact** Because no new construction would occur under the No Project/No Action Alternative, no construction noise would be generated by this alternative, which would result in no impact. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Noise and Vibration (cont.)				
Groundborne Vibration and Noise Levels	**Impact NOI-2:** Project construction could result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. The vibration levels at the Missile Assembly Building in Fort Funston would be above the FTA's building damage threshold for susceptible buildings. (Less than Significant with Mitigation)	**Increased** The nearest vibration-sensitive receiver to the where pile driving activities would take place is the Mission Assembly Building located in Fort Funston. The vibration levels would be above both the FTA's construction vibration and building damage thresholds for historic land uses. (Less than Significant with Mitigation)	**Increased** **Impact ALT-NOI-2:** Project-related vibration levels at the nearest residential building located approximately 200 feet south-east from the John Muir Drive crossing and diversion structure would remain significant and unavoidable after mitigation. (Significant and Unavoidable)	**No Impact** Because no new construction would occur under the No Project/No Action Alternative, no ground-borne vibration would be generated by this alternative, which would result in no impact. (No Impact)
Paleontological Resources				
Paleontological Resource, Paleontological Site, Unique Geological Feature	**Impact PAL-1:** The Project would directly or indirectly destroy a unique paleontological resource or site or unique geological feature. Because new disturbance would occur within geologic units with moderate to high potential for paleontological resources, potentially significant fossils could be adversely affected during construction, particularly within the Merced Formation. Furthermore, ground-disturbing activities could expose and cause impacts on unknown paleontological resources, which would be a potentially significant impact. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. (Less than Significant with Mitigation)	**No Impact** Because no new construction or ground-disturbing activities would occur under the No Project/No Action Alternative, undiscovered paleontological resources would not be encountered. (No Impact)
Transportation and Traffic				
Plans, Ordinances, and Policies	**Impact TRA-1:** Project construction would cause temporary increases in traffic volumes on area roadways, which could cause substantial conflicts with the performance of the circulation system, but would not conflict with applicable plans, ordinances, or policies pertaining to the performance of the circulation system. The increased local congestion/delay and potential conflicts involving Project trucks is considered to be a significant impact. (Less than Significant with Mitigation)	**Similar** Similar to the Project, the increase in traffic volume on local roads would be noticeable, especially due to the slower movements of trucks compared to passenger vehicles, and the increased local congestion/delay and potential conflicts involving trucks is considered to be a significant impact. (Less than Significant with Mitigation)	**Decreased** Daily traffic generated by construction workers and haul/delivery trucks accessing the work site would be somewhat less than for the proposed Project. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. (No Impact)

TABLE ES-1 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Transportation and Traffic (cont.)				
Designated Haul Routes	**Impact TRA-5:** Project construction would result in increased wear-and-tear on the designated haul routes. The wear-and-tear effects on road conditions and driving safety is considered to be a significant impact. Local streets (e.g., Avalon Drive and Fort Funston Road) generally are not built with a pavement thickness that will withstand substantial truck traffic volumes. (Less than Significant with Mitigation)	**Similar** Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a significant impact. (Less than Significant with Mitigation)	**Similar** Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could significantly affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a significant impact. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. (No Impact)

TABLE ES-2
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Aesthetics	The extended presence of construction equipment and activities at the Fort Funston staging area would be readily noticeable from passive recreation areas adjacent to this site and from trails. Also, views of the dunes in this area would be temporarily replaced by equipment and fencing. Furthermore, construction activities on the beach would be visible to hang gliders passing overhead. Mitigation would reduce visual intrusion of construction activities and equipment, so as to result in a short-term, minor adverse effect on scenic quality. The visual impacts from temporary demolition and construction impacts from restoring the Ocean Outlet and Tunnel approximately every 25 years would be similar to those described for initial demolition of the existing structure and construction of the rehabilitated Ocean Outlet.	Tunnel Alignment Alternative visual resource impacts (construction activities, lighting, and permanent structures) would contribute to visual change in the landscape, particularly related to construction activities at the Fort Funston staging area. With mitigation, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as to result in short-term, minor, adverse effect on scenic quality. Impacts to visual character and views from restoring the Ocean Outlet and Tunnel as well as restoring the abandoned, existing Ocean Outlet would be moderate, site-specific, long-term, and, thus, greater than the proposed Project.	Like the Project, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Thus, there would be a short-term, minor, adverse effect on scenic quality after mitigation.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no impacts to aesthetic resources. Ongoing periodic maintenance activities would not be noticeable or intrude on the visual character and quality of the Project area.
Air Quality	Construction emissions of NOx, ROG, and PM2.5 are estimated to be well under the annual de minimis threshold levels applicable to the Project area The Project therefore would be exempt from General Conformity determination requirements and would have a minor adverse impact on air quality.	The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Consequently, construction emissions would be well under annual de minimis threshold levels applicable to the SFBAAB, and have a minor adverse impact on air quality.	The Canal configuration Alternative would not construct the collection box and box culvert, which would result in a reduced duration of construction activity. Also, truck transport of 40,000 cubic yards of excavated materials and clean fill would no longer be needed as would be needed for the proposed Project. Consequently, construction emissions would be well under annual de minimis threshold levels applicable to the SFBAAB, and have a minor adverse impact on air quality.	Because no new construction would occur under the No Project/No Action Alternative, no construction emissions would be generated by this alternative.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Vegetation	*Construction* Project construction would have short-term, minor adverse impacts on vegetation communities within the Project site. Adverse effects on vegetation would be mitigated through avoidance, minimization, and mitigation measures. *Operation* Project-related lake level increase would have effects on vegetation surrounding Lake Merced that would be measurable or perceptible in elevation at which certain communities are present, but localized in context of the vegetation communities as a whole which surround the lake. Following mitigation, all impacts would be minor, but long-term.	*Construction* Impacts on sensitive natural community plant populations within the Project site are expected to be at most moderate and short-term, and would be minimized with mitigation. *Operation* Same as for the proposed Project.	*Construction* Impacts to vegetation communities within the Project site would be at most minor and short-term, and would be reduced with mitigation. *Operation* Same as for the proposed Project.	With this alternative, there would be no change to vegetation in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.
Potential Federally Jurisdictional Wetlands and Other Waters and Riparian Habitat	*Construction* Moderate temporary permanent impacts to potential federally jurisdictional wetlands and other waters and to riparian habitat would occur as a result of construction of the Lake Merced outlet structure in Impound Lake and installation of the new facilities within the Canal. Temporary impacts would be restored to pre-project conditions. Unavoidable permanent impacts to potentially jurisdictional other waters would include 1,350 linear feet of replacement associated with modifications to the Canal, Unavoidable permanent adverse impacts would be mitigated by on-site or off-site creation, restoration, or enhancement of previously lost or degraded waters, wetlands, and/or riparian habitats, or payment to a mitigation bank for in-kind credits.	*Construction* Same as for the proposed Project. *Operation* Same as for the proposed Project.	*Construction* Moderate temporary permanent impacts to potential federally jurisdictional wetlands and other waters and to riparian habitat would occur as a result of construction of the Lake Merced outlet structure in Impound Lake and installation of the new facilities within the Canal. Temporary impacts would be restored to pre-project conditions. Unavoidable permanent impacts to potentially jurisdictional other waters would include 350 linear feet of replacement associated with modifications to the Canal, Unavoidable permanent adverse impacts would be mitigated as described for the proposed Project. *Operation* Operational impacts related to increasing the water level at Lake Merced would be as described for the proposed Project.	With the No Project/No Action Alternative there would be no change to jurisdictional wetlands or other waters in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Potential Federally Jurisdictional Wetlands and Other Waters and Riparian Habitat (cont.)	*Operation* Project operations would have minor, long-term effects on wetlands resulting from increasing the water level at Lake Merced above existing conditions to a target WSE of 7.5 to 9.5 feet City Datum. Impacts associated with the periodic removal of the protruding tunnel and outlet and reconstruction of the outlet would be moderate and require similar methods described under construction for the proposed Project.			
Terrestrial Wildlife and Aquatic Wildlife	*Construction* Adverse impacts on common terrestrial wildlife are expected and include temporary disturbance of habitat or perhaps the loss of a limited number of individuals of a common species. With mitigation, adverse impacts on common terrestrial and aquatic wildlife would be minor and short-term. *Operation* There would be negligible or minor effects on terrestrial wildlife and aquatic habitat resulting from operation of the Project. Beneficial effects on aquatic habitat would likely occur as a result of the increased water volume available to Lake Merced fish species and the maintenance or improvement of water quality.	*Construction* Same as for the proposed Project or Canal Configuration Alternative. *Operation* Same as for the proposed Project or Canal Configuration Alternative.	*Construction* Impacts to terrestrial wildlife and aquatic wildlife would be at most minor and short-term, and would be reduced with mitigation. *Operation* The alternative would offer less habitat for local wildlife due to the smaller size of the treatment capacity of the wetland cell compared to the Project; however, the increase in open waters of Lake Merced resulting from implementation of this alternative would be similar to the proposed Project.	With the No Project/No Action Alternative there would be no change to terrestrial wildlife and aquatic wildlife in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Special-Status Species	*Construction* Impacts to special-status species such as the Northern coastal scrub communities, Western pond turtles, and various resident and migratory birds would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Adverse effects would be short term and minor, and would be avoided, minimized, or offset by mitigation. *Operation* Rising water levels in Lake Merced resulting from operation of the Project would have minor short-term and long-term effects on special-status plants and animal species in the study area.	*Construction* Like the Project, impacts to special-status plant communities and wildlife would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Adverse effects would be reduced with mitigation. Effects would be at most minor and short-term. *Operation* Same as for the proposed Project.	*Construction* Impacts on special-status species would be at most minor and short-term, and would be reduced with mitigation. Like the Project, impacts to special-status species would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. *Operation* Same as for the proposed Project.	With the No Project/No Action Alternative there would be no change to special-status plants and animals in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.
Cultural Resources	The Project would have a major adverse impact on a historic property (the Vista Grande Canal and Tunnel), even with mitigation. Construction activities could result in a minor to major impact by modifying or altering previously unknown archaeological resources, but the impact would be reduced with mitigation. Impacts to known archeological resources, including the Neptune shipwreck, would be negligible after mitigation.	The Canal improvements under the proposed Project paired with the Tunnel Alignment Alternative would adversely affect approximately 69 percent of the Vista Grande Canal and Tunnel system as a whole. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. The Ocean Outlet structure associated with the Tunnel Alignment Alternative could be closer to the wreckage of the schooner Neptune than the proposed Project. This alternative would have the same adverse effect determinations as the proposed Project.	The Tunnel improvements under the proposed Project paired with the Canal Configuration Alternative would have an adverse impact on 53 percent of the Vista Grande Canal and Tunnel system as a whole. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. This alternative would have the same adverse effect determinations as the proposed Project.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. Therefore, no impact on historical resources and archeological resources would occur.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Geology and Soils	Construction activities would result in exposing areas of loose soil that could be subject to erosion by wind and stormwater runoff, but after mitigation the Project would have minor adverse effects on soil erosion. The Project also has a potential for liquefaction and lateral spreading to occur during seismic events. After mitigation, adverse effects from seismic events would be minor. Furthermore, the potential for landslides in the Project area is relatively high. However, with mitigation, the adverse effects from landslides would be minor.	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative the Project site would continue to experience existing levels of geologic and seismic hazards.
Greenhouse Gas Emissions and Climate Change	The Project would have a minor adverse impact with regard to construction related GHG emissions. Operational GHG emissions would be negligible.	The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Like the Project, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.	Construction emissions under this alternative would be reduced compared to the Project because of the reduced amount of excavation and construction associated with the elimination of the collection box and box culvert. Like the Project, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.	Because no new construction would occur under this alternative, no construction-related GHG emissions would be generated by this alternative, and no changes to existing GHG emissions associated with operation and maintenance activities. Short-term increases in GHG emissions would result from occasional emergency repairs and other activities that would occur during canal flooding.
Hazards and Hazardous Materials	The Project would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Following mitigation, safety risks from encountering unexploded ordnance (UXO) and threats to the public from impeding emergency access, including the Fort Funston area and the evacuation route on John Muir Drive, would be minor.	This alternative would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Following mitigation, safety risks from encountering UXO would be minor.	This alternative would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Similar to the Project, potential human exposure to vector-borne diseases and threats to the public from impeding emergency access, including the evacuation route on John Muir Drive, would be minor.	Under this alternative the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hydrology and Water Quality	Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake and the Lake Merced overflow structure in South Lake could result in discharges of pollutants (sediment) to Lake Merced directly. With implementation of mitigation, Project construction would result in short-term, minor effects to water quality. Also, the proposed Project could result in an adverse effect related to alterations of coastal landforms and coastal processes and could conflict with California Coastal Act Sections 30235 and 30253, even after implementation of mitigation. Following mitigation, the impact could remain moderate to major.	Under this alternative, a new tunnel would be constructed to meet the terminus of the existing tunnel at the current extent of the bluff face. As the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed, resulting in an adverse effect related to alterations of coastal landforms and coastal processes. Also, the exposure and rehabilitation of structures under this alternative could conflict with the California Coastal Act Section 30235 and 30253, even after implementation of mitigation. Following mitigation, the impact could remain moderate to major.	As with the proposed Project, construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly. With mitigation, construction of the alternative would result in minor adverse effects.	Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no adverse effects on water quality, from altering coastal processes, or from conflicting with plans, policies, or regulations would occur.
Land Use and Planning	The Project would have short-term, minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. During operation and maintenance, the Project could conflict with the Coastal Act and/or NPS Management Policies related to coastal processes resulting in a moderate to major impact.	Construction of the Tunnel Alignment Alternative would have short-term, minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. During operation and maintenance, the Project could conflict with the Coastal Act and/or NPS Management Policies related to coastal processes and siting development in areas previously disturbed, resulting in a moderate to major impact.	Same as for the proposed Project or Tunnel Alignment Alternative, depending on the tunnel component selected.	Under this alternative, no physical component of the Project would be constructed. Therefore, there would be no change in land use and no impact to existing land use uses or conflicts with applicable land use plans, policies or regulations.
Noise and Vibration	Noise impacts associated with construction-related activities would result in a short-term, minor adverse impact, and would be reduced with mitigation. After mitigation, vibration impacts associated with construction-related activities, such as at the Missile Assembly Building, would result in a short-term minor adverse impact. Noise impacts associated with operation-related activities would result in a negligible impact.	Like the Project, the Tunnel Alignment Alternative would have a short-term, minor adverse impact with respect to construction noise, and would be reduced with mitigation. Construction vibration impacts and noise impacts associated with operation-related activities from this alternative would have the same impact determination as the proposed Project.	This alternative would have a short-term, minor adverse impact with respect to construction noise. After mitigation, vibration impacts associated with construction-related activities would remain as a short-term, major adverse impact. Noise impacts associated with operation-related activities from this alternative would have the same impact determination as the proposed Project.	Because no new construction would occur under this alternative, no construction noise or ground-borne vibration would be generated by this alternative, which would result in no impact. Noise generated by the operation and maintenance of these components would not change.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Geologic and Paleontological Resources	The loss of up to 16,000 cubic feet of soils within the Colma and Merced Formations would be negligible to minor. After mitigation, the inadvertent discovery of a paleontological resource would result in a negligible impact.	The loss of up to 20,000 cubic feet of soils within the Colma and Merced Formations would be negligible to minor. Paleontological resources impacts would be the same as for the proposed Project.	Same as for the proposed Project.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. Therefore, no impact to geologic and paleontological resources would occur.
Recreation	Due to construction activities, the Project would affect a small area (less than 5 percent) of Fort Funston, and would result in short-term, moderate adverse impacts to recreation at Fort Funston. Operation of the Project would result in long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure.	Like the Project, the Tunnel Alignment Alternative would result in short-term, moderate adverse impacts to recreation associated with construction and long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure.	Like the Project, the Canal Configuration Alternative would result in short-term, minor adverse impacts to recreation.	Under this alternative, no physical component of the proposed Project would be constructed, and there would be no impact to recreation.
Environmental Justice	Given the limited nature of construction-related impacts in terms of both duration and intensity, any disproportionate adverse effect on a minority population would be negligible. Furthermore, disproportionate adverse effects on minority populations associated with odors or mosquitoes would be negligible.	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative, the Project would not be constructed. Therefore, there would be no beneficial effect on minority populations from improved conditions due to reduced flooding and no disproportionate adverse effects on minority populations associated with temporary construction impacts or with odors or mosquitoes due to wetland creation.
Socioeconomics	Any adverse or beneficial socioeconomic effects resulting from reduced flooding due to Project improvements would be minor	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative, the Project would not be constructed. Therefore, there would be no adverse or beneficial socioeconomic effects as a result of reduced flooding.

TABLE ES-2 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Transportation and Traffic	With mitigation, the Project would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads. The Project would have short-term, minor effects on access and negligible effects on parking.	With mitigation, the Tunnel Alignment Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.	With mitigation, the Canal Configuration Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.	Under this alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. However, maintenance activities would continue as well as occasional emergency repairs and other traffic-generating activities when the canal floods.

CHAPTER 1
Introduction

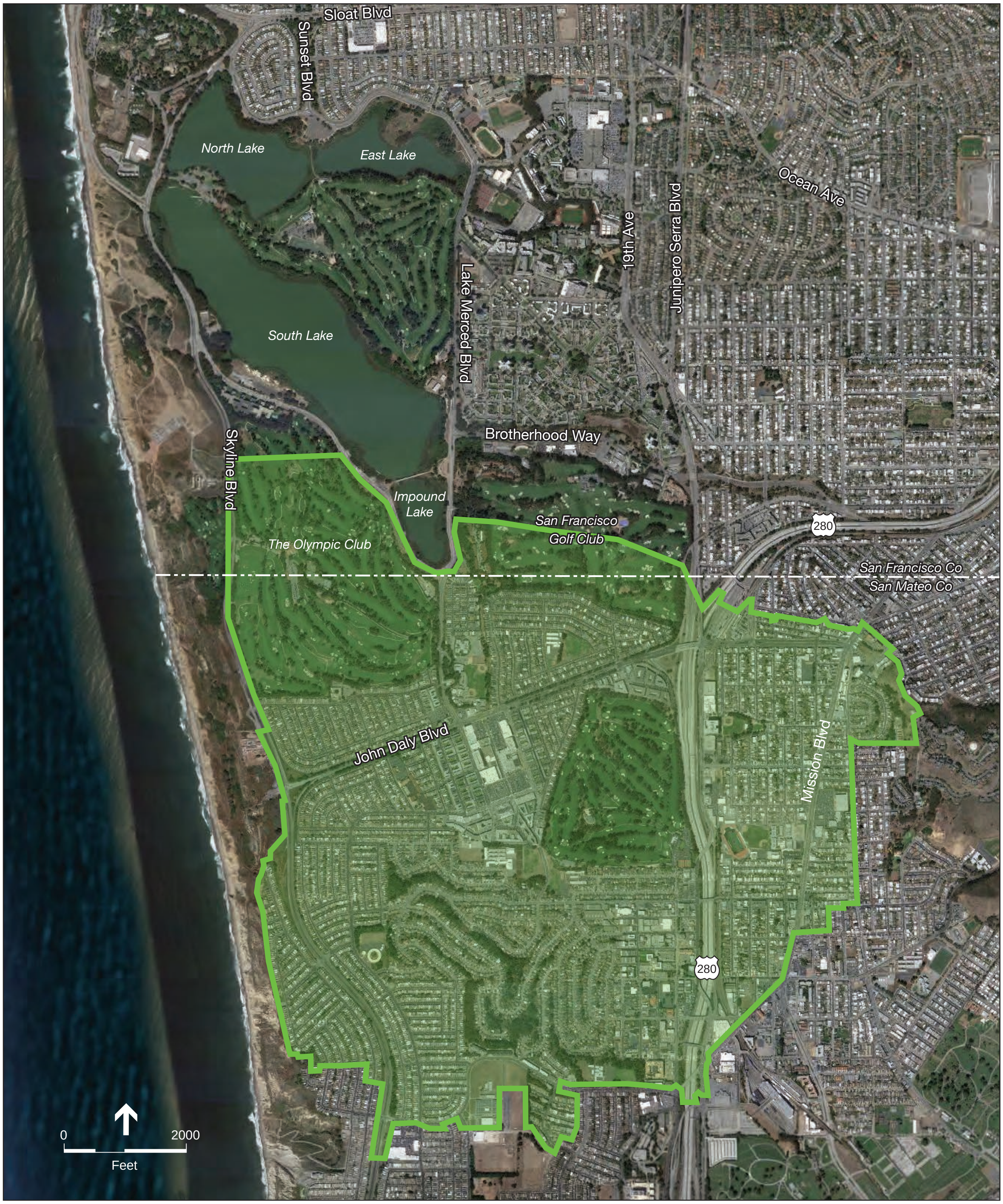
1.1 Project Overview and Background

The City of Daly City (Daly City) is proposing the Vista Grande Drainage Basin Improvement Project (Project) to address storm-related flooding in the Vista Grande Drainage Basin (Basin) while providing the additional benefit of augmenting the water level of Lake Merced. The Vista Grande storm drain system drains the northwestern portion of Daly City and an unincorporated portion of San Mateo County – areas originally within the watershed of Lake Merced. The Basin is shown in Figure 1-1. In the 1890s, the Vista Grande Canal and Tunnel were built to divert stormwater away from the lake to an outlet at the Pacific Ocean. The Ocean Outlet and a portion of the Tunnel are located within Fort Funston, a former U.S. Army installation that currently is part of the Golden Gate National Recreation Area (GGNRA), which is operated under the authority of the National Park Service (NPS). The existing Canal and Tunnel do not have adequate hydraulic capacity to convey peak storm flows, and this periodically causes backup of Tunnel flows into the Canal and flooding during peak storm events in adjacent low-lying residential areas and along John Muir Drive.

As noted, the proposed Project has two primary, mutually supporting objectives: to address storm-related flooding that periodically occurs as a result of inadequate storm drainage capacity in Daly City's Vista Grande Canal and Tunnel, and to augment water surface levels and manage water quality in San Francisco's Lake Merced. Both Daly City and San Francisco independently are proposing to address these respective issues. The proposed Project and alternatives meeting these objectives represent an approach that would jointly address both jurisdictions' proposed improvements while minimizing disturbance, maximizing the beneficial reuse of stormwater, and reconnecting a significant portion of the Lake Merced watershed to Lake Merced.

1.2 Intended Use of the EIR/EIS and Agency Roles, Permits, and Decisions

Daly City and the NPS have determined that that the Project is subject to both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). Compliance with CEQA is required because the Project would be directly undertaken by Daly City and would require numerous state and local permits. Compliance with NEPA is required because the Project would also require federal approvals. Specifically, NEPA would apply to the NPS's issuance of a Special Use Permit for construction-related activities proposed at Fort



SOURCE: McMillen Jacobs Associates

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 1-1
Vista Grande Drainage Basin

Funston; amendment of existing easement(s) to accommodate the proposed expanded Tunnel and associated structures within the easement(s) and to clarify the rights and obligations of the parties to the easement(s); and possible issuance of a right-of-way permit or other authorization to accommodate any portions of the Project that lie outside of the easement(s) (e.g., wing walls). To address the requirements of both CEQA and NEPA, Daly City and NPS have prepared this joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Vista Grande Drainage Basin Improvement Project.

This EIR/EIS has been prepared pursuant to the requirements of the CEQA statute (Pub. Res. Code §21000 et seq.); CEQA Guidelines (14 Cal. Code Regs. §§15000 to 15387); NEPA (42 USC §4341 et seq.); the Council on Environmental Quality (CEQ) NEPA regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); and the NPS NEPA guidelines (Director's Order No.12 and Handbook). Because NEPA and CEQA are somewhat different with regard to procedural and content requirements, the document has been prepared to comply with whichever requirements are more stringent. Daly City is the lead agency for compliance with CEQA, while NPS is the lead federal agency for compliance with NEPA. In accordance with both CEQA and NEPA, the lead agencies have the responsibility for the scope, content, and legal adequacy of the document. Therefore, all aspects of the EIR/EIS scope and process are being coordinated between the agencies. Additionally, because the San Francisco Public Utilities Commission (SFPUC) must take discretionary approval actions over the portions of the Project involving lands or resources under its jurisdiction (e.g., management of Lake Merced water levels and implementation of Lake Management Plan actions in San Francisco), it is a responsible agency under CEQA (CEQA Guidelines §15381).

This joint EIR/EIS is an informational document intended to inform both the decisionmakers and the public of the potentially significant environmental effects associated with the construction, operation, and long-term maintenance of the proposed stormwater management Project. The EIR/EIS also discusses the potential environmental impacts that could result from possible future implementation of actions identified in the Lake Management Plan (see Section 2.6, Project Operation and Lake Level Management), a component of the Project. Should future Lake Management Plan improvements be implemented or any substantial change made to the components of the project, additional CEQA and/or NEPA review could be required if major revision of the analysis found within this EIR/EIS (CEQA Guidelines §15162) is required.

In addition to serving as the basis for Daly City's decision to approve the Project's capital program and construction, this EIR/EIS is intended to cover required environmental review for all permits and approvals needed from the lead agencies, and other federal, state, and local agencies. The following regulatory agency actions and approvals are anticipated to be required:

- National Park Service – Special Use Permit; amended easement(s); possible right-of-way permit or other authorization
- U.S. Army Corps of Engineers – Clean Water Act Section 404 Individual Permit and Rivers and Harbors Act Section 10 Permit

- California Department of Fish and Wildlife – California Fish and Game Code Section 1602 Streambed Alteration Agreement
- California State Parks, Office of Historic Preservation – National Historic Preservation Act Section 106 Consultation
- California State Lands Commission – Amendment to Lease of State Lands
- California Coastal Commission – Issuance of Coastal Development Permit
- San Francisco Bay Regional Water Quality Control Board – Clean Water Act Section 401 Certification/Discharge Permit/Construction General Permit
- San Mateo County – Issuance of Coastal Development Permit and Use Permit
- Daly City – Issuance of Coastal Development Permit and other local discretionary approvals (e.g., grading permit, conditional use permit)
- San Francisco – Issuance of Coastal Development Permit and other local discretionary approvals (e.g., grading permit, conditional use permit)

1.3 Project Objectives and Purpose and Need

Section 15124(b) of the CEQA Guidelines specifies that an EIR shall provide a statement of objectives sought by the proposed Project. Similarly, Section 1502.13 of the NEPA Regulations state that an EIS "…shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." The following subsections describe Daly City's objectives in proposing, and the NPS's purpose and need in responding to a proposal for the Project, as required under CEQA and NEPA.

1.3.1 CEQA Project Objectives

Daly City has identified the following objectives for the proposed Project:

- Improve stormwater drainage of the lower Vista Grande Basin to accommodate peak flows generated by the 25-year/4-hour design storm;
- Provide a sustainable source of stormwater, establish a target maximum water surface elevation, and implement a Lake Management Plan (see Appendix A) for management of Lake Merced water quality, groundwater, and surface water elevation;
- Improve recreational access and reduce litter transfer and deposition along the beach below Fort Funston; and
- Maximize use of existing rights-of-way, easements, and infrastructure to minimize construction-related costs, habitat disturbance, and disruption to recreational users.

1.3.2 NEPA Purpose and Need

The purpose and need for the Project is to alleviate flooding in the Vista Grande Drainage Basin and Canal and provide a sustainable source of water for management of Lake Merced water levels and quality, and to ensure that the portion of the Project within federally managed lands, if authorized, is constructed, operated, and maintained in a manner that is consistent with the protection and enhancement of resources, values, and uses of lands and waters under federal jurisdiction. In considering whether to authorize such activities, the federal government needs to engage in transparent, integrated, and informed decision-making and ensure that any final decision conforms to applicable laws and regulations. In achieving the purpose and need for the Project, NPS's objectives for implementation of the Project include the following:

- Avoid, minimize, or mitigate environmental impacts to park natural and cultural resources;
- During construction, ensure the health and safety of park visitors and staff, maintain access to and through Fort Funston, and minimize impacts to the visitor experience;
- Permanently improve public access along the beach below Fort Funston; and
- Minimize impacts on park assets and sustain or restore all park assets (e.g., facilities, features, grounds) to pre-construction or better conditions.

The federal action NPS is considering is whether to approve, approve with conditions, or deny Daly City's application for a Special Use Permit for the construction, staging and laydown, and access associated with the Tunnel and Ocean Outlet structure within NPS land at Fort Funston; whether to amend the existing easement(s) to accommodate the proposed expanded Tunnel and associated structures within Fort Funston, and to clarify the rights and obligations of the parties to the easement(s), including the dimensions of the easement(s) and of the tunnel; and possibly whether to issue a right-of-way permit or other authorization for any portions of the Project that lie outside of the easement(s) (e.g., wing walls).

1.4 Scoping for the EIR/EIS

Scoping is an early and open process to determine the scope of environmental issues and alternatives to be addressed in a planning document. To focus the analysis for this EIR/EIS, Daly City and NPS identified specific issues (also called "Impact Topics"). Issues were selected for analysis through internal scoping with NPS staff, cooperating agencies, and public scoping as described below. Refer to Chapter 5, Consultation and Coordination, for additional information on public and agency involvement.

The scoping period for the Vista Grande Drainage Basin Improvement Project remained open for 100 days, from February 28, 2013 to June 7, 2013. During that period, the lead agencies held two public meetings, which were attended by approximately 54 people in total. By the close of the comment period, the lead agencies had received 10 comment letters, including four from government agencies, three from a business, one from a civic group, and two from the general public. The scoping process is described more fully in the following paragraphs.

1.4.1 Public Notice of Preparation/Notice of Intent

On February 28, 2013, Daly City issued a joint Notice of Preparation and Notice of Intent (NOP/NOI) to prepare a joint Draft EIR/EIS for the Project. The NOP/NOI described the Project, announced the dates and locations of public meetings in support of the scoping process, and requested comments on the scope of the Draft EIR/EIS by April 26, 2013 (the scoping period was subsequently extended to June 7). Notices were mailed to 183 recipients, including the State Clearinghouse; federal, state, and local agencies; organizations; and individuals. Additionally, Daly City posted notices of a public scoping meeting at the Daly City Department of Water and Wastewater Resources Administration Office, Daly City Office of the City Clerk, and the Westlake and John Daly Libraries. On March 21, 2013, a notice was published in the San Mateo County Times.

On March 4, 2013, the NPS sent an electronic mail (e-mail) message to 1,317 recipients, inviting them to an open house featuring the proposed Project and other projects within the GGNRA. The e-mail message provided a link to Daly City's Vista Grande Project website, where visitors could access the NOP/NOI. Additionally, the NPS posted a notice at various locations within Fort Funston, notifying the public about the Project and Daly City's scoping meeting. The NPS published a NOI to prepare the Draft EIR/EIS in the *Federal Register* on May 8, 2013 (78 FR 26807). The comment period for the NOI published in the *Federal Register* ended on June 7, 2013.

1.4.2 Public Scoping Meetings

The NPS held an open house on March 19, 2013, at the General's Residence in Fort Mason. Several projects and topics were covered at the open house, including the Vista Grande Project. Daly City staff and consultants attended the open house and spoke with attendees about the Project. Approximately 50 members of the public attended the open house. Posters depicting the Project location and proposed components were available for viewing, and copies of the NOP/NOI were made available for attendees. Comment cards were also given to interested attendees to solicit written comments on the scope of the Draft EIR/EIS.

On March 28, 2013, Daly City held a public scoping meeting at the Doelger Senior Center Café/Kitchen to educate members of the public about the Project and to solicit comments on the scope of the Draft EIR/EIS. Four members of the public attended. Oral comments provided by attendees were documented by meeting organizers. All attendees were encouraged to submit written comments and comment cards were made available for that purpose.

1.4.3 Public and Agency Comments on the Notice of Preparation/Notice of Intent

The scoping process presented an opportunity for governmental agencies, organizations, businesses, and the public to provide comments on the issues and scope of the Draft EIR/EIS. During the scoping period, the lead agencies received 10 comment letters. A scoping report summarizing the outcomes of the scoping process, including comments received, and which includes copies of all comment letters received during the scoping period, is included as

Appendix B. As discussed in the report, scoping comments ranged from general suggestions for approaching the impact analysis to more pointed concerns for specific species and the need for specific authorizations from affected public agencies. The majority of comments concerned the Project's potential impacts on biological resources. Key issues raised during the scoping comment period are represented in Section 1.7, *Issues Addressed in the Analysis*, and Chapter 3, *Environmental Analysis.*

1.5 Public Review and Comment

This Draft EIR/EIS will be circulated for a 60-day public comment period, consistent with CEQA Guidelines Section 15105, CEQ NEPA regulations (40 CFR 1506.10), and NPS Director's Order 12 (DO-12) NEPA policies.

The public comment period begins upon the lead agencies' issuance of public notice of Draft EIR/EIS availability, including through the NPS' and USEPA's publication of a Notice of Availability (NOA) for the Draft EIR/EIS in the *Federal Register*. Public comments received during the comment period will be recorded and categorized in order for the lead agencies to prepare responses, which then will be incorporated into the Final EIR/EIS. Where responses to comments require important changes to the EIR/EIS, the body of the text may be revised.

1.6 Final EIR/EIS and Decisionmaking

Following the public review period and responses to comments on the Draft EIR/EIS, Daly City will issue a Notice of Availability (NOA) of the Final EIR/EIS and publish the Final EIR/EIS. Daly City then will consider whether to certify the EIR and approve the Project. It is noted that Daly City may consider approval of the Project, or an alternative to the Project within the range of alternatives considered.

Concurrently, the NPS will submit the Final EIR/EIS to the USEPA and publish a NOA in the Federal Register. No fewer than 30 days after publication of this NOA, the NPS will issue a Record of Decision (ROD) for the Project.

1.7 Issues Addressed in the Analysis

Preliminary issues to be analyzed were identified during the scoping process for the Draft EIR/EIS, and during discussions with regulatory agencies responsible for the actions and approvals defined in Section 1.2, above. These issues largely include the physical, biological, cultural, socioeconomic, and other resources that could be affected by the proposed Project and alternatives. Topical issue areas identified during scoping fall into the following categories:

- **Aesthetics** – Section 3.2 of the EIR/EIS discusses the visual and aesthetic resources of the site and its surroundings, particularly from publicly accessible locations on or near the Project site, and evaluates potential impacts on scenic vistas and scenic resources that could occur as a result of the Project.

- **Biological Resources** – Section 3.4 of the EIR/EIS evaluates potential impacts of the Project on biological resources, such as sensitive habitats and special-status species including, but not limited, to San Francisco spineflower, bank swallow, Western snowy plover, Peregrine falcon, California brown pelican, and San Francisco wallflower. The analysis also addresses potential effects on aquatic habitats associated with diverting flows from the Vista Grande Canal to Lake Merced and raising the lake's water surface elevation for a range of potential target elevations.

- **Cultural Resources** – Section 3.5 of the EIR/EIS describes the Project's potential effects on cultural and archaeological resources. The analysis includes an evaluation of the Project's conformance with standards set by the state and federal historic preservation regulations.

- **Geology and Geologic Resources** – Section 3.6 of the EIR/EIS examines existing geologic and soil conditions within the Project area. Potential impacts evaluated include exposure of people and Project elements to seismic hazards, geologic hazards (such as liquefaction, poor soil conditions, or unstable slopes), and soil erosion. Section 3.12 of the EIR/EIS describes the geologic resources, including paleontological resources, in the Project area and evaluates the impacts of the Project and alternatives on these resources.

- **Greenhouse Gas Emissions and Climate Change** – Section 3.7 of the EIR/EIS describes existing federal, state and local regulations related to greenhouse gases and climate change, quantifies direct and indirect Project-related GHG emissions, examines the Project's contribution to global climate change impacts, and discusses the measures included in the Project to minimize impacts and reduce greenhouse gas emissions.

- **Hazards and Hazardous Materials and Public Health** – Section 3.8 of the EIR/EIS discusses potential hazards and hazardous materials that may be present in the Project area, including hazardous material spills, leaks or cleanups from existing and previous uses, and other public safety issues. The EIR/EIS also evaluates potential impacts from Project-related hazards and hazardous materials releases, including the potential for accidental spills of hazardous materials during Project construction and operation.

- **Hydrology and Water Quality** – Section 3.9 of the EIR/EIS analyzes the Project in light of applicable requirements under the Clean Water Act, state objectives to protect beneficial uses of water bodies, and policies concerning stormwater reuse and water quality. The EIR/EIS evaluates the Project's potential effects concerning erosion and sedimentation during construction, as well as impacts on groundwater levels, flooding, and Lake Merced water quality. This section provides an evaluation of a range of potential target water surface elevations. Finally, the EIR/EIS addresses the effects of removing and replacing the Ocean Outlet structure on the rate and occurrence of coastal erosion and bluff retreat, including the consequences of sea level rise on those processes. Section 3.3, Air Quality, discusses potential odor effects associated with the proposed constructed treatment wetland.

- **Land Use and Planning** – Section 3.10 of the EIR/EIS identifies the land uses and development on and around the Project site. The analysis considers consistency with applicable plans and policies governing land use decisions in the Project area. Potential land use impacts, such as the Project's compatibility with established land uses in the Project area, are also analyzed.

- **Noise and Vibration** – Section 3.11 of the EIR/EIS describes relevant noise policies, regulations, and standards, and discusses noise and vibration levels likely to be generated by Project construction and operation. The EIR/EIS evaluates the potential for Project construction and operation to adversely affect adjacent land uses or violate applicable noise control ordinances. The analysis also evaluates continuous vibrations produced by Project construction (e.g., shaft construction and tunnel excavation) based on the potential to impact sensitive receptors.
- **Recreation** – Section 3.13 of the EIR/EIS describes existing publicly accessible recreational facilities in the Project area and evaluate the impacts of the Project on recreational facilities in surrounding areas including Lake Merced and Fort Funston. The analysis identifies feasible mitigation measures that would reduce any significant recreation impacts of the proposed Project.
- **Transportation** – Section 3.15 of the EIR/EIS discusses the existing circulation network and levels of traffic in the Project vicinity. Potential impacts evaluated include increases in traffic during construction and impacts related to temporary re-routing of John Muir Drive.

1.8 Scope and Organization of the EIR/EIS

This EIR/EIS contains the full range of topics required under both CEQA and NEPA, including a table of contents, summary, purpose and need for the proposed action, description of alternatives, environmental setting, environmental impact analysis for short- and long-term, direct and indirect impacts, as well as cumulative impacts, mitigation measures and monitoring, growth inducing impacts, and significant irreversible changes associated with the Project. The document presents a range of alternatives, which are all evaluated at the same level of detail in the environmental analysis section, as required under NEPA. The type of information to be found in each chapter of the Draft EIR/EIS is described below.

Chapter 1 – Introduction, Purpose and Need

This chapter provides background information for the Project and describes Daly City's Project objectives and the NPS purpose and need for the Project. This chapter also describes the lead and responsible agencies and the intended use of the EIR/EIS.

Chapter 2 – Proposed Action and Alternatives

This chapter describes the proposed Project and alternatives analyzed in the Draft EIR/EIS. Included in this chapter is detailed discussion of proposed Project construction, operation, and maintenance, alternatives carried forward for further analysis, alternatives dismissed from further analysis, a comparison of impacts by alternative, and the CEQA environmentally superior alternative and NEPA lead agency preferred alternative.

Chapter 3 – Environmental Analysis

This chapter describes the environmental and regulatory setting within which Project construction, operation, and maintenance would occur. This chapter also describes possible environmental consequences of the Project. As required by NEPA, the effects of each of alternative are analyzed at an equal level of detail. In addition, the chapter also addresses the cumulative effects of the Project when combination with other projects proposed for the area and/or time.

Chapter 4 – Other CEQA/NEPA Considerations

This chapter includes other impact analyses mandated by CEQA and NEPA guidelines. These include: (1) growth-inducing impacts; (2) energy conservation; (3) significant and unavoidable effects; (4) significant irreversible environmental changes; (5) irreversible and irretrievable commitment of resources; and (6) the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity.

Chapter 5 – Consultation and Coordination

This chapter describes public participation undertaken to date, and additional opportunities that would occur throughout the Draft EIR/EIS process. It also lists agencies and organizations that will receive copies of the Draft EIR/EIS for review and lists the preparers of the document.

Chapter 6 – Acronyms and Abbreviations

This chapter lists and provides the associated meanings of abbreviations and acronyms commonly used in the Draft EIR/EIS.

Chapter 7 – Glossary

This chapter provides definitions for specialized terms related to the Project and associated environmental analysis.

CHAPTER 2
Project and Alternatives

2.1 Introduction

The City of Daly City (Daly City) is proposing the Vista Grande Drainage Basin Improvement Project (Project) to address storm-related flooding in the Vista Grande Drainage Basin (Basin) while providing the additional benefit of augmenting the level of Lake Merced. The Vista Grande storm drain system drains the northwestern portion of Daly City and an unincorporated portion of San Mateo County – areas originally within the watershed of Lake Merced. In the 1890s, the Vista Grande Canal and Tunnel were built to divert stormwater away from the lake to an outlet at the Pacific Ocean, below what is now Fort Funston. The existing Canal and Tunnel do not have adequate hydraulic capacity to convey peak storm flows, and this periodically causes flooding during storm events in adjacent low-lying residential areas and along John Muir Drive. The proposed Project would alleviate this flooding potential, while reconnecting a significant portion of the Lake Merced Watershed to Lake Merced.

The following Sections 2.2 through 2.6 describe the Project location; existing facilities and operations; and proposed Project components, construction methods, and operations (including lake level management). Section 2.7 presents the range of alternatives to the proposed Project that were considered, including those that are carried forward for analysis, including the No Project/No Action alternative, and those alternatives considered but eliminated from further analysis. Section 2.8 presents a comparison of alternatives with respect to environmental impacts, and Section 2.9 presents the environmentally superior alternative as identified under CEQA. Section 2.10 preliminarily identifies the NEPA Lead Agency preferred alternative. Section 2.11 presents a brief overview of all anticipated regulatory requirements, permits, and approvals for the selected alternative/proposed Project.

2.2 Project Location

The Basin (the watershed that drains into the Vista Grande Canal), is located in Daly City and in unincorporated Broadmoor Village in northwestern San Mateo County (see Figure 1-1). This watershed is approximately 2.5 square miles in area and is bordered by San Francisco to the north, Colma Creek watershed to the south and east, and Thornton State Beach and the Pacific Ocean on the west. As shown in **Figure 2-1**, the Vista Grande Canal and Tunnel are located primarily within San Francisco. The Canal alignment is adjacent to John Muir Drive and the southwestern shoreline of Lake Merced. A small portion of the beginning of the Canal is located within unincorporated San Mateo County. The Tunnel runs beneath private lands, Skyline Boulevard, and Fort Funston, a former U.S. Army installation which is now managed by the National Park Service (NPS) as part of the Golden Gate National Recreation Area (GGNRA). The tunnel outlet is located at the Pacific Ocean on the beach below Fort Funston.

2.3 Existing Facilities and Operations

The existing Vista Grande Canal collects stormwater and authorized non-storm flows from the watershed and conveys these flows to the existing Vista Grande Tunnel. The Tunnel discharges to the Pacific Ocean through an existing Ocean Outlet structure on the beach below Fort Funston, located in the GGRNA (see Figure 2-1).

The trapezoidal Canal, which is about 3,600 feet in length and is located adjacent to the west side of John Muir Drive, has a capacity of about 500 cubic feet per second (cfs) and lies parallel to the southwest shores of Lake Merced. At the terminus of the Canal is the mouth of the Tunnel. The Tunnel, which is 3,000 feet long and has a capacity of about 170 cfs, serves as the primary outlet for stormwater from the Vista Grande watershed.

Daly City also separately operates a wastewater effluent discharge system, which conveys treated effluent from the North San Mateo County Sanitation District Wastewater Treatment Plant (WWTP) to an offshore diffuser located in the Pacific Ocean approximately 2,500 feet from the shore. Effluent is conveyed to a submarine outfall via an existing 33-inch pipeline across the beach (submarine outfall pipeline) by two different routes depending on weather conditions, as described below.

During dry weather, residential irrigation runoff and other authorized non-stormwater flows to the Vista Grande Canal and Tunnel. During these low-flow times, the effluent is conveyed to the Tunnel via a gravity system located parallel to the Vista Grande Canal. At the entrance to the Tunnel, the effluent is discharged and mixed with dry weather flows. The Tunnel conveys the mixed irrigation, other non-stormwater, and effluent to the Ocean Outlet structure at the Tunnel's west portal, where the flows are collected into the submarine outfall pipeline. The flows are then conveyed and discharged through a diffuser located 2,500 feet offshore.

Since wet weather storm flows through the Canal and Tunnel would overwhelm the capacity of the submarine outfall pipeline, these storm flows are discharged across the beach via the Ocean Outlet. During wet weather, effluent and storm flows are kept separate so that effluent will not be discharged with storm flows across the beach. When rainfall from a storm exceeds about 0.25 inch or when substantial runoff is observed, WWTP staff diverts effluent from the gravity system and activates pumps that deliver effluent at flows up to 12 mgd through a 24-inch to 27-inch diameter force main that traverses the Olympic Club and Fort Funston to a drop structure located on the bluff above the Tunnel's west portal in Fort Funston. The effluent drops directly into the submarine outfall pipeline beneath the Ocean Outlet structure, where it is conveyed and discharged through the offshore diffuser. Wet weather stormwater flows drain into the Canal and through the Tunnel. At the Tunnel's west portal located on the beach at Fort Funston, the flows are discharged through the Daly City Ocean Outlet structure's south-facing flap gates, where they flow across the beach to the Pacific Ocean.

SOURCE: McMillen Jacobs Associates, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2-1
Location and Jurisdiction

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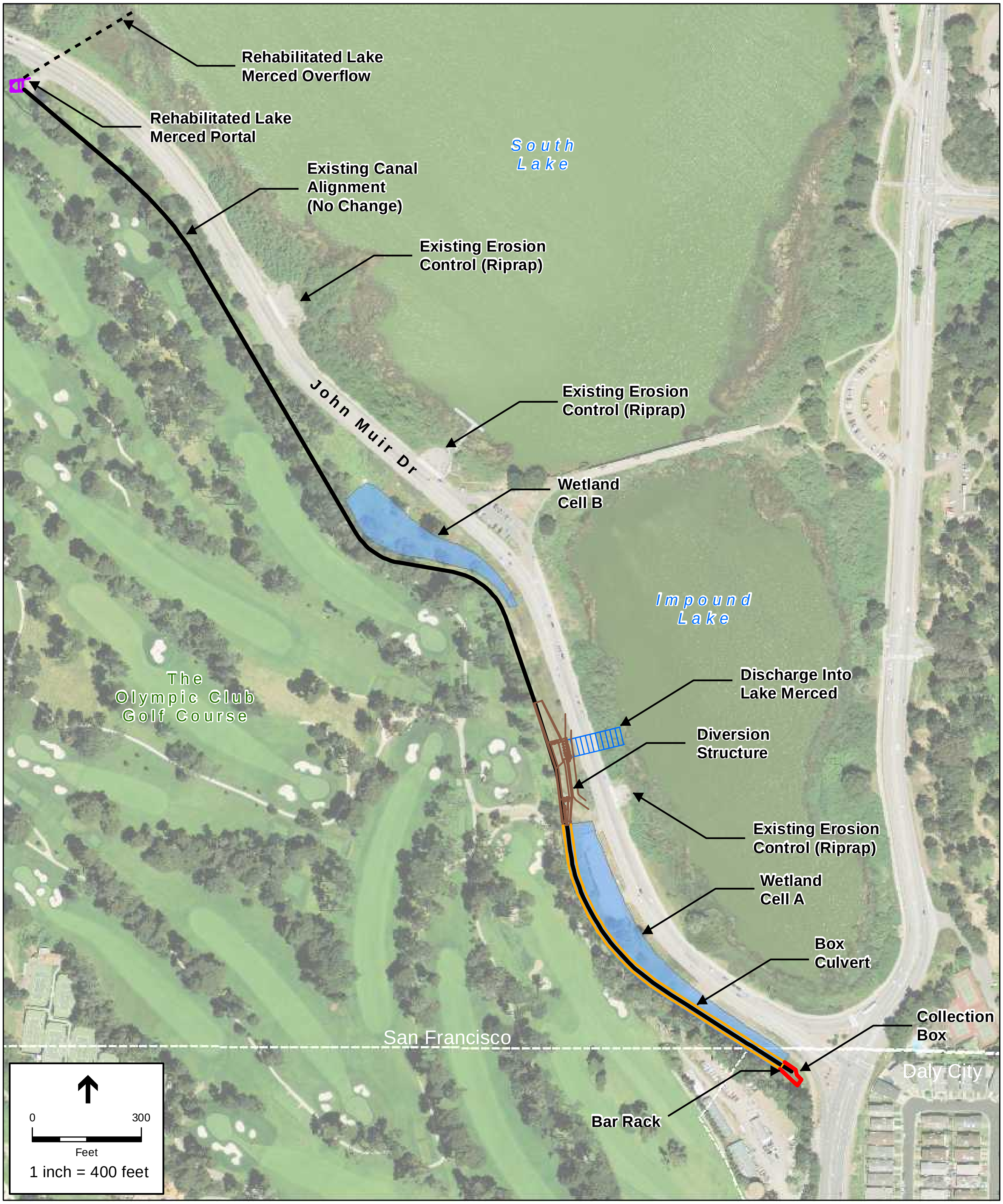
Historically, and as confirmed by hydraulic modeling, rainstorms produce storm runoff that exceeds the Tunnel and Canal capacity less than once per year. When such large rainstorms occur, flows back up in the Canal, causing flooding in local neighborhoods and water flowing across John Muir Drive into Lake Merced. Such flooding and Canal overtopping events cause property damage, bank erosion, traffic nuisances, public safety issues, and may have adverse impacts to Lake Merced water quality. As part of recent repairs to property damaged by Canal overtopping events, three hardened overflow chutes were installed between John Muir Drive and Lake Merced to reduce the potential for bank erosion and roadway damage; however, additional infrastructure modifications are warranted to reduce the occurrence of such overtopping and to reduce the likelihood of neighborhood flooding.

2.4 Proposed Project Components

As described in Section 1.3.1, CEQA Project Objectives, Daly City is proposing the Project to improve stormwater drainage and minimize flooding risk, provide a water source for Lake Merced management, improve recreational access and reduce litter deposition at the beach below Fort Funston, and maximize the use of existing infrastructure and rights-of-way (ROWs). The Project as proposed by Daly City would consist of the following:

- Partial replacement of the existing Vista Grande Canal to incorporate a gross solid screening device, a constructed treatment wetland, and diversion and discharge structures to route some stormwater (and authorized non-stormwater) flows from the Vista Grande Canal to Lake Merced and to allow lake water to be used for summer treatment wetland maintenance, operation of which would be implemented in accordance with the initial Vista Grande Operational Plan, part of the proposed Lake Management Plan (a draft plan is provided as **Appendix A**);
- Modification of the existing effluent gravity pipeline so that it may be used year round to convey treated effluent from the nearby North San Mateo County Sanitation District WWTP to the existing outlet and diffuser by gravity, and abandoning the force main pipeline;
- Modification of the existing lake overflow structure to include an adjustable weir and siphon that allows water from the lake to flow into the Canal and Tunnel;
- Replacement of the existing Vista Grande Tunnel to expand its hydraulic capacity and extend its operating lifetime and replacement of the Lake Merced Portal to the Tunnel;
- Replacement of the existing Ocean Outlet structure and a portion of the existing 33-inch submarine outfall pipeline that crosses the beach at Fort Funston; and
- A prioritized suite of best management practices that may be implemented within the Vista Grande Basin storm drain system upstream of the Vista Grande Canal and/or within the Lake Merced watershed (described in the draft Lake Management Plan, Appendix A).

These components are described below, and locations are shown in **Figures 2-2a** and **2-2b**.

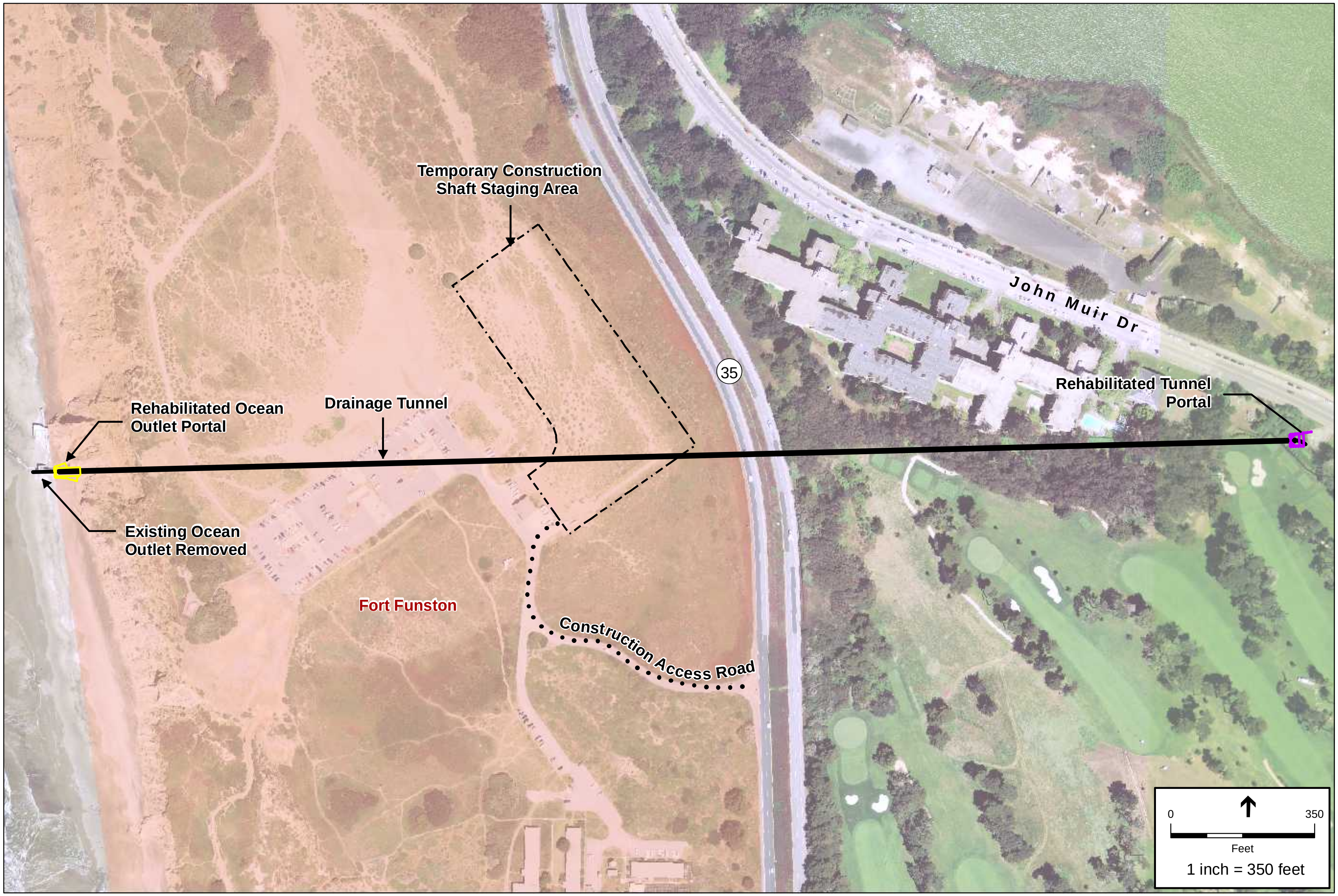


SOURCE: McMillen Jacobs Associates, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2-2a

Proposed Project Components (Canal)



SOURCE: McMillen Jacobs Associates, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2-2b

Proposed Project Components (Tunnel)

Operational components of the Project, further described below, would include management of water surface elevations (WSEs) in Lake Merced and a Lake Management Plan that would include water quality best management practices, including the upstream improvements in the basin described above and additional actions, the implementation of which may be triggered during post-project monitoring. A draft Lake Management Plan is included as Appendix A.

In addition, the Project includes NPS execution of a Special Use Permit for construction activities within GGRNA lands and the expansion of the ROW to accommodate the replacement Ocean Outlet structure.

2.4.1 Vista Grande Canal Improvements and Diversion of Stormwater to Lake Merced

The existing Vista Grande Canal is a 3,600-foot-long, man-made brick-lined trapezoidal channel with a flow capacity of approximately 500 cfs. The Project would replace the upstream portion of the Canal with a collection box, box culvert, debris screening device, and diversion structure that would enable the diversion of Canal flows into Lake Merced. A constructed treatment wetland would be developed in an area between John Muir Drive and the southern edge of the Canal to handle low flows (dry and wet) year-round. From the diversion structure, a box culvert would be developed under John Muir Drive and a screened outlet structure constructed at the edge of Impound Lake (Jacobs Associates, 2011a, p. 12). These components are described below.

2.4.1.1 Collection Box and Box Culvert

A collection box would replace the headworks of the existing Vista Grande Canal to collect flows from the contributing storm drain culverts. Directly downstream of the collection box, a reinforced concrete box culvert would replace approximately 1,000 feet of the existing Canal. The box culvert would run underneath the proposed Wetland Cell A, described below.

2.4.1.2 Debris Screening Device and Diversion Structure

An approximately 275-foot-long linear radial debris screening device would be installed downstream of the box culvert. Stormwater would enter the screening device through several cylindrical casings and exit through louvers perforated in the casings, trapping all debris greater than 5 millimeters (mm) within the casings.

A semi-automated hydraulic diversion structure would be constructed directly downstream of the box culvert and screening device. The diversion structure would include multiple control gates that would divert any combination of flows between the existing Vista Grande Canal, Vista Grande Tunnel, and Ocean Outlet; and a box culvert running beneath John Muir Drive and to Lake Merced. The diversion of flows would be conducted as described in Section 2.5.1.1, below. An access road would be installed in the space between John Muir Drive and the diversion structure. Using this road, vacuum trucks would remove debris from the casings on a scheduled and as-needed basis. The total length of the existing Canal that would be replaced by the debris screening device and diversion structure is approximately 350 feet.

2.4.1.3 Constructed Treatment Wetland

A constructed treatment wetland would be developed along John Muir Drive to treat year-round low flows from the watershed in order to reduce sediment, suspended solids, metals, and nutrients. Low volume stormwater flows, authorized non-storm flows, and recirculated lake water would be treated prior to release to Lake Merced. The wetland would consist of two cells. Wetland Cell A would be approximately 1.7 acres in size, and Wetland Cell B would be approximately 0.9 acres, for a total area of approximately 2.6 acres. A portion of Wetland Cell A would overlie the box culvert. Wetland Cell B would be located between the existing Canal and John Muir Drive, as shown in Figure 2-2a. The wetland would treat year-round low flows from the watershed (also referred to as base flows), which can consist of authorized non-stormwater flows such as residential irrigation runoff. These low flows coming through the box culvert would drain to a buried wetland pump station located adjacent to the flow diversion structure under the new access road via a 12-inch drain. Each of two motorized 10 horsepower (hp) pumps would pump water to one of the wetland cells. Water would then flow by gravity through the wetland, which would be planted with emergent reeds such as cattails or bulrush that would provide water quality improvement by intercepting and settling out suspended particulates and providing attachment surfaces for beneficial bacteria that would remove other constituents such as nitrogen. After passing through the wetland, the treated water would flow by gravity through the diversion structure to the outlet at Impound Lake. During periods of very low or no flow, a recirculating pump would draw water from South Lake to replenish the wetland. A flexible pipeline approximately 18 inches in diameter would be installed within Impound Lake, beneath the pedestrian bridge between Impound and South lakes, and into South Lake to allow water to be pumped via the wetland pump station from South Lake into the diversion structure, then into the treatment wetland. During periods of high algae growth, a skimmer consisting of a floating structure with some wind protection that draws water from the upper few inches of the lake surface would be used to uptake water with high algae concentrations and route it through the treatment wetland via the flexible pipeline and pump station. Water would flow through the wetland at a rate of approximately 0.1 to 0.4 cfs for nitrogen treatment and constituent removal, and up to approximately 1.4 cfs for algae treatment.

2.4.1.4 John Muir Drive Crossing and Lake Merced Outlet

Flows that are directed into Lake Merced would be conveyed into the lake via a 156-foot-long crossing, consisting of precast concrete box culvert sections, constructed under John Muir Drive to an outlet structure on the western bank of Impound Lake. The mouth of the outlet at Impound Lake would be below the normal low WSE of 5 feet City Datum,[1] and a submerged layer of rip rap (below elevation -1.4 City Datum) would be installed to protect against erosion of the lake bed by water flowing into Impound Lake. The location of the outlet structure is shown on Figure 2-2a.

[1] San Francisco City Datum is approximately 11.3 feet higher than NAVD88 datum at the Project location.

2.4.1.5 Treated Effluent Gravity Line

Portions of an existing 30-inch and 33-inch wastewater effluent gravity pipeline that are located adjacent to sections of the Canal would be removed and relocated outside of the limits of the constructed treatment wetlands. The existing 30-inch treated effluent gravity pipe would be relocated underneath the eastern boundary of the wetland cells and over the John Muir Drive crossing culvert. When the gravity pipe is offline during relocation, treated effluent would be routed through the existing force main. The remaining sections of the existing pipeline may remain in place; however, the existing manholes would be modified to accommodate a pressurized system.

2.4.2 Vista Grande Tunnel and East and West Portals

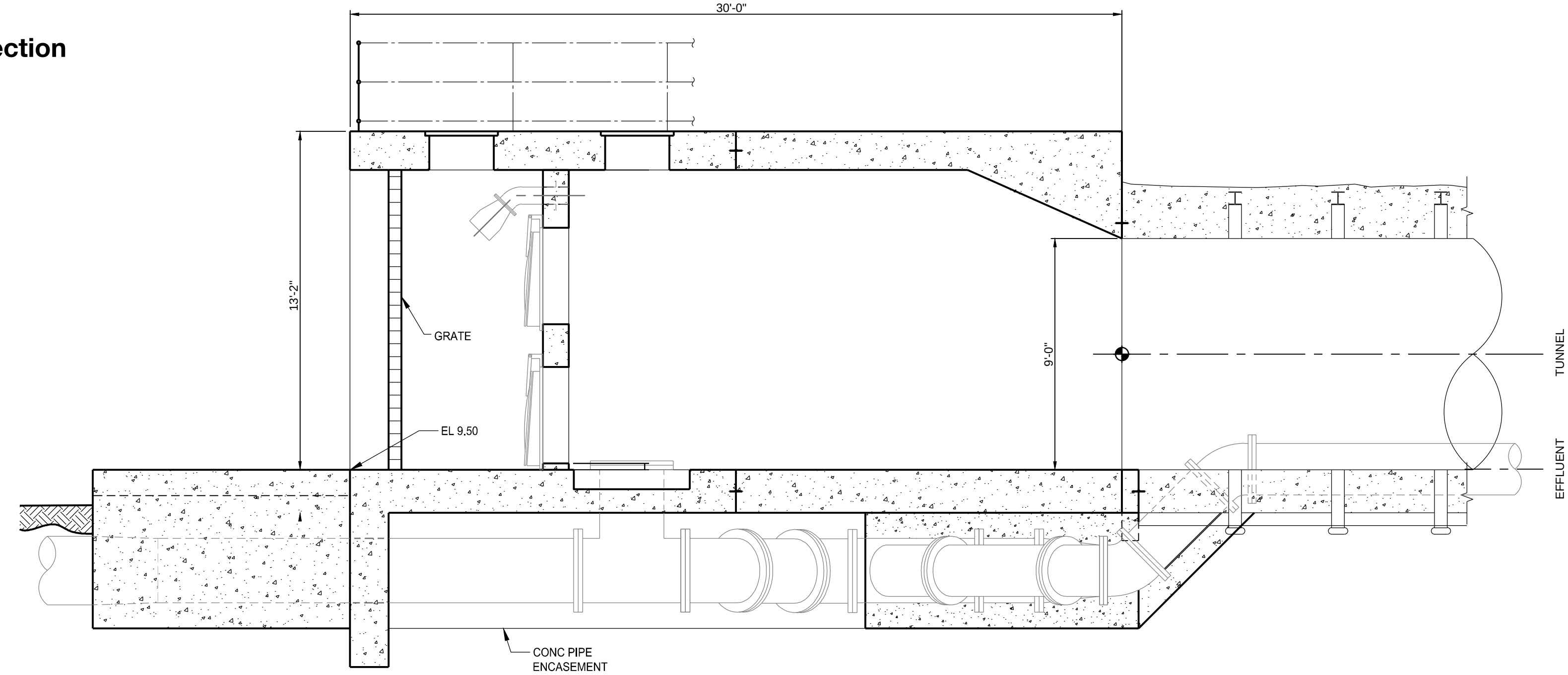
The existing Vista Grande Tunnel, constructed in 1896, has a hydraulic capacity of approximately 170 cfs. The Tunnel would be enlarged to increase its capacity to match the 500 cfs flow capacity of the Canal and to extend its operating life by replacing the aging structure. The new Tunnel would have a concrete lining and a final internal diameter of approximately 9 feet.

Two new 24-inch wastewater pipelines would be installed parallel to but separate from the Tunnel to replace the existing force main and convey treated effluent to the submarine outfall diffuser. The pipelines would merge at the Tunnel inlet (Lake Merced Portal) to connect to the existing 33-inch gravity pipeline. The pipelines would also merge at the Ocean Outlet structure to connect to a new single 30-inch PVC pipe beneath the new Ocean Outlet structure. This 30-inch pipeline then would connect to a new 33-inch welded steel pipe that would replace approximately 120 feet of the existing 33-inch submarine outfall pipeline that crosses the beach. The elevation of this pipeline segment would be the same as the existing pipeline.

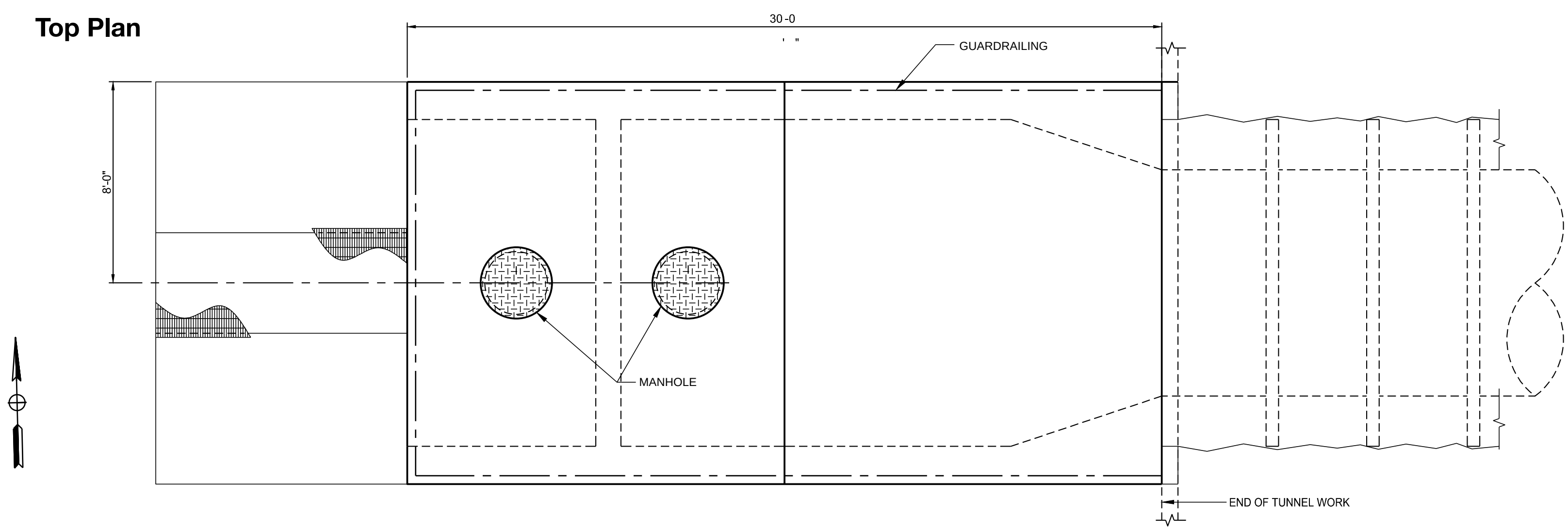
At Fort Funston, the existing Tunnel and Ocean Outlet are located within existing easement(s). San Francisco holds the tunnel easement and leases it to Daly City. As part of the Project, San Francisco would convey this easement to Daly City subject to a reserved drainage easement for Lake Merced. Daly City would replace the Tunnel within the easement, as amended and clarified through agreement with NPS. Daly City would also potentially seek a right-of-way permit or other authorization from NPS to accommodate any portions of the Project that lie outside of the easement(s). These easement updates and potential right-of-way permit or other authorization are within the scope of the Project. Daly City's existing Ocean Outlet structure is located on the beach below Fort Funston. The Ocean Outlet structure discharges the Vista Grande Watershed stormwater to the Pacific Ocean either through the submarine outfall pipeline during low flows or across the beach during higher flows. The Ocean Outlet structure, a segment of the Vista Grande Tunnel, and the force main segment are fully exposed to the surf and waves.

The Project would reconfigure these structures to provide protection from the surf and waves, including the design of the system to withstand the force of high tides and associated waves. The existing Daly City Ocean Outlet structure would be removed and replaced with a low-profile outlet structure set nearer to the existing cliff face to improve beach access. The proposed Ocean Outlet structure design is shown in **Figure 2-3a**. The concrete structure would have a west-facing opening with four flap gates enclosed by a steel grate. The existing 27-inch force main would be abandoned in place, with the exposed portion that is currently protruding from the cliff face removed back to

Section



Top Plan



SOURCE: McMillen Jacobs Associates 2013

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 2-3a

Ocean Outlet Structure Plans

the cliff face. The new portion of submarine outfall pipeline would be supported by new subsurface concrete support piers to protect it from erosion and extend its operating life. The extent of the new portion of the submarine outfall pipeline is shown in **Figure 2-3b**. Wing walls would be constructed to the north and south of the rehabilitated Ocean Outlet. To the north, an approximately 70-foot-long wing wall would be constructed from the Ocean Outlet structure to connect to an existing wing wall that extends south from the SFPUC's Lake Merced Sewer Tunnel outlet (SFPUC outlet) against the cliff face. Additionally, an approximately 100-foot-long wing wall would be constructed to the south of the outlet to protect the cliff face. The design of the proposed Ocean Outlet structure, including the wing walls, considers the effects of sea level rise on both the operation of the outlet and the rate of cliff erosion (discussed further in Section 3.9, Hydrology and Water Quality).

2.4.2.1 Lake Merced Overflow

An existing Lake Merced overflow structure connects South Lake to the Vista Grande Tunnel just downstream of the Tunnel's connection to the Vista Grande Canal. The overflow is currently situated at elevation 13 feet City Datum. The Project would replace a portion of the existing Lake Merced overflow with an adjustable-height weir that would be used to control the lake level and allow water from Lake Merced to be diverted back into the Vista Grande Canal just upstream of the Tunnel to flow to the Ocean Outlet. The weir would include flexible piping of up to 3 to 4 feet in diameter (siphon) that would allow water diverted into the Canal to be taken from any elevation within the lake.

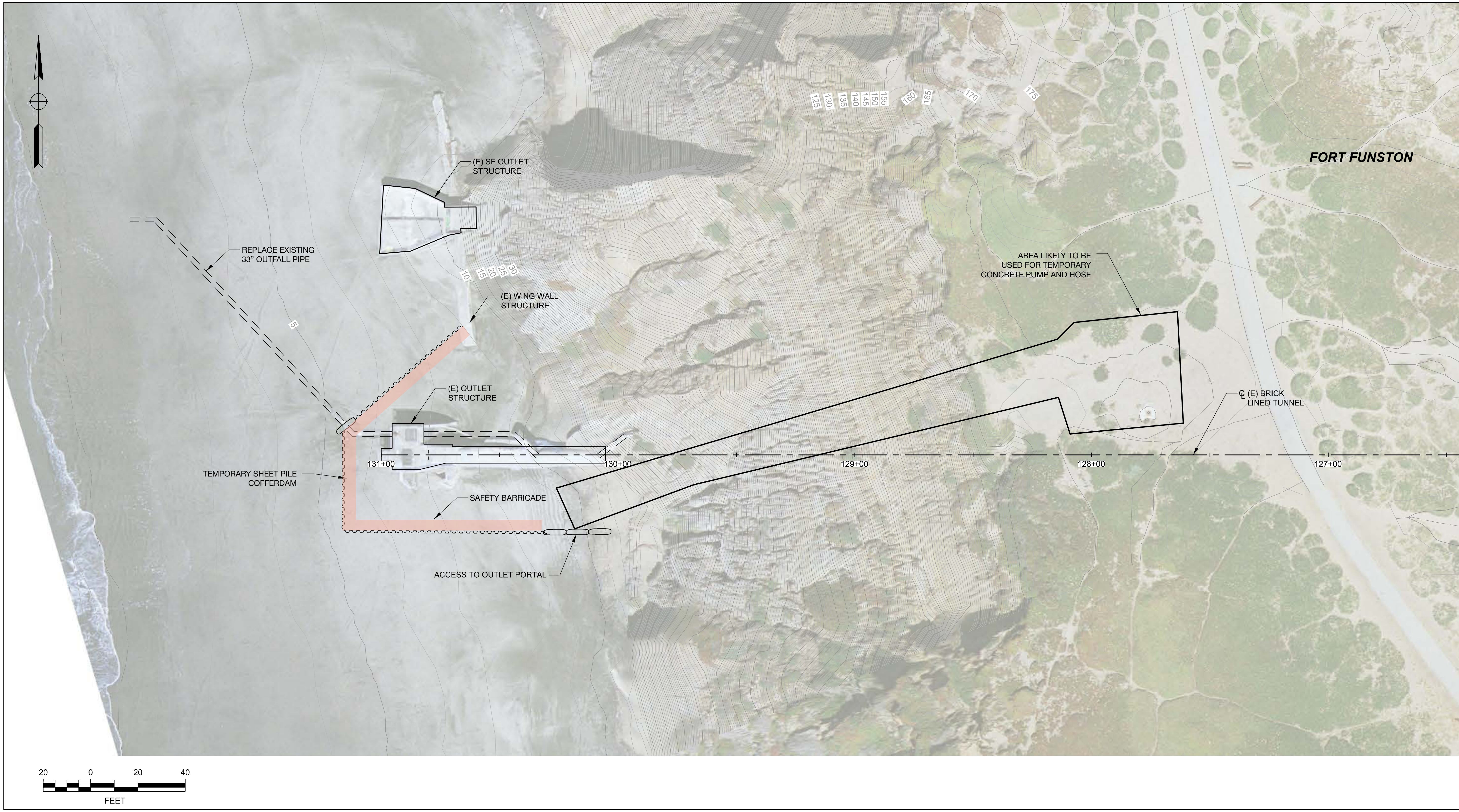
2.5 Project Construction

This section details the construction locations, activities and methods for the proposed project. **Table 2-1** summarizes the proposed construction activities including demolition and tree removal; project component construction or demolition; excavation; spoils[2] storage, waste diversion[3] and disposal, and dewatering activities; and installation of work/staging areas.

2.5.1 Canal Improvements and Diversion to Lake Merced

Improvements to the Vista Grande Canal and the facilities associated with the diversion to Lake Merced would be constructed from staging areas located adjacent to the construction areas. Construction of the Canal improvements, diversion structure/pipeline, and treatment wetland would require site clearing and removal of vegetation in the area bounded by Lake Merced Boulevard, John Muir Drive, and the southern edge of the Canal. The project would require the relocation of portions of the AT&T communication cables and PG&E gas lines within the John Muir Drive right-of-way, as well as a 33-inch treated wastewater effluent gravity pipeline, two Olympic Club sewer pipelines, and several aboveground utilities. The project would not affect the SFPUC's approximately 24-foot-wide combined storm sewer running parallel to John Muir Drive north of the bridge between Impound and South lakes. After completion of construction, staging areas, access routes, and other areas disturbed during construction would be replanted with a mix of native coastal grassland and scrub species.

2 "Spoils" refers to soil remaining from an excavation after backfilling is completed.
3 Diversion requirements set forth under Daly City Municipal Code 15.64.020



SOURCE: Jacobs Associates, 2013

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 2-3b
Ocean Outlet Construction Area

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TABLE 2-1
SUMMARY OF CONSTRUCTION REQUIREMENTS FOR PROJECT COMPONENTS

Project Component / Staging Area	Construction Tasks	Construction Area	Depth of Excavation / Quantity of Excavation and Fill
Vista Grande Canal			
Vista Grande Canal	• Site clearing • Potential tree removal • Relocate AT&T cables and PG&E gas lines • Relocate a 33-inch treated effluent gravity pipeline • Relocate two Olympic Club sewer pipelines • Relocate aboveground utilities	Staging Area: 10 acres Final Footprint: 4 acres	Included in components below
Collection Box and Box Culvert	• Remove 1,400 feet of canal structure • Install precast concrete box culverts • Fill exaction	Included in Canal construction area	Depth: 20 feet Excavation: 19,000 cy Fill: 10,800 cy Spoils: 8,200 cy Imported fill: 500 cy
Debris Screening Device and Diversion Structure	• Excavation • Install cast in place concrete underground screening device and diversion structure	Included in Canal construction area	Depth: 20 feet Excavation: 9,000 cy Fill: -- Spoils: 9,000 cy Structural fill: 500 cy
Constructed Treatment Wetland	• Surficial grading • Install wetland plants	Included in Canal construction area	Included in other components
John Muir Drive Crossing, Diversion Box Culvert and Lake Merced Outlet Structure	• Excavation • Install east side of culvert • Clear vegetation • Grading and paving • Install precast box culvert • Backfill • Remove temporary diverted roadway • Install sheet piles for excavation of remainder of box culvert and diversion structure • Install flexible pipeline	Included in Canal construction area	Depth: 20 feet Excavation: 4,000 cy Fill: 1,600 cy Spoils: 2,400 cy Structural fill: 240 cy
Lake Merced Overflow Structure	• Demolish part of overflow structure • Construct overflow extension into lake • Install adjustable-height weir • Install flexible pipeline (siphon)	Included in Canal construction area	Included in Lake Merced Portal components
Lake Merced Portal	• Clear vegetation around existing portal • Demolish remaining structures from CDS system pilot testing program • Demolish 150 feet of Canal structure • Install soldier piles by drilling • Excavate portal and install lagging • Tunneling • Reconstruct Canal • Construct cast-in place structure to join the Canal and Tunnel	Included in Canal construction area	Depth: 15 feet Excavation: 3,000 cy Fill: 2,500 cy Spoils: 500 cy Structural fill: --

TABLE 2-1 (Continued)
SUMMARY OF CONSTRUCTION REQUIREMENTS FOR PROJECT COMPONENTS

Project Component / Staging Area	Construction Tasks	Construction Area	Depth of Excavation / Quantity of Excavation and Fill
Vista Grande Tunnel			
Vista Grande Tunnel	• Prepare staging area • Install shaft sheet piles • Excavate shaft • Excavate Tunnel • Install new Tunnel lining • Install two 24-inch effluent pipes • Connect 24-inch pipes with 30-inch pipeline to connect to submarine outfall • Remove shaft sheet piles	Staging Area: 4 acres Final Footprint: 0 acres (no permanent surface disturbance)	Depth: 180 feet Excavation: 31,900 cy Fill: 5,300 Spoils: 26,600 Structural fill: --
Ocean Outlet			
Ocean Outlet	• Install cofferdam • Demolish and remove existing outlet and exposed portions of the existing Tunnel • Create portal structure • Install new Ocean Outlet structure of cast-in-place concrete • Remove existing 27-inch force main • Connect new 33” welded steel pipeline to existing submarine outfall pipeline, insert concrete pier support structures • Remove cofferdam sheet piles	Staging Area: 0.2 acres Final Footprint: 0.01 acres	Depth: 15 feet Excavation: 390 cy Fill: 40 cy Spoils: 350 cy Structural fill: --
Totals		Subtotal Staging: 14.2 acres Total Final Footprint: 4 acres	**Subtotals** Excavation: 67,290 cy Fill: 20, 240 cy Spoils**: 47,050 cy**

2.5.1.1 Collection Box and Box Culvert

The Canal structure would be removed using an excavator and impact hammer. The excavation would likely use trench boxes for temporary shoring during installation of the precast concrete box culverts. Following construction of the box culvert, the excavation area would be filled, and Wetland Cell A constructed over top of the box culvert.

2.5.1.2 Debris Screening Device and Diversion Structure

The screening device and diversion structure would be constructed directly downstream of the box culvert using similar excavation techniques to remove the existing Canal structure. At the same time, the wetland pump station would be installed underground adjacent to the diversion structure. Construction of these structures would follow restoration of John Muir Drive after construction of the John Muir Drive crossing and Lake Merced Outlet (Section 2.5.1.4). The excavation activities would be supported by an internally braced sheet pile shoring system. Sheet piles would be driven or vibrated as determined during final engineering, with pile driving lasting approximately 13 days. The structures would be a cast in place concrete, constructed within the shored excavation. A new paved access road would be constructed in the space between John Muir Drive and the diversion structure.

2.5.1.3 Constructed Treatment Wetland

Construction of the treatment wetland would include surficial grading, followed by construction of small berms and retaining walls, and planted with various types of plants such as bulrush and cattails. A new 8-inch diameter low flow supply pipe would be installed along each wetland cell's eastern boundary, connected to the wetland pump station at the diversion structure, to supply Wetland Cell A at its southern end and Wetland Cell B at its northern end. A 12-inch drain pipe would be installed at the downstream end of each cell (the northern end of Wetland Cell A and the southern end of Wetland Cell B) to drain treated wetland flows into the diversion structure. In addition, chain-link fencing would be installed around the treatment wetland, with an access gate for maintenance access.

2.5.1.4 John Muir Drive Crossing and Lake Merced Outlet

The John Muir Drive crossing, consisting of several precast concrete box culverts, would be installed in phases. The first phase consists of installing the east side of the crossing that connects to Impound Lake. The excavation would be supported by internally braced sheet piles driven over a period of approximately 9 days. The precast box culverts would be installed between the shoring struts. During this time, traffic on John Muir Drive would be temporarily rerouted to the west within what is now the vegetated area between John Muir Drive and the existing Canal. The temporarily rerouted portion of John Muir Drive would be the same width as the existing road and would include the bicycle lanes. This area would be cleared of vegetation, graded, and paved to accommodate the rerouted traffic. Once the first portion of the box culverts have been installed and backfilled, John Muir Drive would be restored and traffic would resume as under existing conditions.

The second phase consists of removing the temporary roadway adjacent to the Canal and installing the remainder of the precast box culverts at the same time the diversion structure is constructed.

2.5.2 Vista Grande Tunnel and East and West Portals

The replacement Tunnel would be constructed from a temporary construction shaft located at Fort Funston, in an approximately 4-acre area that would also be used as a construction staging area (see Figure 2-2b). Most construction activities associated with Tunnel construction would take place in this area. The staging area would include space for loading and unloading trucks, materials and equipment storage, shop facilities, office trailers and parking. Existing vegetation in this area would be cleared for use prior to initiation of construction activities.

The temporary construction shaft would be approximately 30 feet in diameter. A crane would be positioned near the shaft edge to hoist personnel, materials, and equipment between the Tunnel and the surface. Tunneling would begin in both directions from the Fort Funston shaft – the segments from the shaft to the beach and from the shaft to the Lake Merced Portal are referred to as tunnel "drives." The alignment of the new Tunnel would coincide with existing Tunnel but would have a larger diameter. The existing Tunnel would be temporarily supported directly ahead of the advancing Tunnel face to prevent collapse and loss of ground ahead. Tunneling spoils would contain native ground and existing Tunnel lining, and possibly the timber from the initial support of the existing Tunnel. Muck cars would be used within the Tunnel and a crane would be used at the shaft to lift excavated materials to surface. The Tunnel final lining would most likely be cast-in-place concrete, or could be reinforced concrete cylinder pipe.

A concrete collar would be constructed around the shaft perimeter, and sheet piles would be installed for the topmost 30 feet of shaft. These sheet piles would be internally braced with ring beams. Sheet piles would be driven at the Fort Funston shaft over a period of approximately 4 days. Below 30 feet, the shaft would be supported with ring beams and timber lagging. Shaft excavation would be performed with a mid-sized excavator, and spoils would be removed with a crane situated above the shaft. Tunneling operations in both directions would be staged from this shaft. The proposed Tunnel would be constructed using either a digger shield or standard mini-excavator. Upon completion of tunneling, the shaft would be backfilled with native material and the site would be restored to pre-construction conditions.

Tunnel construction would occur over a 21-month period. During most of this time, the existing Tunnel would be unavailable to route stormwater from the Basin to the Ocean Outlet. Therefore, during tunnel construction, storm flows would be diverted directly to Lake Merced via the proposed diversion structure, which would be constructed in advance of taking the Tunnel offline. However, all base flows and the initial hour of storm flows in the Canal following an extended antecedent dry period would be diverted, retained and conveyed into the SFPUC combined stormwater sewer system for treatment and disposal via the Lake Merced Transport overflow structure.

To accomplish this, the contractor would install a temporary containment and pumping system just upstream of the tunnel inlet. The containment would consist of a temporary dam within the canal to prevent water from entering the tunnel. The pumping system would consist of a temporary pump and 24-inch pipe with a flow capacity of 20 cfs to convey storm water to SFPUC's combined storm sewer system. During the first storm of the season, Canal flow would accumulate behind the temporary dam and accumulated storm flow would be simultaneously pumped into SFPUC's system. When the Canal has filled to the defined upper level, retaining up to 1.5 million gallons (mg), the main Canal control gates at the diversion structure would be closed and newly arriving stormwater would flow into Impound Lake via the Lake Merced outlet structure. Any remaining retained water from the initial diversion and retention would continue to be conveyed to the SFPUC system. At a rate of 20 cfs and a maximum retained volume of approximately 1.5 MG, an additional 2.75 hours of pumping may occur (Brown and Caldwell, 2015). All Canal flows diverted to Lake Merced would be conveyed through the proposed debris screening device.

2.5.2.1 Lake Merced (East) Portal and Lake Merced Overflow

The site around the existing portal would be cleared of vegetation, and the remaining structures from the CDS system pilot testing program would be demolished, as well as approximately 150 feet of the Canal structure to support access to the portal and approximately 100 feet of the 33-inch treated effluent gravity pipeline. A portal shoring structure would be installed, consisting of an internally braced soldier pile and lagging shoring system. Pier drilling would be required to install soldier piles and would occur over approximately 2 days. After the tunneling described above has been completed, the remaining section of the 33-inch treated effluent gravity pipeline would be connected to a new system of pipes that would connect to the two 24-inch pipes located under the new Tunnel, the Canal would be reconstructed to match the existing Canal section, and a cast-in-place structure would be constructed to join the Canal and Tunnel. An adjustable-height weir/pipeline would be installed in place of the mouth of the existing Lake Merced Overflow across John Muir Drive from the Lake Merced Portal. The portal area would be re-graded to match existing conditions.

2.5.2.2 Ocean Outlet (West Portal) and Submarine Outfall Pipe

Construction access to the work area at the beach below Fort Funston would be provided through the newly constructed Tunnel via the construction shaft or across the beach via an access point at Avalon Canyon, located approximately 2.5 miles south of the outlet structure.

A temporary cofferdam would be constructed around the outlet structure and the portion of the submarine outfall pipe to be replaced in order to protect the work area from ocean waves. The cofferdam would begin at the cliff face south of the existing outlet structure and continue to the existing wing wall south of the SFPUC outlet structure, as shown in Figure 2-3b. Sheet piles would be driven for the cofferdam over a period of approximately 4 days. The sheet piling equipment would most likely be brought up the beach from the Avalon Canyon access road. The existing outlet structure and exposed portions of the existing Tunnel would be demolished. The demolished materials would either be hauled offsite via the Avalon Canyon access road and Avalon Drive, or would be temporarily stockpiled at the outlet for later removal via the Tunnel and shaft once the tunnel drive has reached the beach. After the existing structures are demolished, a portal structure approximately 23 feet high by 17 feet wide would be created in order to stabilize the bluff ahead of the tunnel break-out. Approximately 350 cubic yards of material would be removed, and the excavation would be supported with shotcrete and soil nails. After completion of the Tunnel, the new outlet structure would be constructed of cast-in-place concrete within the portal excavation.

Additionally, approximately 120 feet of the existing 33-inch submarine outfall pipeline that crosses the beach (outside of the cofferdam) would be replaced with a new 33-inch welded steel pipeline. This replacement pipe would be supported by four 3-foot by 3-foot concrete piers embedded in the consolidated sand beneath the beach sand.

An approximately 75 hp concrete pump would be placed within Fort Funston on the bluff above the Ocean Outlet for approximately one week to supply shotcrete for the portal wall (see Figure 2-3b).

A hose connected to the pump would convey concrete to the construction area at the beach. The bluff face would be protected from the hose using jute netting or burlap. The area around the pump would be fenced to maintain the safety of visitors to Fort Funston.

Due to recent land sliding and subsequent damage to a portion of the existing Avalon Canyon access road, improvements to the access road would be required to allow vehicle and equipment access to the beach. The area of potential disturbance associated with this repair work is shown in **Figure 2-4**. It is anticipated that the construction contractor would reroute the access road within the disturbance area shown in order to avoid the undermined portion of the existing road. This would require the removal of a portion of the slope inside the curve of the existing road to accommodate the new grade of the road; or the slope would be stabilized with a small tie-back and lagging wall. Up to approximately 60 cy of material removed from the slope would be hauled offsite for reuse or disposal.

After completion of construction at the Ocean Outlet location, excavations would be backfilled and disturbed areas would be regraded with native materials to match existing profiles.

2.5.3 Construction Schedule, Workforce, and Equipment

2.5.3.1 Schedule and Workforce

Construction is expected to begin in late 2017 and take place over approximately 24 to 44 months, depending on the work hours and construction methods used for tunneling. It is anticipated that the box culvert and the Lake Merced diversion structure and outlet would be completed prior to tunneling so that storm flows may be diverted away from the Tunnel and into Lake Merced and/or to the SFPUC combined sewer system during construction.

It is anticipated that the east and west tunnel drives would be completed sequentially; however, if the construction contractor chooses to complete the tunnel drives concurrently, this could result in a reduced overall length of construction. Additionally, work hours at the construction site would vary depending on the nature of the construction activities occurring at any particular time and the status of the Project with respect to schedule. Construction in the Lake Merced, Canal, and Lake Merced portal areas generally would occur between 7 a.m. and 7 p.m., Monday through Friday, in accordance with San Francisco Noise Control Ordinance. Daly City anticipates that the proposed tunneling activities could occur 24 hours per day in two to three shifts; with excavated materials stored onsite within the staging area during nighttime construction and off-hauled during day time hours. However, work hours within Fort Funston are subject to NPS restriction under the terms of the special use permit. If 24-hour tunneling is not permitted, this analysis assumes that tunneling work hours would be approximately the same as the rest of the Project components (referred to as 12-hour tunneling for purposes of this document). **Table 2-2** provides a range of potential work schedules for the tunneling component depending on these variables.

Construction of the replacement pipe section and piers on the beach would require that work be completed during low tide, necessitating 24-hour work and construction access via the Avalon Canyon access road over a period of several days to one week, most likely in January or July.

SOURCE: McMillen Jacobs Associates

Vista Grande Drainage Basin Improvement Project. 207036.01
Figure 2-4
Avalon Canyon Access Road Work Area

TABLE 2-2
CONSTRUCTION DURATION BY ACTIVITY TYPE

Project Component	Construction Activity	Expected Duration
Vista Grande Canal		
Vista Grande Canal	• Site clearing • Relocate utilities • Relocate sewer pipelines • Relocate aboveground utilities	1.5 months
Collection Box and Box Culvert	• Remove canal structure • Install box culverts • Fill exaction	4.5 months
Debris Screening Device and Diversion Structure	• Excavation • Install screening device and diversion structure	7.25 months
Constructed Treatment Wetland	• Grading • Install wetland plants	4.5 months
John Muir Drive Crossing, Diversion Box Culvert and Lake Merced Outlet Structure	• Excavation • Install east side of culvert • Clear vegetation • Grading and paving • Install box culvert • Backfill • Remove temporary diverted roadway • Install sheet piles for excavation of remainder of box culvert and diversion structure	4.5 months
Lake Merced Overflow Structure	• Demolish part of overflow structure • Construct overflow extension into reservoir • Install adjustable-height weir	1 month
Lake Merced Portal	• Clear vegetation • Demolish remaining structures from CDS system pilot testing program • Demolish 150 feet of canal structure • Install soldier piles by drilling • Excavate portal and install lagging • Reconstruct canal • Construct cast-in place structure to join the Canal and Tunnel	4 months
Vista Grande Tunnel		
Vista Grande Tunnel	• Prepare staging area • Sheet piles driven at Fort Funston shaft • Excavate shaft • Excavate tunnel (concurrent or sequential tunnel drives; 24-hour or daytime only) • Install new tunnel lining (concurrent or sequential tunnel drives; 24-hour or daytime only) • Remove 33-inch effluent sewer pipe • Install two 24-inch effluent pipes • Connect 24-inch pipes with 30-inch pipeline connected to existing submarine outfall Concurrent drives, 24-hour tunneling: 17 months Sequential drives, 24-hour tunneling: 21 months Concurrent drives, 12-hour tunneling: 30 months Sequential drives, 12-hour tunneling: 37 months	17 to 37 months
Ocean Outlet		
Ocean Outlet	• Install cofferdam • Demolish and remove existing outlet and exposed portions of the existing Tunnel • Create portal structure • Construct new outlet structure • Remove existing 27-inch force main • Connect effluent sewer to existing submarine outfall pipeline	5.5 months

This schedule assumes approximately 10 workers for construction of the Canal and treatment wetland, 5 workers for construction of each portal, and up to 35 workers for the tunnel drive construction (15 during day shift, 10 during evening and/or night shifts). If the tunnel drives are completed concurrently, each drive would require this number of workers (i.e., up to 30 workers during day shift and 20 workers during evening and/or night shifts). **Table 2-2** provides the approximate duration necessary for each construction activity.

2.5.3.2 Construction Equipment

During construction, a variety of equipment and vehicles would be operating at the Project site. **Table 2-3** provides a list of the type and number of equipment and vehicles expected to be required to construct each of component of the Project.

TABLE 2-3
CONSTRUCTION EQUIPMENT USAGE BY PROJECT COMPONENT

	Construction Usage			
Equipment	**Project Component**	**Number**	**Duration of Use (weeks)**	**Daily Use (hours/day)**
Compactor (CAT 563)	Canal and Wetlands	1	26	6
Excavator with hammer (750 Hitachi)	Canal and Wetlands	1	18	6
Excavator to clean ditch (CAT 320E L)	Canal and Wetlands	1	18	6
Excavator (CAT 320E L)	Shaft/Ocean Outlet and Tunnel Portal	1	18	6
Loader (CAT 966 or 950)	Ocean Outlet and Tunnel Portal/Canal and Wetlands	1	20	8
Pile Driver	Shaft/Ocean Outlet and Tunnel Portal/Canal and Wetlands	1	18	8
Drill Rig	Ocean Outlet and Tunnel Portal	1	2	6
Concrete pump (75 HP)	Ocean Outlet	1	1	3
Loader (CAT 966 or 950)	Tunnel	1	72 to 160	8
Road Header (Alpine EBZ132) or mini-excavator	Tunnel	2 or 1[a]	28 to 112[a]	8 to16
Crane (150 ton)	Tunnel	1	72 to 160	12 to 24
Air Compressor	Tunnel	1	72 to 160	12 to 24
Ventilation Fan (100 HP)	Tunnel	2	72 to 160	12 to 24

NOTE:
a If tunnel drives are completed sequentially, one road header or mini excavator would be used for a total duration of 56 weeks (24-hour tunneling) or 112 weeks (daytime tunneling only). If tunnel drives are completed concurrently, two would be used for a duration of 28 weeks (24-hour tunneling) or 56 weeks (daytime tunneling only).

2.5.3.3 Construction Traffic Volumes

Table 2-4 lists the anticipated maximum number and type of construction-related vehicle trips (round trip) that are associated with workers' daily travel to the Project site, material and equipment delivery, and on- and off-hauling of fill and spoils material. Daily trip volumes would continue throughout the construction period for each Project component except where noted. The construction options associated with 24-hour tunneling and concurrent or sequential tunnel drives could reduce the total number of haul trips per day while extending the number of days these trips would occur (e.g., if tunnel drives are constructed sequentially using a 12-hour per day tunneling schedule, only five haul truck round trips per day would occur, but these would occur over 560 work days).

TABLE 2-4
CONSTRUCTION VEHICLE ROUND TRIPS PER DAY (MAXIMUM)

	Project Component		
Trip Type	**Tunnel / Staging Area**	**Ocean Outlet and Tunnel Portals**	**Canal and Wetlands**
Concrete Truck	30[a]	2	5
Haul Truck	17[b]	3	40
Worker Vehicle	70[c]	5	10
Maximum Total	**117**	**10**	**55**

NOTES:
a would occur for 30 work days (if 24-hour tunneling permitted) or every other day for 60 work days (if 24-hour tunneling not permitted)
b would occur for 165 work days if tunnel drives constructed concurrently
c would occur if tunnel drives constructed concurrently

2.5.3.4 Construction Power and Emergency Generators

Electricity demand during construction would be approximately 1,300 kilowatts (kW) and would be required for the shaft staging area only. For a conventional tunneling operation, the estimated minimum required power connection is about 3,000 kVA. Equipment included in this estimate includes roadheader or mini-excavator per tunnel drive; and ancillary equipment consisting of shotcrete application equipment, a batch plant, a compressor, pumps, ventilation fans, water treatment facilities, shop equipment and warehouse, a change house, yard lighting, and office trailers. Temporary construction power would be provided to the staging area at Fort Funston via a temporary Pacific Gas & Electric (PG&E) service connection. An emergency power supply (generator) with the capacity to provide 1,000 kVA would be located on-site during construction.

2.5.3.5 Lighting

Construction lighting would be used for tunnel and beach work, and could be required for security lighting of staging areas. Nighttime illumination of the shaft and staging areas during construction would be directed downward, and visual barriers would be erected between traffic and staging areas. Light deflectors would be used to direct light sources.

Nighttime lighting would be required for several nights in a row during construction of the replacement pipe section and piers on the beach, most likely in January or July.

2.5.4 Staging Areas and Public Access

Staging areas would be established for each segment of the Project site for the storage of contractors' construction equipment and materials (e.g., vehicles, fuels, lubricants). The staging areas might also be used to stockpile excavated soil for eventual reuse by the Project during construction. Areas of temporary disturbance would be returned to pre-Project conditions or similar.

- **Box culvert, diversion structure, and Lake Merced Portal:** Staging areas would be adjacent to work areas. Construction and staging areas adjacent to John Muir Drive would be enclosed by chain link fencing erected along John Muir Drive. There is no existing public access to these areas.

- **Diversion to Impound Lake – John Muir Drive Crossing:** An internally braced sheetpile excavation would cross John Muir Drive. Chain link fencing would be placed around the excavation. Traffic and pedestrian access would be temporarily re-routed around the excavation. See also John Muir Crossing construction activity description.

- **Shaft staging and shotcrete installation:** The Fort Funston staging area and the area used for shotcrete installation would likely have chain link fencing around the perimeter. These are the only areas that would be excluded from public use during construction activities.

- **Ocean Outlet:** A "U" shaped sheet pile cofferdam around the Ocean Outlet structure would form the barrier to exclude the public and dogs from the construction area and to isolate the work area from tidal waters. The cofferdam would extend slightly beyond the seaward extent of the existing outlet structure.

2.5.5 Tree and Vegetation Removal

Vegetation removal would be required in each of the project construction areas. In addition, a small number of trees would be removed adjacent to the Canal. Permitting authority and regulations regarding tree and vegetation removal would vary throughout the site depending on the jurisdiction of the area affected (see Section 3.4, Biological Resources).

2.5.6 Water Consumption

Construction activities would require water supply for dust control, including wheel washing and ground application. The most likely source of water for Project construction is the Daly City Department of Water and Wastewater Resources or the SFPUC.

2.5.7 Excavation, Stockpiling, and Disposal of Materials

Excavation would generate demolition debris through the removal of existing structures, as well as excavated soils (cut and fill).

Demolition-related materials generated during construction would consist of the following types and volumes.

- **Canal Area:** 600 cy of concrete and brick canal lining to be demolished and disposed of at landfill. Approximately 1,400 feet of 30-inch concrete pipe and 1,400 feet of 18-inch vitrified clay pipe to be demolished and disposed of.
- **John Muir Drive Crossing:** 60 cy of asphaltic concrete to be demolished and disposed of at landfill. Bracing and sheet piles for excavation would be recycled or reused.
- **East Portal:** 50 cy of concrete and brick canal lining to be demolished. CDS test unit consisting of concrete piping and concrete vaults to be demolished and disposed of at a landfill. Bracing and wood lagging for excavation support would be recycled or reused.
- **Tunnel and shaft:** 2,500 cy of brick tunnel lining to be removed. This material would likely be disposed of along with the tunnel spoils at a landfill, or used at nearby projects that need construction fill, if any are identified prior to construction. Timber supports from the original tunnel may still be intact and would be disposed of at a landfill.
- **Ocean Outlet structure:** 300 cy of exposed brick and shotcrete lined tunnel and concrete outlet structure to be demolished and disposed of. Approximately 140 feet of 33-inch concrete pipe to be disposed of.

Cut and fill volumes for each segment of the Project are shown in **Table 2-5**.

TABLE 2-5
CUT AND FILL VOLUMES

Component	Cut Volume (cy) [a]	Fill Volume (cy)
Tunnel	25,000	--
Fort Funston Shaft	6,900	5,300
Lake Merced Portal	3,000	2,500
Ocean Outlet	390	40
Box Culvert[b]	19,000	10,800
John Muir Drive Crossing	4,000	1,600
Diversion Structure[b]	9,000	--
Avalon Canyon access road	60	--
Total	67,350	20,240
Excess		47,110

NOTE:
[a] Cut volumes are provided after bulking (swell) is estimated.
[b] Cut and fill volumes associated with surficial grading for the treatment wetland is included in volumes given for these components.

As shown in Table 2-5, Project construction is expected to generate a total of approximately 47,110 cubic yards of excess excavated materials. Materials would be stored on-site and tested periodically. If any soil is found to contain hazardous materials, it would be characterized, transported from site in lined container trucks, and disposed of at an appropriate landfill in compliance with federal, state, and local regulations. Excavated materials not containing hazardous materials may be used to backfill excavations as shown in Table 2-5; excess materials would be disposed of off-site. Daly City would coordinate with the NPS to determine whether any fill materials could be used on site for restoration.

Construction is not anticipated to generate hazardous waste.

2.5.8 Dewatering

If water were to accumulate in an open excavation as a result of groundwater seepage or precipitation, or within a coffer dam area, dewatering could be necessary to maintain a somewhat dry working environment so that construction activities may proceed. Dewatering typically involves pumping water out of the excavated area into holding tanks and, following appropriate on-site treatment, discharging the water over land or into San Francisco's combined sewer system or to the Vista Grande Canal. Discharge to the San Francisco combined sewer system would require a permit from the SFPUC Wastewater Enterprise. Discharge to an open channel or over land must be performed in accordance with municipal stormwater permits and the requirements of the Statewide General Construction Permit for Stormwater Discharges Associated with Construction Activity issued by the State Water Resources Control Board.

Some dewatering at the box culvert, diversion structure, and east portal excavations, inflows would be likely because groundwater levels are up to a few feet above the bottom of the excavations. Inflows during tunnel construction are anticipated to be less than approximately 50 gpm. Water would be pumped out of the Tunnel through the shaft via discharge lines leading to holding tanks within the shaft staging area. Water would be discharged to the combined sewer system or broadcast and allowed to evaporate.

It is not anticipated that dewatering would generate contaminated water that would require special handling or disposal. However, for any flows that may be contaminated with cementitious products, silts and sediments, oil and grease derived from equipment, and/or other potential contaminants, the contractor would be required to have the necessary facilities (portable water treatment units located in the staging areas) to collect, handle, and treat these flows. Discharge water quality would be tested and maintained in accordance with the individual discharge permits.

2.5.9 Chemicals and Fuel Storage

A variety of standard chemicals and fuels necessary for construction activities would be used in construction areas and some would be stored in staging areas for use during construction. The contractor would maintain a binder of material safety data sheets (MSDSs) for all chemicals used or stored on-site. Most chemicals would not be stored on-site and would be transported to the site as needed. Fuels would be stored in skid tanks with fire protection.

2.5.10 Construction Safety

The tunnel drilling contractor(s) would implement a Drilling Health and Safety Plan that would address responsibilities and best practices for worker safety, including site-specific elements such as providing training for construction personnel in the recognition, avoidance, and reporting procedures for suspected hazardous materials or conditions.

2.6 Project Operation and Lake Level Management

2.6.1 Management of Stormwater Flow

Stormwater and authorized non-stormwater flows would flow by gravity through a box culvert located below the wetlands for a distance of approximately 1,350 feet. Here the flow would enter a diversion structure where it could be pumped to the treatment wetlands, or either directed to Lake Merced or allowed to continue through the Canal and Tunnel to the Ocean Outlet. Variable control would be available at the diversion structure gates so that all or only portions of the flow may be directed in either direction.

The collection box, box culvert, gross solids screening device, and diversion structure would be sized conservatively to more than accommodate peak flows generated by the 25-year design storm, which is approximately 1,070 cfs. The box culvert under John Muir Drive would also be designed to accommodate the full capacity of 1,070 cfs; however, since a portion of the total flow could be directed through the Canal and Tunnel, only approximately 570 cfs capacity is needed to accommodate peak flows generated by the design storm. The segment of the Canal between the diversion structure and the Tunnel portal would remain unimproved, with a capacity of approximately 500 cfs. The improved tunnel would be designed with a capacity of at least 500 cfs.

After passing through the solids screening device, year-round low flow stormwater and authorized non-storm flows would be pumped to the start of one of the surface treatment wetland cells. Water would flow by gravity to the terminus of the treatment wetlands, where it would typically drop into a box culvert below and continue to flow into Lake Merced. Treated water also would have the capability of returning to the Canal and Tunnel in order to bypass Lake Merced if requested by the SFPUC.

As discussed in Section 2.6.2, Lake Level Management, the Project would provide a water supply to maintain lake levels within a WSE that would be selected as a target annual operational level, which is referred to as the target WSE. The initial storm event of the winter season and other storm events with long antecedent dry periods would flow through the Canal to the Tunnel and then to the Ocean Outlet. The Project also has the capability to continue to route runoff from various types of events to the Pacific Ocean. Stormwater would be routed to Lake Merced dependent on stormwater flow rate, Lake Merced levels, and other diversion criteria, including rainfall frequency, predicted rainfall duration and magnitude, Canal flow rates, and other factors. More detailed diversion criteria would be developed further during design of the diversion facilities, and further refined following the first wet season of operation and throughout implementation of a Lake Management Plan (see Section 2.6.4). However, the principal diversion routing options are:

1. **Summer and Winter Low-Flow Routing, Lake Merced below target WSE.** Screened dry weather flows (authorized non-stormwater) and low-volume stormwater flows would be routed through the treatment wetlands, after which the treated water would drain into the Lake Merced Outlet to Impound Lake. These flows would help to maintain overall lake level and sustain the proposed treatment wetlands throughout the year. There would be no flow through the Tunnel or beach discharge.

2. **Summer and Winter Low-Flow Routing, Lake Merced at target WSE.** Screened dry weather flows (authorized non-stormwater) and low-volume stormwater flows would be routed through the treatment wetlands after which the treated water would drain into the Lake Merced Outlet to Impound Lake. These flows would help to maintain overall lake level and sustain the proposed treatment wetlands throughout the year. Inflows into the Lake that occur when the lake is at the target WSE would increase the WSE above the Lake Merced Overflow elevation, resulting in outflows from South Lake to the Vista Grande Tunnel via the Lake Merced Overflow. Overflows would be conveyed via the Vista Grande Tunnel to the Ocean Outlet.

3. **Winter Storm Routing, Lake Merced below target WSE.** Screened initial stormwater flows would be routed through the Canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake, and there may be no flow through the Tunnel or beach discharge.

4. **Winter Storm Routing, Lake Merced at target WSE.** Screened initial stormwater flows would be routed through the Canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake. Inflows into Impound Lake would increase the WSE above the Lake Merced Overflow weir elevation, resulting in outflows from South Lake to the Vista Grande Tunnel and Ocean Outlet via the Lake Merced Overflow.

5. **Winter Storm Exceeding 25-year, 4-hour criteria, Lake Merced at target WSE.** Screened initial stormwater flows would be routed through the Canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake. In addition, if stormwater flows from the Vista Grande watershed exceed the combined capacity of Lake Merced and the Vista Grande Canal and Tunnel, Canal flows could overtop the Canal and flow across John Muir Drive to Lake Merced, as occurs under existing conditions. Flows would cross the existing hardscape areas (riprap) between John Muir Drive and South Lake. Inflows into either Impound Lake or South Lake would result in overflows back to the Tunnel as capacity is available and would be discharged via the Ocean Outlet. This option would temporarily raise lake levels above the target WSE, providing short-term storage during major storm events to reduce flooding in the Vista Grande Basin.

When Lake Merced is at the target WSE, additional contributions to the lake from Vista Grande Canal stormwater, precipitation, or other contributions, such as groundwater interactions or other drainage from the existing watershed, would flow from the lake into the Canal from a flexible pipeline installed near the lake bottom at the Lake Merced overflow structure (see Figure 2-2a).

In addition, at the time of winter flows that exceed 25-year, 4-hour criteria storms, the overflow weir would be raised such that lake levels could exceed the WSE target for short time periods.

2.6.2 Ocean Outlet Structure Discharges

Treated effluent would exit the two 24-inch pipelines under the rehabilitated Tunnel and be combined in the rehabilitated 33-inch submarine outfall pipeline underneath the Ocean Outlet structure. The elevation of the effluent pipeline would be the same as the existing pipeline. These treated effluent flows would continue to be discharged offshore through the submarine outfall pipeline.

Low stormwater or authorized non-storm flows from the Tunnel would drop into the rehabilitated submarine outfall and be discharged offshore through the submarine outfall pipeline, similar to under existing conditions. Larger storm flows would discharge through the west-facing flap gates in the Ocean Outlet structure and would flow across the beach.

2.6.3 Lake Level Management

As discussed above, the proposed Project would divert some stormwater and authorized non-stormwater flows to Impound Lake to aid the SFPUC in operating Lake Merced within desired water levels. The water level of Lake Merced has fluctuated historically from Elevation (El.) 13 feet (San Francisco City Datum) in the 1940s (City Datum is 11.37 feet higher than the North American Vertical Datum 1988) to a low of El. -3.2 feet in 1993. Since then, the WSE of Lake Merced has risen due to increases in average rainfall and water additions by the SFPUC (SFPUC, 2011). From 2006 to 2010, the lake level ranged from El. 4.8 feet to El. 6.9 feet with an average of approximately El. 5.8 feet (City Datum). SFPUC has identified a goal of establishing maximum water levels in the lake that would serve beneficial uses and provide a reliable emergency water supply for firefighting and sanitation purposes (SFPUC, 2011). The range of potential WSE scenarios that could occur under this Project includes mean WSEs of 6.5 to 8.5 feet, with a maximum high WSE of 9.5 feet. However, the actual proposed operation WSE range would be determined by the SFPUC, following completion of this CEQA/NEPA review process. In determining the actual proposed operation WSE range, SFPUC would consider their operations and maintenance requirements, and would consult with the City and County of San Francisco departments responsible for operating facilities immediately adjacent to Lake Merced to address any facility requirements, such as potential modifications to boat docks to accommodate higher lake water levels.

Three representative operational scenarios are considered under the Project: maximum WSEs of 7.5, 8.5, and 9.5 feet (see **Figure 2-5**). This is the elevation at which the lake overflow weir would be set under each scenario. After winter rains taper off, about 1.5 feet of water is lost each year, primarily due to evaporation. Thus, for each scenario there is a corresponding target normal minimum WSE. The term normal is used to refer to normal and wet year conditions. Under dry year and multiple dry year conditions, it is assumed that WSE would fall below the target normal range. During a storm event, the lake's WSE may rise above the target maximum WSE, as the flow of stormwater being diverted into the lake exceeds the capacity of the overflow outlet, thus providing short-term water storage for flood events.

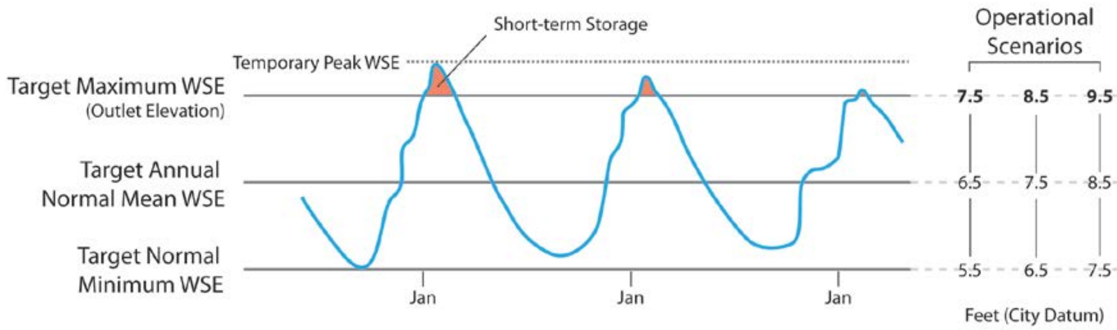


Figure 2-5
Representative Lake Level Operational Scenarios

2.6.4 Lake Management Plan

Daly City and SFPUC have developed and agreed to implement a Lake Management Plan (LMP) to maintain and, where feasible, improve the water quality of Lake Merced. The LMP, included as Appendix A, includes an initial operational plan for the diversion of stormwater from the Canal to Lake Merced, a Lake monitoring plan to assess trends in hydrology and water quality, and a prioritized suite of best management practices (BMPs) that would be implemented by Daly City and SFPUC, in conjunction with regulatory adjustments to reflect site-specific conditions. Implementation of the Lake Management Plan is considered part of Project implementation and is analyzed as such throughout this document. BMPs implemented throughout the watershed would include detention and filtration of stormwater (i.e., low-impact development), pet waste management, green infrastructure education programs, habitat enhancement around Lake Merced, separating stormwater from SFPUC's combined storm sewer system, reducing nutrient sources from major contributors such as parks and other agency-maintained green space, and storm drain catch basin screening. These are described in more detail in Section 5.1 of Appendix A.

Additional adaptive management actions[4] would be undertaken as needed based on the results of monitoring conducted under the LMP; in particular, aeration mixing in Lake Merced may have beneficial water quality effects. While the LMP includes discussion of an aeration mixing project, it may or may not be implemented under the Lake Management Plan. It is noted that, SFPUC has proposed to implement a demonstration aeration mixing project to evaluate its potential benefits. That demonstration project is evaluated as a component of the cumulative scenario described in Section 3.1 of this document.

4 Adaptive management is the standard scientific approach for managing complex natural resource projects such as the proposed Project and alternatives, and consists of a monitoring, assessment, and adjustment feedback loop whereby adjustments are informed by observed conditions and, where available, process and/or technological improvements. It is the accepted approach used by natural resource management agencies.

2.6.5 Project Maintenance

The gross solids screening device within the Canal would be emptied of collected debris approximately twice per year, once after the initial storm flow of the wet season and once at the end of the wet season. Post-project monitoring would determine whether more frequent cleaning would be required. Vacuum trucks would access the device via a new 15-foot-wide access road on the western side of John Muir Drive. It is anticipated that as much as 100 cubic yards of debris could be removed at each cleaning, and debris would be disposed of at Ox Mountain Landfill located in Half Moon Bay. Annual inspections of infrastructure and removal of sediments from open portions of the Canal would continue, as currently occurs. However, the volume of sediments requiring removal from the Canal would be reduced given the addition of the gross solids screening device.

Operation of the treated wetlands would require mosquito control using bacterial methods[5] and trash removal on an annual basis, harvesting of bio mass approximately every 5 years, and removal of silt and other organic material every 10 to 20 years. Operational activities would be implemented in accordance with a treatment wetlands management plan that would be required as part of the San Francisco Regional Water Quality Control Board permit issued in accordance with Section 402 Policy on the Use of Constructed Wetlands for Urban Runoff (No. 94-201) (see Section 2.10, Regulatory Requirements, Permits, and Approvals).

In order to maintain adequate flow in the constructed treatment wetlands to support vegetation, water would be drawn from Lake Merced during periods of low flow availability in the Canal and would pass through the treatment wetlands, after which it would return to Lake Merced through the box culvert under John Muir Drive and the Lake Merced Outlet. This would require operation of the pumps located in the wetland pump station.

Due to the existing and ongoing erosion of the bluff at Fort Funston, over time, the proposed Ocean Outlet structure and a portion of the Tunnel would become exposed on the beach, in a manner similar to what has occurred in the past with the existing infrastructure. Therefore, at some point in the future, removal and reconstruction of the Ocean Outlet structure may be needed to address the effects of bluff erosion and sea level rise on Project infrastructure. Current projections estimate that this removal and reconstruction could occur in approximately 25-year intervals, but this time period may vary based on bluff erosion rates, future sea level rise, and other factors. The scope and nature of such removal and reconstruction would be very similar to the removal and reconstruction of the existing infrastructure proposed for the Project, including the need for applicable permits, easement amendment(s), and possibly a right-of-way or other authorization. As with the proposed Project, demolition and construction access may be provided via the Avalon Canyon access road and/or via the Tunnel. The methods for demolition and construction would also be similar to those described for the proposed initial Ocean Outlet rehabilitation.

5 Bacteria that infect and kill mosquito larvae. These bacteria are highly selective, killing only mosquitoes and their close relatives like gnats and black flies, and do not harm other kinds of insects, fish, birds, or mammals.

2.7 Project Alternatives

CEQA requires that an EIR describe a reasonable range of alternatives to the project or to the location of the project that would "feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project" (CEQA Guidelines §15126.6(a)). "Feasible" is defined as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors" (CEQA Guidelines §15364). Additional factors that may be taken into account in assessing feasibility are the availability of infrastructure and consistency with other plans or regulatory limitations (See CEQA Guidelines §15126.6(f)(1)).

In addition to the requirement that alternatives be potentially feasible, an EIR must focus on alternatives that would accomplish most of the project's basic objectives (CEQA Guidelines §15126.6(a)-(b)). For this reason, an EIR need not present alternatives that are incompatible with fundamental project objectives.[6]

Alternatives selected for examination in an EIR must avoid or substantially lessen the project's significant environmental effects (CEQA Guidelines §15126.6(c)). An alternative that would avoid or lessen the project's significant effects may nonetheless have significant effects of its own.

Finally, an EIR is not required to consider all potential variations on alternatives already included in the analysis.[7]

Thus, under CEQA, a project alternative may be eliminated from detailed consideration in an EIR based on its failure to meet most of the basic project objectives, infeasibility, the alternative's inability to avoid significant environmental effects, or the alternative's similarity to an existing project alternative carried forward for full evaluation.

Under NEPA, an EIS must "[r]igorously explore and objectively evaluate all reasonable alternatives." (40 CFR 1502.14.) The NPS Director's Order 12 (DO-12) Handbook (NPS, 2001) provides that the EIS must evaluate a "full range of alternatives" that "meet project objectives to a large degree, although not necessarily completely" (Section 2.7(A)). It further explains that "[u]nreasonable alternatives may be those that are unreasonably expensive; that cannot be implemented for technical or logistic reasons; that do not meet park mandates; that are inconsistent with carefully considered, up-to-date park statements of purpose and significance or management objectives; or that have severe environmental impacts" (Section 2.7(B)). In addition, alternatives that "could not be implemented if they were chosen, or that do not resolve the need for the action and fulfill the stated purpose in taking action to a large degree, should be eliminated as unreasonable before impact analysis begins" (Section 2.7(B)). Alternatives may also be

6 See In re Bay-Delta Programmatic Envt'l Impact Report Coordinated Proceedings (2008) 43 Cal.4th 1143, 1165.

7 See Mira Mar Mobile Community v. City of Oceanside (2004) 119 Cal.App.4th 477, 491 ("CEQA does not require an EIR to consider each and every conceivable variation of the alternatives stated"); Village Laguna of Laguna Beach, Inc. v. Board of Supervisors (1982) 134 Cal.App.3d 1022, 1029 (same).

considered unreasonable if they are “economically and technically” infeasible or that lack “evidence of common sense” (Section 2.7).

2.7.1 Range of Alternatives

Consistent with the requirements described in Section 2.7, alternatives to the proposed Project were screened for CEQA (14 Cal. Code Regs. §15126.6(a)) and NEPA (see NPS DO-12 NEPA Handbook Section 2.7; NPS, 2001) purposes based on the following criteria:

1. Does the alternative meet most of the objectives of the Project?
2. Does it respond to the NPS’s purpose and need?
3. Is its implementation feasible?
4. Is it consistent with the basic policy objectives for the management of the area?
5. Is its implementation remote or speculative?
6. Is it substantially similar in design to an alternative that is analyzed?
7. Would it have substantially similar effects to an alternative that is analyzed?
8. Would it avoid or substantially lessen any significant effects of the Project?

This process for retaining or eliminating potential alternatives from detailed analysis complies with CEQA Guidelines Section 15126.6, 40 CFR Section 1502.14(a), and NPS DO-12 Section 4.12 (2011).

The range of alternatives presented in this EIR/EIS reflects collaborative efforts by Daly City, the NPS GGNRA, SFPUC, applicable regulatory agencies, and outreach with interested parties and individuals. Beginning in 2007, Daly City and its engineering and environmental consultants evaluated 17 alternative engineering concepts for managing stormwater in the Basin to alleviate flooding. The engineering alternatives included various combinations of facilities including different tunnel alignments and capacities, stormwater detention structures, and groundwater recharge facilities. These engineering alternatives were evaluated in the 2007 draft Alternatives Evaluation Report based on their potential for reducing flooding, operational viability, public impacts, environmental benefits, and constructability. The report also considered diversion of stormwater to Lake Merced as an optional element that could be used in combination with a new tunnel alignment or stormwater retention alternative to help address both flooding and water quality management objectives. Daly City held public meetings in 2008 to introduce interested parties to the conceptual engineering alternatives and hear input about the community’s concerns (Daly City, 2008a, 2008b). Following further discussions in July 2009 with the public and key stakeholders, Daly City and San Francisco agreed to explore the potential benefits of augmenting the existing infrastructure adjacent to and including Lake Merced to reduce the localized flooding potential within the watershed and simultaneously better manage Lake Merced water levels. This collaborative effort led to the inclusion of the “Lake Merced Alternative” in a revised Alternatives Analysis Report. A public hearing was held in May 2011 to review the alternatives presented in this revision, and several stakeholders spoke in support of the Lake Merced Alternative (North San Mateo County Sanitation District, 2011). As a result of this evaluation process, Daly City further defined the Lake Merced Alternative, which became the proposed Project as described in Sections 2.4 through 2.6. The other engineering alternatives and additional design options were considered to determine whether they met the alternatives selection criteria listed above. The alternatives that met the selection criteria are described in Section 2.7.2 and analyzed throughout this EIR/EIS. A No Project/No Action alternative also is carried forward for analysis; it is described in Section 2.7.2.3. Alternatives considered but dismissed from further consideration because they do not meet the selection criteria listed above are described in Section 2.7.3.

2.7.2 Alternatives Carried Forward for Analysis

2.7.2.1 Tunnel Alignment Alternative

The Tunnel Alignment Alternative, described in more detail below, is carried forward for analysis in this EIR/EIS because it meets the screening criteria listed in Section 2.7.1, Range of Alternatives. This alternative could replace the proposed Project's Lake Merced (East) Portal and Vista Grande Tunnel improvement components with an entirely new tunnel and a different east portal. The components of the Tunnel Alignment Alternative could be paired with the proposed components described in Section 2.4.1, Vista Grande Canal Improvements and Diversion of Stormwater to Lake Merced, or could be paired with the alternative Canal components described below in Section 2.7.2.2, Canal Configuration Alternative. Therefore, regardless of the selected Canal configuration, the Tunnel Alignment Alternative would not affect the opportunities for stormwater reuse, one of the Project's primary objectives.

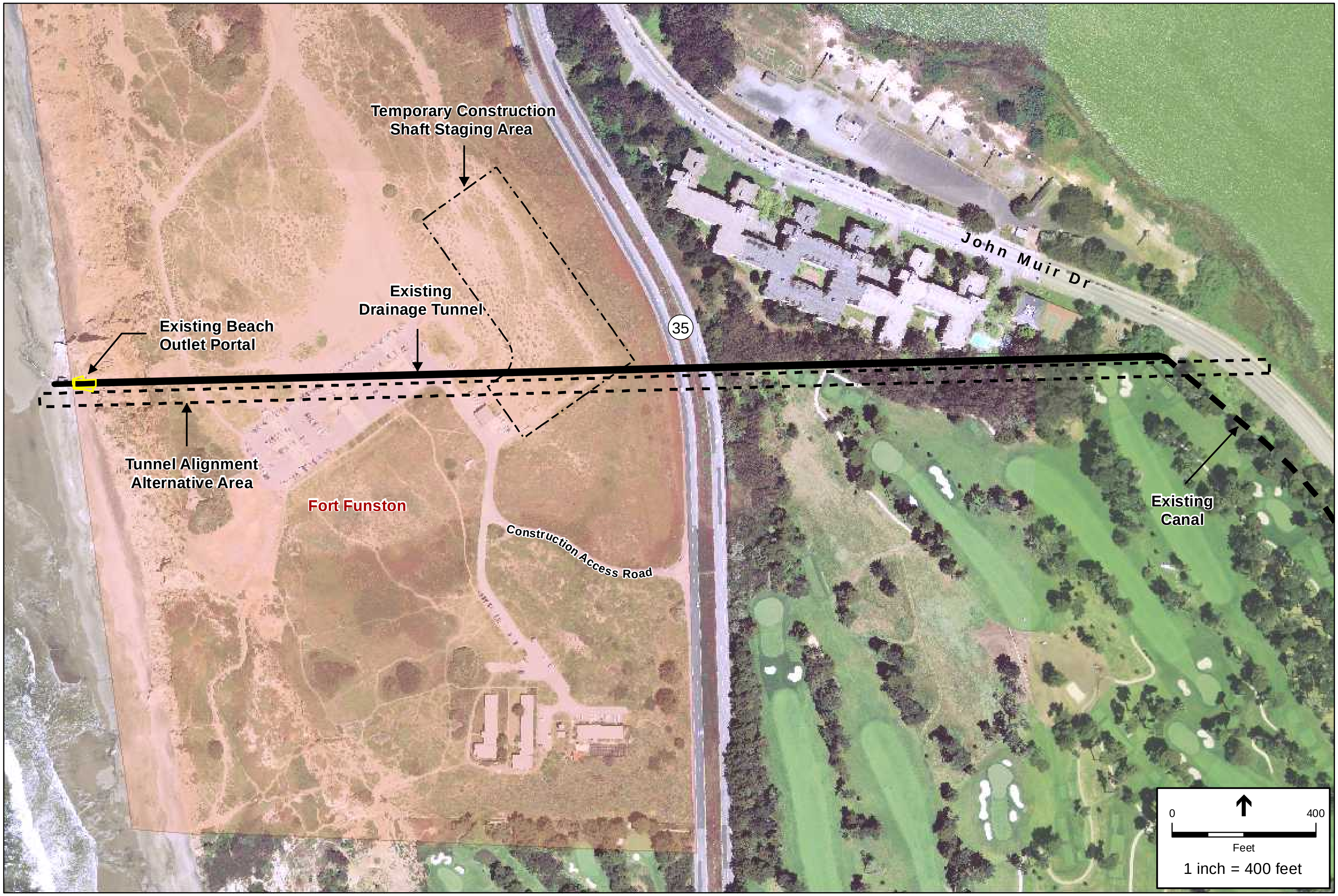
Additionally, under this alternative, the Lake Merced overflow, submarine outfall pipeline, and Avalon Canyon access road components would remain the same as under the proposed Project. Therefore, the description and analysis of this alternative addresses the Tunnel and East Portal components only.

The purpose of this alternative is to consider whether it is possible to avoid adverse impacts associated with the proposed destruction of the existing Vista Grande Tunnel, a historic resource.

Description

The Tunnel Alignment Alternative would include the construction of a replacement tunnel south of the existing Tunnel, which would be located within an area between the existing Tunnel and a line approximately 50 feet to the south, to avoid positioning structures in areas of geologic instability and sensitive biological resources. The exact alignment within this area would be determined during final design and following additional geotechnical investigation. All areas of potential disturbance within this approximately 50-foot-wide corridor are analyzed in this EIR/EIS in order to adequately identify and disclose the potential impacts of this alternative. The area within which this alternative would be located is shown on **Figure 2-6**.

The new tunnel would run west from a new east portal at the Canal to a new or rehabilitated Ocean Outlet structure. The Tunnel would run beneath the Olympic Club, Highway 35, and the GGNRA lands.



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2-6

Tunnel Alignment Alternative Area

New Facilities and Modifications and Connections to Existing Facilities

The new facilities included in this alternative would include the construction of an up to 9-foot-diameter, 3,200-foot-long tunnel; and either

- A rehabilitated outlet structure at the same location as the existing Ocean Outlet, and demolition of the existing structure as described for the proposed Project, or
- A new outlet structure with the same or similar design as that described for the proposed Project, but located up to 50 feet south of the existing outlet structure, and removal of or abandonment of the existing structure in place. Under this option, a new connection to the portion of the existing submarine outfall pipeline that crosses the beach also would be constructed in a manner similar to that described for the proposed Project. This portion of pipe would be up to 50 feet longer than under the proposed Project in order to connect to the existing submarine outfall pipeline.

Similar to the proposed Project, it is assumed that as bluff erosion continues, exposed portions of the new and existing tunnel would need to be removed periodically.

The new Tunnel under this alternative would connect to the existing Canal with a new east portal located at a point south (upstream) of the existing Lake Merced Portal, the location of which would be dependent on the final alignment of the Tunnel.

Construction Methods

The temporary construction shaft would be approximately the same diameter as the shaft for the proposed Tunnel, or approximately 30 feet in diameter (see Section 2.5.2). It would be located at a point along the alternative alignment (approximately 50 to the south of the proposed shaft location) within the proposed staging area, as shown on Figure 2-6. Like the proposed Project, a crane would be positioned near the shaft edge to hoist personnel, materials, and equipment between the tunnel and the surface.

Because the tunnel would follow a new alignment (i.e., not re-mining the existing tunnel), excavation would use either a digger shield or a micro-tunnel boring machine (MTBM), which cannot be used to excavate through an existing tunnel. With either option, a cylindrical shield of a slightly larger diameter than the final tunnel diameter is driven through the ground by a series of hydraulic jacks. A digger shield uses hydraulic jacks located at the tail of the machine to thrust against previously installed supports, with each round or support installed directly behind the shield. An MTBM is propelled forward via a string of pipe jacked from the shaft. Like the Project, tunneling would begin in both directions from the Fort Funston shaft. Similar to the proposed Project, approximately 150 feet of the existing Canal and approximately 100 feet of the 33-inch treated effluent gravity pipeline would need to be demolished to accommodate construction of the new Lake Merced Portal. After the tunneling has been completed, the remaining section of the 33-inch treated effluent gravity pipeline would be connected to a new system of pipes that would connect to the two 24-inch pipes located under the new Tunnel, the Canal would be reconstructed to match the existing Canal section, and a cast-in-place structure would be constructed to join the Canal and Tunnel. The same adjustable-height weir/pipeline would be installed in place of the mouth of the existing Lake Merced Overflow across John Muir

Drive from the Lake Merced Portal as under the proposed Project. The portal area would be re-graded to match existing conditions or similar.

Tunneling spoils would contain native ground and would total approximately 19,000 cubic yards. Muck cars would be used within the tunnel and a crane would be used at the shaft to lift excavated materials to surface. The tunnel final lining would likely consist of cast-in-place concrete. The existing tunnel would be abandoned in place. For safety and liability purposes and to prevent collapse of the existing tunnel and overlying soils, the existing tunnel would be backfilled with concrete.

Operational Scenarios

Operation of the new Tunnel would be the same as for the proposed enlarged tunnel. The operational scenarios for flows through the Tunnel would be as described in Section 2.6 if the proposed Canal improvements are constructed, or as described in Section 2.7.2.2 if the alternative Canal configuration is constructed.

Relationship to Other Alternatives Considered

A similar alternative was considered in the 2007 draft Alternatives Evaluation Report and 2011 Alternatives Analysis Supplement (Jacobs Associates, 2007, 2011a), and information provided in that report is relied on to the extent possible for the description of this alternative. Called Alternative 7, it consisted of two options: a large-diameter (15-foot) tunnel with a capacity of at least 1,000 cfs (7A) and a small-diameter microtunnel with a capacity of 330 cfs (7B). The latter would have complemented the existing Tunnel's capacity, while option 7A would have replaced it. This engineering alternative was considered one of the "top three" tunnel alignment alternatives Daly City was considering before proposing the Project (Jacobs Associates, 2011a). Similarly, Alternatives 5B and 6, described in Section 2.7.3.1, also would begin at a point along the Canal and end at the existing outlet, but because these would require longer tunnels and would therefore increase tunneling-related environmental impacts relative to the Tunnel Alignment Alternative, they were not considered further.

2.7.2.2 Canal Configuration Alternative

The Canal Configuration Alternative, described in more detail below, is carried forward for analysis in this EIR/EIS because it meets the screening criteria listed in Section 2.7.1, Range of Alternatives. This alternative could replace the proposed components described in Section 2.4.1, Vista Grande Canal Improvements and Diversion of Stormwater to Lake Merced, with a different set of structures located within the Canal. The components of the Canal Configuration Alternative could be paired with the proposed components described in Section 2.4.2, Vista Grande Tunnel and East and West Portals, or could be paired with the alternative Tunnel and East Portal components described below in Section 2.7.2.1, Tunnel Alignment Alternative. Under this alternative, the Ocean Outlet, submarine outfall pipeline, and Avalon Canyon access road components would remain the same as under the proposed Project. Therefore, the description and analysis of this alternative addresses the upstream Canal components (i.e., all but the East Portal) only.

The purpose of considering this alternative is to minimize adverse impacts associated with the proposed destruction and replacement of a portion of the existing Vista Grande Canal, a historic resource and jurisdictional other waters of the U.S.

Description

The Canal Configuration Alternative would minimize changes to the existing Canal while still allowing for some discharges to Lake Merced. This alternative would not construct the box culvert replacing the first 1,000 feet of the Canal; rather, the diversion structure described for the proposed Project would be relocated to the southern (upstream) end of the Canal as shown in **Figure 2-7**. The box culvert under John Muir Drive also would be relocated and would cross under John Muir Drive close to the southern end of Impound Lake. The design of the diversion structure, box culvert under John Muir Drive, and Lake Merced Outlet would be approximately the same as for the proposed Project, but located as shown on Figure 2-7. The diversion structure would replace the first approximately 350 feet of the Canal, and the rest of the Canal would be unchanged except as needed for the Lake Merced Tunnel Portal, described above for the proposed Project.

Under the Canal Configuration Alternative, only one wetland cell of approximately 1.7 acres would be constructed, providing a reduced water treatment capacity compared to the Project.

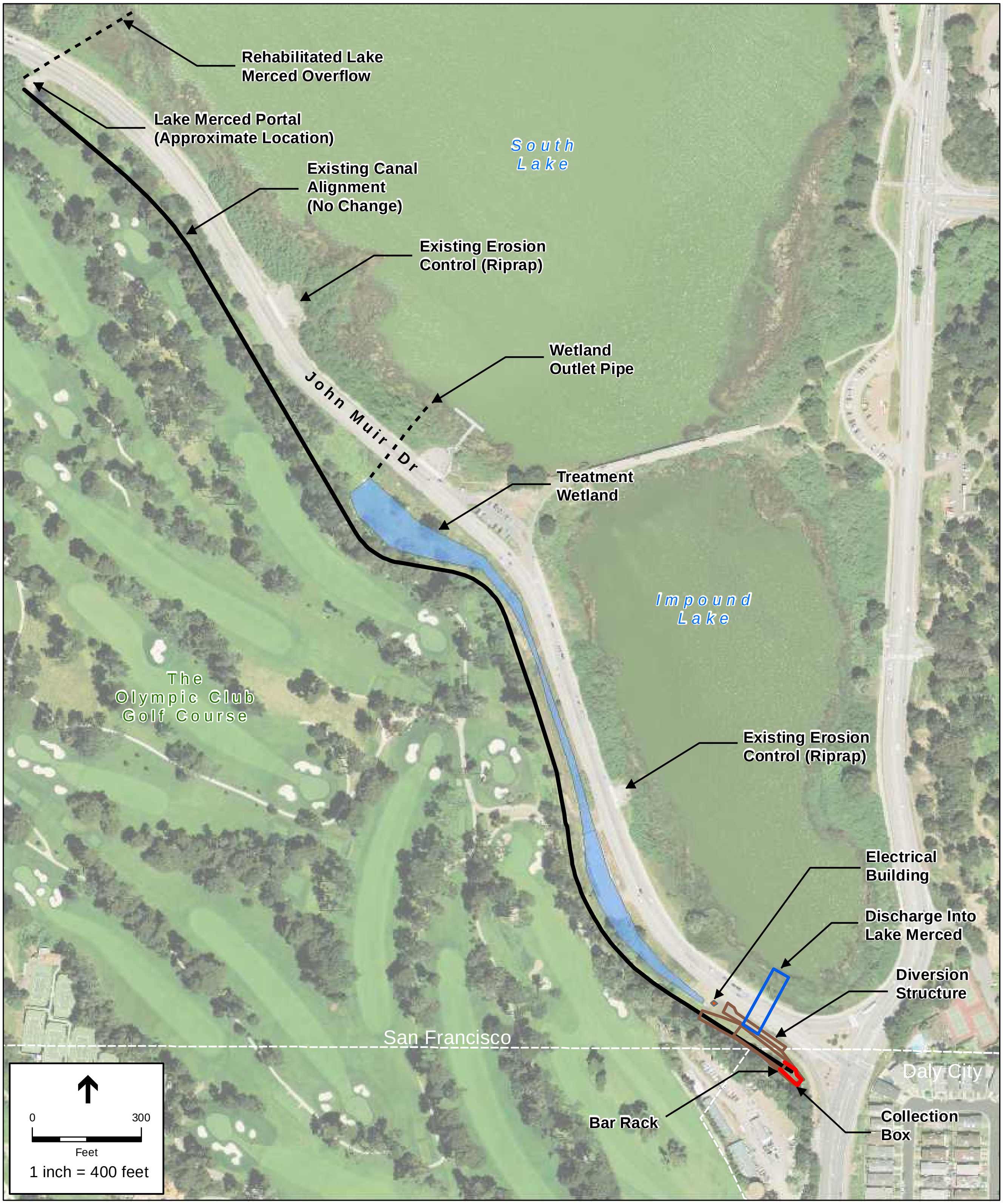
New Facilities

- Debris screening device
- Diversion structure
- Box culvert under John Muir Drive
- Impound Lake Outlet Structure
- Wetland cell (1.7 acres)

The debris screening device, diversion structure, John Muir Drive crossing, and Impound Lake outlet structure would be the same dimensions and design as the proposed Project, but would be located at the mouth of the Canal at the south end of Impound Lake.

Construction Methods

The construction methods for this alternative would be similar to those for the diversion from the Canal to Lake Merced under the proposed Project, described in Section 2.5.1. This alternative would require the same utility relocations and would not affect SFPUC’s combined storm sewer running parallel to John Muir Drive north of the bridge between Impound and South lakes. The John Muir Drive crossing would require similar temporary rerouting of John Muir Drive, but shifted to the southeast along John Muir Drive, close to the intersection with Lake Merced Boulevard.



SOURCE: McMillen Jacobs Associates, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2-7
Canal Configuration Alternative

Operational Scenarios

Stormwater and authorized non-stormwater flows would flow by gravity to the headwaters of the Canal, which would be replaced by the debris screening and diversion structure where it could be pumped to the constructed treatment wetland cell, or either directed to Lake Merced or allowed to continue through the Canal and Tunnel to the Ocean Outlet. Variable control of Canal flows would be available at the diversion structure gates so that all or only portions of the flow from within the Canal may be directed in either direction.

The debris screening device and diversion structure would be sized to accommodate peak flows coming through the Canal or up to 1,070 cfs. The box culvert under John Muir Drive would also be designed to accommodate 1,070 cfs.

After passing through the solids screening device, year-round low flow stormwater and authorized non-storm flows would be pumped at rates of up to approximately 400 gpm (approximately 0.9 cfs) to the start of the surface treatment wetland cell. Water would flow by gravity to the terminus of the treatment wetland, where it would be conveyed into South Lake via a 18-inch pipeline under John Muir Drive. Treated water also would have the option of being returned to the Canal and continuing to the Tunnel in order to bypass Lake Merced if requested by the SFPUC.

Maintenance of the debris screening device would be as described for the proposed Project.

The proposed operating model would be similar to the proposed Project. Like the Project, under this alternative, the initial storm event of the winter season and other storm events with long antecedent dry periods would flow through the Canal to the Tunnel and then to the Ocean Outlet. This alternative also would maintain the capability to continue to route runoff from various types of events to the Pacific Ocean. Stormwater would be routed to Lake Merced dependent on stormwater flow rate, Lake Merced levels, and other diversion criteria, including rainfall frequency, predicted rainfall duration and magnitude, Canal flow rates, and other factors. More detailed diversion criteria would be developed further during design of the diversion facilities, and further refined following the first wet season of operation. The principal diversion routing options are the same as the proposed Project described in Section 2.6.1, Management of Stormwater Flows, except that treated water from the constructed treatment wetland would drain into South Lake rather than Impound Lake, and the constructed treatment wetland would have a reduced capacity compared to the proposed Wetland Cells A and B.

2.7.2.3 No Project/No Action Alternative

CEQA requires an EIR to evaluate a “no project” alternative to allow decision-makers to compare the impacts of approving a proposed project with the impacts of not approving it (CEQA Guidelines §15126.6(e)). The “no project” analysis evaluates the existing conditions at the time the Notice of Preparation was published as well as what reasonably would be expected to occur in the foreseeable future if the proposed project were not approved, based on current plans, permits and available infrastructure and services.

Similarly, NEPA (§1502.14(d)) requires that an EIS "include the alternative of no action" to set a baseline of existing impact continued into the future against which to compare impacts of action alternatives, and NPS DO-12 requires that all NPS EISs provide a full analysis of no action (NPS, 2001, §2.7(C)).

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and none of the proposed operational changes to stormwater routing would be made. The Lake Management Plan would not be implemented. The NPS would not grant the Special Use Permit, and no construction could occur within NPS-managed lands.

Annual Canal sediment removal activities would continue, as well as as-needed maintenance activities. Because Canal and Tunnel capacity would not be improved, occasional flooding of the Canal and associated flooding of John Muir Drive into Lake Merced and in local neighborhoods would continue.

2.7.3 Alternatives Considered but Eliminated from Detailed Analysis

This section describes those alternatives considered but dismissed from further consideration because they do not meet the selection criteria defined in Section 2.7.1.

2.7.3.1 Drainage Tunnel Alternatives

As explained in Section 2.7.1, Range of Alternatives, Daly City's 2007 draft Alternatives Evaluation Report evaluated several tunnel alignments to varying degrees of detail. The tunnel alignment alternative that that would avoid some of the proposed Project's significant environmental effects, and that is potentially feasible, is described in Section 2.7.2 and has been carried forward for full evaluation in this EIR/EIS. As explained below, several alternatives initially considered in the 2007 draft Alternatives Evaluation Report will not be carried forward for full evaluation in this EIR/EIS due to their failure to meet most of the basic project objectives; failure to reduce any of the proposed Project's significant environmental effects; infeasibility based on economic, environmental, legal, social, technological or other factors; and/or due to their similarity to Project alternatives already being evaluated in this EIR/EIS. As explained in Section 2.7, Daly City and NPS are not required to consider all potential variations on the tunnel alignment alternative.[8] The drainage tunnel alternatives considered but eliminated are summarized in **Table 2-6** and discussed below.

As detailed the 2007 draft Alternatives Evaluation Report, geotechnical reconnaissance for the Project found considerable evidence of deep-seated landslides beginning in the southern portion of Fort Funston and continuing south to the vicinity of Thorton State Beach (Jacobs Associates, 2007; Gilpin Geosciences, 2007). The new outlet structure sites for Alternatives 1A, 2, 3, 4, 5A,

8 Mira Mar Mobile Community, 119 Cal.App.4th at 491; Village Laguna of Laguna Beach, Inc., 134 Cal.App.3d at 1029.

TABLE 2-6
DRAINAGE TUNNEL ALTERNATIVES CONSIDERED BUT ELIMINATED

2007 Report ID	Tunnel Inlet Location	Alignment/Attributes	Tunnel Outlet Location	Notes
1A	Beginning of Vista Grande Canal	Beneath Olympic Club	New outlet 3,600 feet south of existing	Outlet location found technically infeasible. Would not meet stormwater reuse objective.
1B	Beginning of Vista Grande Canal	Beneath Olympic Club and Fort Funston	Existing outlet	Would not meet stormwater reuse objective.
2	Doelger Senior Center (Westlake Park)	Beneath Olympic Club and Fort Funston	New outlet at Thornton State Beach	Outlet location found technically infeasible. Would not meet stormwater reuse objective.
3	South side of Cliffside Drive	Beneath John Daly Boulevard	New outlet at Thornton State Beach	Outlet location found technically infeasible. Would not meet stormwater reuse objective.
4	Westlake Park	Beneath Northgate Avenue	New outlet at Thornton State Beach	Outlet location found technically infeasible. Would not meet stormwater reuse objective.
5A	Approximately 800 feet downstream of the beginning of the Vista Grande Canal	Beneath Olympic Club	New outlet 3,600 feet south of existing	Outlet location found technically infeasible.
5B	Approximately 800 feet downstream of the beginning of the Vista Grande Canal	Beneath Olympic Club and Fort Funston	Existing outlet	Substantially similar to Tunnel Alignment Alternative (see Section 2.7.2.1), but with potential for greater environmental effects.
6	Approximately 2,100 feet downstream of the beginning of the Vista Grande Canal	Beneath Olympic Club	Existing outlet	Substantially similar to Tunnel Alignment Alternative (see Section 2.7.2.1), but with potential for greater environmental effects.
7A and 7B	Approximately 3,500 downstream of the beginning of the Vista Grande Canal	Beneath Olympic Club 7A: Large diameter 7B: Small diameter (330 cfs)	Existing outlet	Substantially similar to Tunnel Alignment Alternative (see Section 2.7.2.1).
8	Westlake Park	Beneath a portion of Northgate Avenue and the Olympic Club Small diameter (330 cfs)	New outlet at Thornton State Beach	Thornton State Beach portion found technically infeasible.

SOURCE: Jacobs Associates, 2007.

and 8 are located within this landslide deposit, which is prone to landsliding and aggressive bluff erosion. A new tunnel and outlet structure constructed in the geologically unstable area would be exposed to routine sloughing and landslides. Routine outlet structure maintenance would involve removing landslide material from the structure and waterway using large earthmoving equipment. Daly City also would need to relocate the beach structure landward more frequently than if the structure were constructed further north, outside of this landslide deposit. The existing Daly City Ocean Outlet site at Fort Funston is considerably less susceptible to landslides and aggressive bluff erosion (Jacobs Associates, 2008). For this reason, the alternatives that included an outlet structure south of Fort Funston, including at Thornton State Beach, are considered technically infeasible and are not carried forward for detailed analysis in this EIR/EIS.

Each of the alternatives listed in Table 2-6 would involve some continued use of the existing Vista Grande Canal and Tunnel (i.e., for flows under 170 cfs), but would also require the construction of a new tunnel outside of the existing tunnel easement. Each alternative could be used in conjunction with constructed treatment wetlands adjacent to the Canal to treat the flows that would continue to travel through the Canal. One of the advantages of constructing a new tunnel would be that during the construction period, wet weather flows would be able to continue down the existing Canal and Tunnel to the existing outlet as under existing conditions. For this reason, the EIR/EIS fully evaluates a tunnel alignment alternative, as described in Section 2.7.2.1, that would require the construction of a new tunnel up to 50 feet south of the existing tunnel. However, because each of the tunnel alignment alternatives would require the construction of a new tunnel, the energy consumption, tunneling spoils, and potential air quality and greenhouse gas emissions and noise impacts associated with drilling would be greater for these alternatives than the existing tunnel alignment that would be utilized under the proposed Project.

Tunnel alignments 1A, 2, 3, 4, 5A, 6, 7B, and 8, described in Table 2-6, would require a new outlet structure that would result in additional beach discharge points compared to existing conditions and to the proposed Project, potentially resulting in increased erosion potential at the outlet, and would not involve the improvement of the existing Daly City Ocean Outlet structure.

For each of the tunnel alignment alternatives described in Table 2-6, construction under NPS-managed lands would still be required but would fall outside of Daly City’s existing entitlements, necessitating the establishment of a new right-of-way through the GGNRA. NPS Management Policies currently require issuance of new right-of-way permits to be limited to a period no longer than 10 years, thus requiring Daly City to renew the permit for additional 10-year periods (NPS Director’s Order 53: Special Park Uses; NPS, 2010). Permission to issue right-of-way permits for a period longer than 10 years requires a written waiver of this policy by the Director. Similarly, a new easement would be required from the Olympic Club for any new tunnel alignment that would traverse this property. Because one of the core project objectives is to utilize existing infrastructure and entitlements, and due to the legal and practical uncertainties associated with obtaining new rights-of-way, Daly City and NPS chose to fully evaluate only one tunnel alignment alternative in this EIR/EIS.

In addition to those tunnel alignment alternatives considered in the 2007 draft Alternatives Evaluation Report and described in Table 2-6, Daly City and SFPUC considered the option of connecting the Vista Grande Canal to the existing SFPUC Lake Merced Tunnel approximately 100 feet north of and parallel to the existing Vista Grande Tunnel, to allow storm flows that exceed the capacity of the Vista Grande Tunnel to flow northward and into the SFPUC Lake Merced Tunnel, discharging at the SFPUC beach outlet structure also located just to the north of Daly City's Ocean Outlet. Although the SFPUC Lake Merced Tunnel has excess capacity during most times of the year, it was acknowledged that those times when storm flows within the Vista Grande Drainage Basin exceed the Vista Grande Tunnel capacity coincide with times when the SFPUC Lake Merced Tunnel capacity is needed to drain areas of San Francisco experiencing large storms, and backups due to a lack of capacity would continue to occur during peak flow periods. Therefore, this alternative would not meet one of the two primary Project objectives of reducing flooding in the Vista Grande Drainage Basin, and has not been carried forward for detailed analysis.

Finally, Daly City considered construction of a new tunnel 50 to 700 feet south of the existing tunnel, locating the construction staging area and tunnel shaft to the south of the proposed staging area in one of two undeveloped areas at Fort Funston, and alternate or improved access to the Fort Funston staging area(s). Following additional review of the vegetation present and topography of those areas, including the presence of rare plants, Daly City in collaboration with the NPS limited the scope of the Tunnel Alignment Alternative such that its construction could be accommodated within the proposed staging area (Figure 2-6) and excluded changes in access to the Fort Funston staging area in order to avoid impacts to high-quality and restored vegetation and to rare plants.

2.7.3.2 Storage/Detention Alternative

Alternative 9 in the 2007 draft Alternatives Evaluation Report considered the construction and use of a large-capacity stormwater detention structure located beneath Westlake Park. Stormwater flow within the Basin could be temporarily routed to the detention structure which, following the peak runoff flow, would pump stored water back into the box culvert connected to the Vista Grande Canal. This would reduce the volume of peak flows through the Canal, substantially reducing the potential for flooding within the Basin and/or overtopping of the Canal. This alternative could be used independently to address flooding in the Basin, or used in combination with a tunnel alignment alternative to reduce the rate of discharges through a beach outlet structure. Structure sizes capable of storing 3.9 million gallons (mg), 16.2 mg, 30.8 mg, and 43 mg were evaluated in the 2007 draft Alternatives Evaluation Report, with the necessary capacity depending on whether the existing Tunnel is left in place or a new or enlarged tunnel is constructed with increased flow capacity.

If used independently to address flooding (i.e., while maintaining the existing capacities and facilities of the Vista Grande Canal and Tunnel), the detention structure would need to be sized to store 30.8 MG. Such an alternative would meet the flood protection objective but would not facilitate the management of Lake Merced water quality and ground and surface water elevations.

If used with a new or enlarged tunnel with a capacity of 500 cfs, such as the enlarged tunnel described under the proposed Project or the new tunnel described under the Tunnel Alignment Alternative, the detention structure would need to be sized to store 16.2 mg. If paired with an improved Canal, this option could be used in conjunction with constructed treatment wetlands adjacent to the Canal to treat the flows that would continue to travel through the Canal.

This alternative would result in temporary disruption to traffic, parking, and recreation at and around Westlake Park, and noise and vibration effects during construction of the detention structure. This alternative would not minimize construction-related costs, habitat disturbance, and disruption to recreational users by maximizing use of existing rights-of-way, easements, and infrastructure. This alternative would be substantially higher in cost than the proposed Project.

Detention Paired with New Tunnel and Outlet Pipeline

Daly City considered a detention alternative to balance the need to divert water to Lake Merced with the size of the infrastructure required to do so. This alternative would consist of two systems to move Vista Grande water into Lake Merced: 1) a diversion structure in and adjacent to the Canal consisting of a 12-inch drain and pumps conveying Canal base flows to a single constructed treatment wetland cell similar to the one described for the Canal Configuration Alternative, which would discharge treated base flows to South Lake via a wetland outlet pipe, and 2) a detention basin sized to accommodate flows in excess of 500 cfs, a new tunnel parallel to the existing Tunnel sized to accommodate 500 cfs (matching the capacity of the existing Canal) and a 24-inch pipe connecting the detention structure to a discharge at Lake Merced.

After analyzing further, it was determined most flows through the Canal are under 500 cfs, and would result in only periodic need for flows generated during severe storms to be routed to the detention structure. Furthermore, the alternative would be substantially more costly than the proposed Project, as the cost of a periodically used detention structure would be added to the overall cost of a project similar to the proposed Project. Impacts associated with this alternative would not be reduced compared to the proposed Project, with the exception of effects to potential wetland and other waters of the U.S., due to the reduced disturbance of Lake Merced banks and Canal. However, impacts associated with the construction of a detention basin would increase overall effects associated with traffic, air quality, and noise. Therefore, due to the above issues, this alternative to the Project was not considered any further.

2.7.3.3 Groundwater Replenishment

Alternative 10 in the 2007 draft Alternatives Evaluation Report considered groundwater replenishment through infiltration facilities or injection wells (as well as the treatment wetland and diversion to Lake Merced included in the proposed Project).

The 2007 report anticipated that groundwater replenishment could occur either through infiltration facilities such as ponds, other surface facilities, or in conjunction with Alternative 9 described above via a pervious subfloor and drainage system beneath the storage basin at Westlake Park; or through injection wells. It also anticipated that if using injection wells, stormwater would need to be treated, and that treatment requirements would be established during the RWQCB permitting process.

Because the Vista Grande watershed is within a sloped, urban area with substantial impervious areas, the flow rate and volume of stormwater flows is high. In order for stormwater to be utilized for groundwater replenishment, a very large area would be required for infiltration facilities that could adequately reduce peak flows. However, the level of development within the watershed offers few opportunities to divert or retain wet weather flows without constructing retention facilities similar to those described above in Section 2.7.3.2, Stormwater/Detention Alternatives. Because a groundwater replenishment alternative would not be used in conjunction with diversion to Lake Merced due to cost and insufficient stormwater to meet both uses, this alternative would not facilitate the management of Lake Merced water quality and elevations. It also would not minimize construction-related costs, habitat disturbance, and disruption to recreational users by maximizing use of existing rights-of-way, easements, and infrastructure. This alternative would be substantially higher in cost than the proposed Project.

2.7.3.4 Canal Portion Alternatives

Options for the design of the Canal portion of the proposed Project that were considered but dismissed include adjustments to the existing Canal structure, new box culvert, new diversion structure, and new wetlands.

Daly City considered an option to construct a new tunnel to entirely bypass the existing Canal, beginning at an upstream point, to provide flood protection but avoid permanent impacts on 1,350 linear feet of the Canal as well as the wetland and open waters at Lake Merced. However, this alternative to the Canal portion of the Project would not meet the Project objective of managing Lake Merced water levels and water quality, because the new tunnel would not have a connection to the lake. Furthermore, the alternative would cut off all flow from the Basin into and through the Canal, potentially resulting in an adverse effect on some existing, low quality channel functions and values within the Canal. For these reasons, this alternative to the Canal was not considered any further.

A new box culvert and diversion structure adjacent to the Canal was considered to avoid impacts to 1,350 feet of the Canal that would occur under the proposed Project. However, areas adjacent to the Canal were determined to be technically infeasible to construct the new box culvert and/or diversion structure due to topographic and infrastructural constraints. Therefore, this alternative too was not considered any further.

Another alternative outlet design considered by Daly City to avoid permanent impacts to wetlands and open waters would locate the Lake Merced Outlet structure at existing hardscapes. This alternative outlet design would have the benefit of reducing permanent impacts to the Canal by 150 feet from the proposed Project impact level, because the length of the box culvert would be reduced. However, the design has several technical and impact issues. Technically, the box culvert would be infeasible to design, because the outlet could not accommodate gravity flows due to the higher elevation of the hardscape compared to the invert elevation of the Canal. Also, the alternative outlet design would need to be extended into the wetlands and open waters to avoid erosion of the lake bank and outlet design requirements, which would likely result in greater permanent impacts on wetlands and waters compared to the proposed Project.

Furthermore, due to the reduction in length of the box culvert, a smaller constructed wetland would be constructed, and result in reduced water quality improvements compared to the proposed Project. Therefore, for the technical and impact issues described above, this alternative outlet design was not considered any further.

Locations within both South Lake Merced and Impound Lake were considered as options for locating a discharge outlet from the Canal and constructed treatment wetlands. Because of the presence of San Francisco's 3-compartment sewer, which crosses the lake at the boundary between South Lake and Impound Lake and then roughly follows John Muir Drive, constructing a discharge outlet into South Lake would require excavating underneath the sewer and constructing an invert siphon to carry the water below the sewer and back up to the proper lake discharge elevation. Excavating underneath the existing sewer would require the addition of substantial structural support to the sewer so that it could bridge the excavation without damage. Even with the addition of support to the sewer, the risk of damage during construction could not be eliminated completely. Damage to the sewer could result in inadvertent discharge of untreated wastewater to Lake Merced, service interruption for areas served by this sewer line, and substantial increase in construction impacts in and/or around Lake Merced to repair the sewer. In addition to the added cost, complexity, and risk associated with constructing an invert siphon underneath the sewer, there are long-term impacts to operations and maintenance that would result from the invert siphon because the invert would be a low point in the system that would act as a trap and accumulate sediment and debris. Furthermore, accessing the invert siphon for maintenance or repair would require the installation of bulkheads at both ends to prevent ingress of water, and pumping to remove water from the siphon. Locating the discharge at South Lake also would increase the length of the existing Vista Grande Canal that would need to be demolished and replaced with box culverts, increasing ground disturbance and impacts to a potential historic resource and waters of the U.S.

An additional complication was identified when considering where to discharge. One alternative evaluated would discharge to the side(s) of the existing bridge between South Lake and Impound Lake to avoid 0.06 acres of permanent impacts to wetlands and open waters associated the installation of the proposed Lake Merced outlet structure. However, it was determined that the construction of an outlet structure at that location would be infeasible, because the size of the box culvert needed to discharge the design storm could not be accommodated by the existing bridge.

Because locating the discharge at South Lake would increase the construction risks, environmental impacts, and long-term operation and maintenance challenges associated with crossing the 3-compartment sewer compared to the proposed discharge into Impound Lake, this alternative was not carried forward for detailed analysis.

2.7.3.5 Alternative Water Supplies to Lake Merced

Daly City and the SFPUC considered a variety of alternative water supplies to manage the water levels and water quality in Lake Merced from the proposed Project's source of water coming from the Vista Grande Canal. After inspection, it was determined that none of the alternative water sources would be practicable as a means to achieve management of water levels and water quality improvements in Lake Merced to meet Project goals and objectives as well as Regional

Water Quality Control Board objectives. **Table 2-7** provides a description and states impacts and constraints of the alternative sources of water considered.

TABLE 2-7
ALTERNATIVE WATER SOURCES CONSIDERED BUT ELMINATED

Alternative Water Source	Source Description	Impacts and Constraints on Implementation
SFPUC System Water	Use existing system water	• Conflicts with the WSIP water supply goals by providing Lake Merced with potable water • Insufficient supply to maintain Lake Merced
SFPUC Recycled Water	Use 0.4 mgd (annual average daily) capacity available for potential future users from the San Francisco Westside Recycled Water Project	• Not likely a sufficient supply to manage Lake Merced water levels and water quality
SFPUC Desalination	Use previously considered 4 mgd capacity desalination plant at the Oceanside Water Pollution Control Plant	• Conflicts with WSIP waters supply goals by providing Lake Merced with potable water • Would have new potentially significant impacts to marine biological resources and ocean water quality • Would have approximately the same or greater permanent impacts to Lake Merced's shoreline and surrounding wetlands as the proposed Project • Not an approved project
Groundwater	Use local aquifer	• Due to the lake-aquifer connection, would not result in substantial lake level increases • Pumping near the Lake Merced could result in an additional drop in the water level
Other Sources	Use water from the SFPUC's Sewer System Improvement Program (SSIP) or Parkmerced	• Insufficient volume of water to maintain Lake Merced water levels and water quality

2.8 Comparison of Impacts by Alternative

This section describes the project alternatives that were selected and analyzed in accordance with CEQA Guidelines Section 15126.6, CFR Section 1502.14(a), and NPS DO-12 Section 4.12 (2011). The three alternatives to the proposed Project selected for detailed analysis in this EIR/EIS are:

- Tunnel Alignment Alternative
- Canal Configuration Alternative
- No Project/No Action Alternative

The range of alternatives presented in this EIR/EIS reflects collaborative efforts by Daly City, the NPS GGNRA, SFPUC, applicable regulatory agencies, and outreach with interested parties and individuals. The alternatives evaluation process (described in Section 2.7.1, Range of Alternatives) included evaluation of potential environmental effects; comments during public hearings; and a comparison against alternatives selection criteria. Thus the proposed Project was selected after undergoing a thorough evaluation of a reasonable range of alternatives.

Table 2-8 provides a brief description of these alternatives and highlights how they differ from the proposed Project. Table 2-8 also summarizes the environmental impacts of the selected alternatives compared to those of the proposed Project under CEQA requirements. This table presents the significant impacts of the proposed Project as well as less-than-significant impacts whose severity would be different under the project alternatives than under the proposed Project. Table 2-8 does not include less-than-significant impacts of the proposed Project that would have the same significance determination and/or impact severity as those of the project alternatives. Similarly, **Table 2-9** summarizes the environmental impacts that would occur as a result of the proposed Project and alternatives by environmental impact under NEPA requirements. The focus of the table is on moderate to high adverse effects, but also lists some minor and negligible effects as well.

2.9 CEQA Environmentally Superior Alternative

CEQA Guidelines Section 15126.6(e)(2) requires an EIR to identify an environmentally superior alternative. If the environmentally superior alternative is the No Project/No Action Alternative, the EIR also must identify an environmentally superior alternative from among the other alternatives. In general, the environmentally superior alternative is defined as that alternative with the least adverse impacts to the project area and its surrounding environment.

The No Project/No Action alternative would avoid all impacts of the proposed Project and would not create any new significant impacts of its own. However, as noted in Section 3.9.5.4, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Basin would continue to flood during storm events, resulting in flooding of residential areas along John Muir Drive.

The CEQA Guidelines define the environmentally superior alternative as that alternative with the least adverse impacts to the project area and its surrounding environment. The primary differences among the alternatives, other than the No Project/No Action alternative, relate to impacts on aesthetics, wetlands and other jurisdictional waters, cultural resources, water quality, and noise and vibration.

The Tunnel Alignment Alternative was fully analyzed in this Draft EIS/EIR to avoid or reduce the significant, unavoidable impact related to the destruction of the existing Tunnel, a part of the historic Vista Grande Canal and Tunnel system. However, it has been determined that for safety and liability reasons, the existing Tunnel would need to be backfilled with concrete if left in place. This would negate the potential benefits of leaving the existing Tunnel intact because its value as a historic property would be substantially diminished and it would become inaccessible; thus, the significant unavoidable impact of destroying the Tunnel would not be avoided or substantially lessened. Therefore, the Tunnel Alignment Alternative is not superior to the proposed Project from a cultural resources perspective. Furthermore, implementation of the Tunnel Alignment Alternative could increase visual contrast at the beach below Fort Funston by introducing a new outlet structure in addition to those structures already existing on the beach (if a new ocean outlet location is selected).

TABLE 2-8
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Aesthetics				
Day and Nighttime Views	**Impact AES-3:** Project construction could result in a new source of substantial light or glare that would adversely affect day or nighttime views in the area. It is anticipated that tunneling activities could occur 24 hours per day in two to three shifts, and construction of the replacement pipe section and piers on the beach would necessitate 24-hour work over a period of several days to one week. Construction would create a new temporary source of nighttime lighting in the immediate area and the light and glare effects from Project construction could be substantial. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would include the same types of temporary aboveground components and activities during construction as the proposed Project, and the methods and duration required to construct the Tunnel Alignment Alternative would be similar to the Tunnel portion of the proposed Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct the Canal Configuration Alternative would not change compared to the proposed Project. (Less than Significant with Mitigation)	**No Impact** No physical component of the proposed Project would be constructed, and there would be no impacts to aesthetic resources. (No Impact)
Scenic Vista, Scenic Resource, Visual Character, and Visual Quality	**Impact AES-2:** Project operation would not result in a substantial adverse impact on a scenic vista, scenic resource, or on the visual character or quality of the site or its surroundings. The design character of the treatment wetland cells would integrate the treatment wetlands and associated infrastructure with the existing visual environment of the Project site. The Project would reduce the contrast of the Ocean Outlet and the surrounding scenery to a moderately low level by reducing the size of the structure and would provide better views of the area. Approximately every 25 years, the Ocean Outlet would be reconstructed and appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure. (Less than Significant)	**Increased** If a new ocean outlet location is selected, a third outlet structure (in addition to the existing Ocean Outlet structure and SFPUC's outlet structure) would be present along the beach and toe of the cliff below Fort Funston within an area of approximately 150 feet or less. This would increase the overall level of visual contrast in this location and would not provide the benefit of removing an obstruction to views. Visual conditions would remain similar to existing conditions in the vicinity of the existing outlet structure; with an additional outlet that would be moved as bluff erosion continues, as under the proposed Project. (Less than Significant)	**Similar** The design character of the treatment wetland cell would integrate the treatment wetland and associated infrastructure with the existing visual environment of the Project site. (Less than Significant)	**No Impact** Ongoing periodic maintenance activities would not be noticeable or intrude on the visual character and quality of the Project area. Future uncontrolled flood events could damage public facilities and private properties in the vicinity of Lake Merced, which could degrade the visual character and quality of the area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Air Quality				
Air Quality Standards	**Impact AIR-1:** The Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Without appropriate dust controls, dust emissions generated within federally administered areas could contribute to the SFBAAB's existing PM10 and PM2.5 non-attainment status, a potentially significant impact. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would have similar construction characteristics of the Project. The construction methods and duration to construct this alternative would not change compared to the Tunnel portion of the Project, except that a micro tunnel boring machine would be used in place of a mini excavator. (Less than Significant with Mitigation)	**Decreased** The Canal Configuration Alternative would have many similar construction characteristics of the Project. The construction methods for Canal Configuration Alternative would not change compared to the Project, except that the collection box and box culvert would not be constructed. (Less than Significant with Mitigation)	**No Impact** No construction emissions would be generated by this alternative. Regarding operational emissions, there would be no changes to the existing operations of the project site. (No Impact)
Cumulative Emissions Impacts	**Impact AIR-2:** The Project could result in a cumulatively considerable net increase of ozone, PM10, or PM2.5 (for which the SFBAAB is in non-attainment), including releasing emissions which exceed quantitative thresholds for ozone precursors. Construction activities would result in cumulatively significant fugitive dust emissions. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would have similar construction characteristics of the Project. (Less than Significant with Mitigation)	**Similar** The Canal Configuration Alternative would have many similar construction characteristics and nearly identical methods as the Project. (Less than Significant with Mitigation)	**No Impact** No construction emissions would be generated and operational emissions would not change. (No Impact)
Biological Resources				
Special-Status Plant Species	**Impact BIO-1:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on plant species identified as sensitive or special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Project construction activities including materials and equipment staging at multiple sites within at Fort Funston associated with the Vista Grande Tunnel and Ocean Outlet replacement, maintenance on and use of the Avalon Canyon Road beach access route, and construction of the Impound Lake discharge structure could result in impacts to special-status plant populations and their supporting vegetation communities. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive and special-status plant species and sensitive vegetation communities are expected. Similar to the Project, potential impacts to special-status plants and the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status plant species and sensitive vegetation communities are expected. Like with the Project, potential impacts to special-status plants and the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to sensitive natural and special-status plants in the study area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Special-Status Reptile Species	**Impact BIO-2:** Project construction could have a substantial adverse effect either directly or through habitat modifications, on reptile species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could adversely affect the western pond turtle by direct mortality, should it be present, which would be a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status animal species are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on special-status animal species are expected. Like the Project, construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could adversely affect western pond turtle. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status reptile species in the study area. (No Impact)
Migratory Bird Species and Special-Status Bird Species	**Impact BIO-3:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on migratory birds and/or on bird species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Construction activities could disrupt birds attempting to nest in the vicinity of the Project site, disrupt parental foraging activity, or displace mated pairs with territories in the Project vicinity. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on migratory and special-status bird species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to this alternative would not change substantially compared to the proposed Project, and similar impacts on migratory and special-status bird species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status bird species in the study area. (No Impact)
Special-Status Bat Species	**Impact BIO-4:** Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on bats identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Clearing vegetation (including trees) and removing structures in support of Project construction could result in direct mortality of special-status bats roosting in tree cavities, under bark, and in structures within the	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on bat species are expected. Adverse effects on special status bats associated with tree removal and structure modification would be similar to the Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on bat species are expected. Adverse effects on special-status bats associated with tree removal and structure modification would be similar to the Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status bat species in the study area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
	Project site. Direct mortality of special-status bats would be a significant impact. Additionally, common bats may establish maternity roosts in these same locations which are protected under CEQA. (Less than Significant with Mitigation)			
Central Dune Scrub	**Impact BIO-5:** Project construction could have a substantial adverse effect on central dune scrub, a sensitive natural community identified by the CDFW. Impacts to central dune scrub are expected to occur during Project-related improvements to the Avalon Canyon access road and through use of the proposed staging area at Fort Funston where approximately 0.497-acre of central dune scrub is present on the eastern and southern boundaries. In addition, restored central dune scrub has been established near Impound Lake where the outlet structure is proposed; however, the Project facilities are not located in areas where central dune scrub has been mapped. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Similar to the Project, removal of central dune scrub vegetation would be considered a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Like with the Project, potential impacts to the sensitive natural community central dune scrub would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to a sensitive natural community in the study area. (No Impact)
Upland Vegetation Communities	**Impact BIO-6:** Project construction would not have a substantial adverse effect on upland vegetation communities identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. Trees that may be impacted by the Project during construction occur in an area managed by the San Francisco Department of Public Works (SFDPW) or located on San Francisco owned land. Such areas are subject to Article 16, Section 808 of the Public Works Code as designated street or significant trees. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on upland vegetation communities are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on upland vegetation communities are expected. During construction, trees could be removed within the Project area during construction. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to an upland vegetation community in the study area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Sensitive Communities	**Impact BIO-7:** Construction of the Project would have a substantial adverse effect on sensitive communities identified in local or regional plans, policies, regulations, or by CDFW or USFWS through the introduction or spread of invasive plants. Project construction activities could contribute to the spread of invasive plants and introduce new invasive plants to the study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events which would be a significant impact. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. Like with the Project, work areas, staging areas, and access roads cleared of non-sensitive upland vegetation could contribute to the spread of invasive plants and introduce new invasive plants to the Project study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on sensitive vegetation communities are expected. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to a sensitive community in the study area. (No Impact)
Wetlands and Other Jurisdictional Waters	**Impact BIO-8:** Project construction could have a substantial adverse effect on wetlands and other jurisdictional waters. Project impacts to these potential jurisdictional features would involve temporary and permanent discharges of structures and/or fill within waters and wetlands, and/or alterations of the bed and/or banks of a lake or stream, to accommodate Project activities. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on potential federally jurisdictional wetlands and other waters are expected. As under the Project, there are no impacts to potential jurisdictional features from the tunnel component itself. Impacts to potential jurisdictional waters associated with rehabilitating the existing Ocean Outlet would not exceed those described under the Project. (Less than Significant with Mitigation)	**Decreased** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on potential federally jurisdictional wetlands and other waters are expected. Impacts to potential jurisdictional wetlands and waters associated with constructing the new facilities at Lake Merced would be less than those described under the Project due to the reduced modifications to the Canal. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to wetlands and other jurisdictional waters in the study area. (No Impact)
Native Resident Fish Species	**Impact BIO-9:** Construction of the Project could impede movement of native resident fish species. A variety of common fish species reside in Lake Merced and could be adversely affected by in-water work at the lake associated with the Project. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on fish species are expected. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on fish species are expected. Like the Project, construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could adversely affect common fish species. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to fish species in the study area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Native Resident or Migratory Species	**Impact BIO-10:** Construction of the Project could interfere substantially with the movement of native resident or migratory species or with established native resident or migratory corridors, or impede the use of nursery sites. Construction activities associated with the Ocean Outlet and the submarine outfall on Ocean Beach and those associated with the Fort Funston tunnel shaft staging and work area could adversely impact birds migrating along the Pacific Flyway and nearby resident wildlife with the introduction of night lighting into an otherwise dark environment. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on resident and migratory species are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**Similar** The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on resident species, migratory species, and wildlife nursery sites are expected. Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding bird season, the use of nighttime lighting, and increased noise and visual disturbance would be significant. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to resident species, migratory species, and wildlife nursery sites in the study area. (No Impact)
Lake Merced Plant Species	**Impact BIO-12:** Project operation could adversely affect central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrub, and Vancouver rye grassland associated with Lake Merced. Loss of central dune scrub would be less than 1 percent under the Project and canyon live oak would be unaffected. Wax myrtle scrub would be unaffected by increased lake levels up to 9 feet City Datum but would incur a 12.50 percent loss at a 10 feet City Datum WSE, which would be considered significant. Thimbleberry scrub occurs above 13 feet City Datum and would not be inundated by rising water surface elevations under any scenario. Vancouver rye grassland would incur losses below 10 percent with an increase in lake levels up through 9 feet City Datum but would experience significant impacts at 10 feet where there would be a 46.15 percent loss (i.e., if the target maximum of 9.5 WSE was selected). (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would not change operational impacts on special-status plant species associated with Project implementation. (Less than Significant with Mitigation)	**Similar** Operation of the Canal Configuration Alternative would result in similar impacts on special-status plant species as the proposed Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to special-status plant species in the study area. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Biological Resources (cont.)				
Lake Merced Wildlife	**Impact BIO-15:** Project operation could adversely affect native wildlife nursery sites associated with Lake Merced. Water level increases above 9 feet City Datum under the Project that persist for more than one month (i.e., with a target maximum WSE of 9.5 feet) would result in the change in habitat attributed to the Project in excess of 10 percent which would be considered a significant impact on these wildlife nursery sites. (Less than Significant with Mitigation)	**Similar** The Tunnel Alignment Alternative would not change operational impacts on wildlife nursery sites associated with Project implementation. (Less than Significant with Mitigation)	**Increased** Operation of the Canal Configuration Alternative would result in similar impacts on wildlife nursery sites as the proposed Project. A smaller treatment wetland would offer 0.4 acre less habitat to wildlife than the treatment wetlands proposed under the Project. (Less than Significant with Mitigation)	**No Impact** With the No Project/No Action Alternative there would be no change to wildlife nursery sites in the study area. (No Impact)
Cultural Resources				
Historical Resource	**Impact CUL-1:** The Project would cause a substantial adverse change in the significance of a historical resource because it would demolish the majority of the historic Vista Grande Canal and Tunnel. Construction would substantially affect the vast majority of the historic Vista Grande Canal and Tunnel as an entire drainage system. (Significant and Unavoidable)	**Decreased** The Canal improvements under the proposed Project paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel system as a whole, though less than the proposed Project. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel as a whole. (Significant and Unavoidable)	**Decreased** The Tunnel improvements under the proposed Project paired with the Canal Configuration Alternative would have an adverse impact on most of the Vista Grande Canal and Tunnel system as a whole, though less than the proposed Project. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect most of the Vista Grande Canal and Tunnel as a whole. (Significant and Unavoidable)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)
Archaeological Resource	**Impact CUL-2:** The Project could cause a substantial adverse change in the significance of an archaeological resource, including shipwrecks. While unlikely, ground-disturbing activities could expose and cause impacts on unknown archaeological resources or shipwrecks, which would be a potentially significant impact. The existing outlet is approximately 900 feet north of the shipwreck remains. (Less than Significant with Mitigation)	**Increased** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown archaeological resources. The Ocean Outlet structure associated with the Tunnel Alignment Alternative could be slightly closer to the 1882 schooner Neptune that wrecked in 1900 than the proposed Project. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown archaeological resources. (Less than Significant with Mitigation)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Cultural Resources (cont.)				
Human Remains	**Impact CUL-3:** Project construction could disturb human remains. Project construction could result in direct impacts to previously undiscovered human remains during earthmoving activities. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover human remains. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover human remains. (Less than Significant with Mitigation)	**No Impact** No new construction or ground-disturbing activities would occur under the No Project/No Action Alternative. (No Impact)
Geology and Soils				
People and Structures	**Impact GEO-1:** Construction, operation, and maintenance of the Project could expose people or structures to potential substantial adverse effects involving strong seismic ground shaking and/or seismic-related ground failure. Holocene slip was observed in trench exposures of the Serra Fault and geotechnical investigation concluded there is a high potential for rupture as a result of faulting within the proposed tunnels alignment. Groundshaking during an earthquake in the Project area has the potential to be strong, with peak ground acceleration around 0.6 g, which could result in significant groundshaking effects on the proposed facilities. Also, seismic damage due to liquefaction and related phenomena could occur along the pipeline and at other facilities. In particular, the new tunnel portal and Lake Merced overflow inlet are planned in an area of potentially liquefiable soil. (Less than Significant with Mitigation)	**Similar** As with the Project, structural damage to facilities could occur as a result of strong seismic groundshaking. As with the Project, the Tunnel Alignment Alternative also has the potential for seismic-related ground failure resulting from liquefaction and lateral spreading. (Less than Significant with Mitigation)	**Similar** Structural damage to facilities could occur as a result of strong seismic groundshaking and/or seismic-related ground failure. As with the Project, the Canal Configuration Alternative has the potential to encounter liquefaction and lateral spreading. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Soil Erosion and Loss of Topsoil	**Impact GEO-2:** The Project could result in substantial soil erosion or the loss of topsoil. Construction activities such as excavating, trenching, and grading can remove stabilizing vegetation and expose areas of loose soil that, if not properly stabilized during construction, can be subject to erosion by wind and stormwater runoff, potentially	**Similar** As with the Project, the Tunnel Alignment Alternative construction could result in erosion from wind and stormwater runoff. (Less than Significant with Mitigation)	**Similar** As with the Project, the Canal Configuration Alternative construction could result in erosion from wind and stormwater runoff. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. Daly City would continue to use the existing ocean outlet structure at Fort Funston which would continue to contribute to erosion of the cliff

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Geology and Soils (cont.)				
	resulting in a significant impact with respect to soils. Also, during operation of the project, erosion and improper water flow could occur within the retaining wall backdrain systems if they are not properly maintained. (Less than Significant with Mitigation)			face where it is located. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Unstable Soil	**Impact GEO-3:** The Project may be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project. The outlet structure is in an area where the potential for shallow or wedge failures up to about 10 to 15 feet thick under static conditions is moderate to high. During large seismic events, the potential for relatively large-scale landsliding is high. In addition, there is landslide potential at Avalon Canyon which would provide beach access during construction of the outlet structure. (Less than Significant with Mitigation)	**Similar** As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. (Less than Significant with Mitigation)	**Similar** As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Life and Property	**Impact GEO-4:** The proposed Project would not create substantial risks to life or property due to expansive or corrosive soils. Project area soils have a mild to moderate corrosion potential which could corrode the micropiles. (Less than Significant with Mitigation)	**Similar** Like with the Project, the area soils have a mild to moderate corrosion potential. (Less than Significant with Mitigation)	**Similar** As with the Project, the area soils have a mild to moderate corrosion potential. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Project site would continue to experience existing levels of geologic and seismic hazards. (No Impact)
Hazards and Hazardous Materials				
Public and Environment	**Impact HAZ-2:** Project construction could result in a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Lead is a known contaminant within 0.25 mile of the Project site. During construction, ground-disturbing activities could unearth UXO, which would pose a safety risk to workers on-site. (Less than Significant with Mitigation)	**Similar** Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils or groundwater or to UXO. (Less than Significant with Mitigation)	**Similar** Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils, or groundwater. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hazards and Hazardous Materials (cont.)				
Emergency Response Plan and Emergency Evacuation Plan	**Impact HAZ-3:** Project construction would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Construction could affect the availability of travel lanes when construction occurs within or adjacent to John Muir Drive, due to the presence of large, slow-moving trucks that may cause delays. These delays could interfere with implementation of the Emergency Response Plan, which would be a significant impact. (Less than Significant with Mitigation)	**Similar** Construction activities associated with the Tunnel Alignment Alternative would result in impacts on emergency access similar to those identified for the Project. (Less than Significant with Mitigation)	**Similar** Like the Project, construction could interfere or disrupt the evacuation route along John Muir Drive, as identified in San Francisco's Emergency Response Plan, due to the presence of large, slow-moving trucks that may cause delays. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards. (No Impact)
Hydrology and Water Quality				
Water Quality Standards	**Impact HYD-1:** Project construction could violate water quality standards and/or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality. Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake and of the Lake Merced overflow structure in South Lake could result in discharges of pollutants to Lake Merced directly, resulting in substantial water quality effects. (Less than Significant with Mitigation)	**Similar** The construction methods and duration to construct this alternative would not substantially differ as compared to the Tunnel portion of the proposed Project, and impacts associated with the Canal portion would either be identical to the proposed Project or the Canal Configuration Alternative. (Less than Significant with Mitigation)	**Similar** As with the proposed Project, construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no construction related water quality impacts would occur. (No Impact)
Alteration of Coastal Landforms or Processes	**Impact HYD-9:** The Project could conflict with plans, policies, or regulations related to alteration of coastal landforms or processes adopted for the purpose of avoiding or mitigating an environmental effect. The alteration of coastal processes would result in a potentially significant impact relating to coastal processes such as bluff retreat and alterations to the beach profile. In addition, the proposed Project could conflict with California Coastal Act Sections 30235 and 30253 and/or NPS Management Policies (described in Section 3.9.2.1) should bluff erosion rates and	**Similar** Under this alternative, the new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to connect to the existing Ocean Outlet location is selected, construction and long-term maintenance of the Ocean Outlet structure would be as described for the proposed Project. However, under this alternative, a new tunnel would be constructed to meet the terminus of the existing tunnel at the current	**Similar** Impacts associated with the Canal portion would either be identical to the proposed Project or the Tunnel Alignment Alternative. (Significant and Unavoidable)	**No Impact** Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no alteration of coastal processes or conflicts with plans, policies, or regulations would occur. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hydrology and Water Quality (cont.)				
	patterns alter as a result of the proposed Project, including a local decrease of the sediment availability at the site due to diminished sand supply. (Significant and Unavoidable)	extent of the bluff face. As the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed, resulting in an adverse effect related to alterations of coastal landforms and coastal processes. Also, the exposure and rehabilitation of structures under this alternative could conflict with the California Coastal Act Section 30235 and 30253 and/or NPS Management Policies. (Significant and Unavoidable)		
Land Use and Planning				
Land Use Policies	**Impact LU-1:** The Project could be inconsistent with some of the sub-policies of the Coastal Act and with portions of the NPS Management Policies regarding coastal processes. (Significant and Unavoidable)	**Increased** The development of a new tunnel and potentially a new Ocean Outlet to the south of the existing structures may conflict with NPS Management Policies for coastal processes by introducing new developments in an area subject to wave erosion or active shoreline processes when a practicable alternative. (Significant and Unavoidable)	**Similar** Impacts associated with the Canal portion would either be identical to the proposed Project or the Tunnel Alignment Alternative. (Significant and Unavoidable)	**No Impact** Because the Project would not be implemented, no potential conflict with the Coastal Act or NPS Management Policies would occur. (No Impact)
Noise and Vibration				
Temporary Noise	**Impact NOI-1:** Project construction could temporarily expose persons to or generate noise levels in excess of local noise ordinances or create a substantial temporary increase in ambient noise levels. (Less than Significant with Mitigation)	**Similar** The location of the tunnel shaft would be somewhat farther from the nearest sensitive receptor compared to Tunnel portion of the Project. However, the location of the Lake Merced Portal would be farther from the nearest residential receiver than under the proposed Project. (Less than Significant with Mitigation)	**Increased** **Impact ALT-NOI-1:** This alternative would not construct a collection box and box culvert, which would reduce the duration of construction activity. However, it would decrease the distance between the location of impact pile driving and the nearest residential receptors, resulting in noise levels up to 82 dBA and exceeding the 70 dBA Leq speech interference threshold for greater than two weeks. A noise reduction of at least 12 dBA may not be achieved with mitigation, and, therefore noise impacts associated with	**No Impact** Because no new construction would occur under the No Project/No Action Alternative, no construction noise would be generated by this alternative, which would result in no impact. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Noise and Vibration (cont.)				
			construction-related activities could remain significant. (Potentially Significant and Unavoidable)	
Groundborne Vibration and Noise Levels	**Impact NOI-2:** Project construction could result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. The vibration levels at the Missile Assembly Building in Fort Funston would be above the FTA's building damage threshold for susceptible buildings. (Less than Significant with Mitigation)	**Increased** The nearest vibration-sensitive receiver to the where pile driving activities would take place is the Mission Assembly Building located in Fort Funston. The vibration levels would be above both the FTA's construction vibration and building damage thresholds for historic land uses. (Less than Significant with Mitigation)	**Increased** **Impact ALT-NOI-2:** Project-related vibration levels at the nearest residential building located approximately 200 feet south-east from the John Muir Drive crossing and diversion structure would remain significant and unavoidable after mitigation. (Significant and Unavoidable)	**No Impact** Because no new construction would occur under the No Project/No Action Alternative, no ground-borne vibration would be generated by this alternative, which would result in no impact. (No Impact)
Geologic and Paleontological Resources				
Paleontological Resource, Paleontological Site, Unique Geological Feature	**Impact PAL-1:** The Project could directly or indirectly destroy a unique paleontological resource or site or unique geological feature. Because new disturbance would occur within geologic units with moderate to high potential for paleontological resources, potentially significant fossils could be adversely affected during construction, particularly within the Merced Formation. Furthermore, ground-disturbing activities could expose and cause impacts on unknown paleontological resources, which would be a potentially significant impact. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. (Less than Significant with Mitigation)	**Similar** Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. (Less than Significant with Mitigation)	**No Impact** Because no new construction or ground-disturbing activities would occur under the No Project/No Action Alternative, undiscovered paleontological resources would not be encountered. (No Impact)
Transportation and Traffic				
Plans, Ordinances, and Policies	**Impact TRA-1:** Project construction would cause temporary increases in traffic volumes on area roadways, which could cause substantial conflicts with the performance of the circulation system, but would not conflict with applicable plans, ordinances, or policies pertaining to the performance of the circulation system. The increased local congestion/delay and	**Similar** Similar to the Project, the increase in traffic volume on local roads would be noticeable, especially due to the slower movements of trucks compared to passenger vehicles, and the increased local congestion/delay and potential conflicts involving trucks is considered to be a significant	**Decreased** Daily traffic generated by construction workers and haul/delivery trucks accessing the work site would be somewhat less than for the proposed Project. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. (No Impact)

TABLE 2-8 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER CEQA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Transportation and Traffic (cont.)				
	potential conflicts involving Project trucks is considered to be a significant impact. (Less than Significant with Mitigation)	impact. (Less than Significant with Mitigation)		
Designated Haul Routes	**Impact TRA-5:** Project construction would result in increased wear-and-tear on the designated haul routes. The wear-and-tear effects on road conditions and driving safety is considered to be a significant impact. Local streets (e.g., Avalon Drive and Fort Funston Road) generally are not built with a pavement thickness that will withstand substantial truck traffic volumes. (Less than Significant with Mitigation)	**Similar** Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a significant impact. (Less than Significant with Mitigation)	**Similar** Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could significantly affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a significant impact. (Less than Significant with Mitigation)	**No Impact** Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. (No Impact)

TABLE 2-9
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Aesthetics	The extended presence of construction equipment and activities at the Fort Funston staging area would be readily noticeable from passive recreation areas adjacent to this site and from trails. Also, views of the dunes in this area would be temporarily replaced by equipment and fencing. Furthermore, construction activities on the beach would be visible to hang gliders passing overhead. Mitigation would reduce visual intrusion of construction activities and equipment, so as to result in a short-term, minor adverse effect on scenic quality. The visual impacts from temporary demolition and construction impacts from restoring the Ocean Outlet and Tunnel approximately every 25 years would be similar to those described for initial demolition of the existing structure and construction of the rehabilitated Ocean Outlet.	Tunnel Alignment Alternative visual resource impacts (construction activities, lighting, and permanent structures) would contribute to visual change in the landscape, particularly related to construction activities at the Fort Funston staging area. With mitigation, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as to result in short-term, minor, adverse effect on scenic quality. Impacts to visual character and views from restoring the Ocean Outlet and Tunnel as well as restoring the abandoned, existing Ocean Outlet would be moderate, site-specific, long-term, and, thus, greater than the proposed Project.	Like the Project, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Thus, there would be a short-term, minor, adverse effect on scenic quality after mitigation.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no impacts to aesthetic resources. Ongoing periodic maintenance activities would not be noticeable or intrude on the visual character and quality of the Project area.
Air Quality	Construction emissions of NOx, ROG, and PM2.5 are estimated to be well under the annual de minimis threshold levels applicable to the Project area The Project therefore would be exempt from General Conformity determination requirements and would have a minor adverse impact on air quality.	The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Consequently, construction emissions would be well under annual de minimis threshold levels applicable to the SFBAAB, and have a minor adverse impact on air quality.	The Canal configuration Alternative would not construct the collection box and box culvert, which would result in a reduced duration of construction activity. Also, truck transport of 40,000 cubic yards of excavated materials and clean fill would no longer be needed as would be needed for the proposed Project. Consequently, construction emissions would be well under annual de minimis threshold levels applicable to the SFBAAB, and have a minor adverse impact on air quality.	Because no new construction would occur under the No Project/No Action Alternative, no construction emissions would be generated by this alternative.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Vegetation	*Construction* Project construction would have short-term, minor adverse impacts on vegetation communities within the Project site. Adverse effects on vegetation would be mitigated through avoidance, minimization, and mitigation measures. *Operation* Project-related lake level increase would have effects on vegetation surrounding Lake Merced that would be measurable or perceptible in elevation at which certain communities are present, but localized in context of the vegetation communities as a whole which surround the lake. Following mitigation, all impacts would be minor, but long-term.	*Construction* Impacts on sensitive natural community plant populations within the Project site are expected to be at most moderate and short-term, and would be minimized with mitigation. *Operation* Same as for the proposed Project.	*Construction* Impacts to vegetation communities within the Project site would be at most minor and short-term, and would be reduced with mitigation. *Operation* Same as for the proposed Project.	With this alternative, there would be no change to vegetation in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.
Potential Federally Jurisdictional Wetlands and Other Waters and Riparian Habitat	*Construction* Moderate temporary permanent impacts to potential federally jurisdictional wetlands and other waters and to riparian habitat would occur as a result of construction of the Lake Merced outlet structure in Impound Lake and installation of the new facilities within the Canal. Temporary impacts would be restored to pre-project conditions. Unavoidable permanent impacts to potentially jurisdictional other waters would include 1,350 linear feet of replacement associated with modifications to the Canal, Unavoidable permanent adverse impacts would be mitigated by on-site or off-site creation, restoration, or enhancement of previously lost or degraded waters, wetlands, and/or riparian habitats, or payment to a mitigation bank for in-kind credits.	*Construction* Same as for the proposed Project. *Operation* Same as for the proposed Project.	*Construction* Moderate temporary permanent impacts to potential federally jurisdictional wetlands and other waters and to riparian habitat would occur as a result of construction of the Lake Merced outlet structure in Impound Lake and installation of the new facilities within the Canal. Temporary impacts would be restored to pre-project conditions. Unavoidable permanent impacts to potentially jurisdictional other waters would include 350 linear feet of replacement associated with modifications to the Canal, Unavoidable permanent adverse impacts would be mitigated as described for the proposed Project. *Operation* Operational impacts related to increasing the water level at Lake Merced would be as described for the proposed Project.	With the No Project/No Action Alternative there would be no change to jurisdictional wetlands or other waters in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Potential Federally Jurisdictional Wetlands and Other Waters and Riparian Habitat (cont.)	*Operation* Project operations would have minor, long-term effects on wetlands resulting from increasing the water level at Lake Merced above existing conditions to a target WSE of 7.5 to 9.5 feet City Datum. Impacts associated with the periodic removal of the protruding tunnel and outlet and reconstruction of the outlet would be moderate and require similar methods described under construction for the proposed Project.			
Terrestrial Wildlife and Aquatic Wildlife	*Construction* Adverse impacts on common terrestrial wildlife are expected and include temporary disturbance of habitat or perhaps the loss of a limited number of individuals of a common species. With mitigation, adverse impacts on common terrestrial and aquatic wildlife would be minor and short-term. *Operation* There would be negligible or minor effects on terrestrial wildlife and aquatic habitat resulting from operation of the Project. Beneficial effects on aquatic habitat would likely occur as a result of the increased water volume available to Lake Merced fish species and the maintenance or improvement of water quality.	*Construction* Same as for the proposed Project or Canal Configuration Alternative. *Operation* Same as for the proposed Project or Canal Configuration Alternative.	*Construction* Impacts to terrestrial wildlife and aquatic wildlife would be at most minor and short-term, and would be reduced with mitigation. *Operation* The alternative would offer less habitat for local wildlife due to the smaller size of the treatment capacity of the wetland cell compared to the Project; however, the increase in open waters of Lake Merced resulting from implementation of this alternative would be similar to the proposed Project.	With the No Project/No Action Alternative there would be no change to terrestrial wildlife and aquatic wildlife in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Special-Status Species	*Construction* Impacts to special-status species such as the Northern coastal scrub communities, Western pond turtles, and various resident and migratory birds would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Adverse effects would be short term and minor, and would be avoided, minimized, or offset by mitigation. *Operation* Rising water levels in Lake Merced resulting from operation of the Project would have minor short-term and long-term effects on special-status plants and animal species in the study area.	*Construction* Like the Project, impacts to special-status plant communities and wildlife would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. Adverse effects would be reduced with mitigation. Effects would be at most minor and short-term. *Operation* Same as for the proposed Project.	*Construction* Impacts on special-status species would be at most minor and short-term, and would be reduced with mitigation. Like the Project, impacts to special-status species would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. *Operation* Same as for the proposed Project.	With the No Project/No Action Alternative there would be no change to special-status plants and animals in the study area. Also, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, would not occur.
Cultural Resources	The Project would have a major adverse impact on a historic property (the Vista Grande Canal and Tunnel), even with mitigation. Construction activities could result in a minor to major impact by modifying or altering previously unknown archaeological resources, but the impact would be reduced with mitigation. Impacts to known archeological resources, including the Neptune shipwreck, would be negligible after mitigation.	The Canal improvements under the proposed Project paired with the Tunnel Alignment Alternative would adversely affect approximately 69 percent of the Vista Grande Canal and Tunnel system as a whole. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. The Ocean Outlet structure associated with the Tunnel Alignment Alternative could be closer to the wreckage of the schooner Neptune than the proposed Project. This alternative would have the same adverse effect determinations as the proposed Project.	The Tunnel improvements under the proposed Project paired with the Canal Configuration Alternative would have an adverse impact on 53 percent of the Vista Grande Canal and Tunnel system as a whole. The Canal Configuration Alternative paired with the Tunnel Alignment Alternative would adversely affect approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. This alternative would have the same adverse effect determinations as the proposed Project.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. Therefore, no impact on historical resources and archeological resources would occur.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Geology and Soils	Construction activities would result in exposing areas of loose soil that could be subject to erosion by wind and stormwater runoff, but after mitigation the Project would have minor adverse effects on soil erosion. The Project also has a potential for liquefaction and lateral spreading to occur during seismic events. After mitigation, adverse effects from seismic events would be minor. Furthermore, the potential for landslides in the Project area is relatively high. However, with mitigation, the adverse effects from landslides would be minor.	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative the Project site would continue to experience existing levels of geologic and seismic hazards.
Greenhouse Gas Emissions and Climate Change	The Project would have a minor adverse impact with regard to construction related GHG emissions. Operational GHG emissions would be negligible.	The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Like the Project, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.	Construction emissions under this alternative would be reduced compared to the Project because of the reduced amount of excavation and construction associated with the elimination of the collection box and box culvert. Like the Project, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.	Because no new construction would occur under this alternative, no construction-related GHG emissions would be generated by this alternative, and no changes to existing GHG emissions associated with operation and maintenance activities. Short-term increases in GHG emissions would result from occasional emergency repairs and other activities that would occur during canal flooding.
Hazards and Hazardous Materials	The Project would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Following mitigation, safety risks from encountering unexploded ordnance (UXO) and threats to the public from impeding emergency access, including the Fort Funston area and the evacuation route on John Muir Drive, would be minor.	This alternative would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Following mitigation, safety risks from encountering UXO would be minor.	This alternative would result in minor adverse effects on public safety after adhering to hazardous materials and stormwater regulations and the NPDES Construction Permit. Similar to the Project, potential human exposure to vector-borne diseases and threats to the public from impeding emergency access, including the evacuation route on John Muir Drive, would be minor.	Under this alternative the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Hydrology and Water Quality	Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake and the Lake Merced overflow structure in South Lake could result in discharges of pollutants (sediment) to Lake Merced directly. With implementation of mitigation, Project construction would result in short-term, minor effects to water quality. Also, the proposed Project could result in an adverse effect related to alterations of coastal landforms and coastal processes and could conflict with California Coastal Act Sections 30235 and 30253, even after implementation of mitigation. Following mitigation, the impact could remain moderate to major.	Under this alternative, a new tunnel would be constructed to meet the terminus of the existing tunnel at the current extent of the bluff face. As the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed, resulting in an adverse effect related to alterations of coastal landforms and coastal processes. Also, the exposure and rehabilitation of structures under this alternative could conflict with the California Coastal Act Section 30235 and 30253, even after implementation of mitigation. Following mitigation, the impact could remain moderate to major.	As with the proposed Project, construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly. With mitigation, construction of the alternative would result in minor adverse effects.	Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no adverse effects on water quality, from altering coastal processes, or from conflicting with plans, policies, or regulations would occur.
Land Use and Planning	The Project would have short-term, minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. During operation and maintenance, the Project could conflict with the Coastal Act and/or NPS Management Policies related to coastal processes resulting in a moderate to major impact.	Construction of the Tunnel Alignment Alternative would have short-term, minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. During operation and maintenance, the Project could conflict with the Coastal Act and/or NPS Management Policies related to coastal processes and siting development in areas previously disturbed, resulting in a moderate to major impact.	Same as for the proposed Project or Tunnel Alignment Alternative, depending on the tunnel component selected.	Under this alternative, no physical component of the Project would be constructed. Therefore, there would be no change in land use and no impact to existing land use uses or conflicts with applicable land use plans, policies or regulations.
Noise and Vibration	Noise impacts associated with construction-related activities would result in a short-term, minor adverse impact, and would be reduced with mitigation. After mitigation, vibration impacts associated with construction-related activities, such as at the Missile Assembly Building, would result in a short-term minor adverse impact.	Like the Project, the Tunnel Alignment Alternative would have a short-term, minor adverse impact with respect to construction noise, and would be reduced with mitigation. Construction vibration impacts and noise impacts associated with operation-related activities from this alternative would have the same impact determination as the proposed Project.	This alternative would have a short-term, minor adverse impact with respect to construction noise. After mitigation, vibration impacts associated with construction-related activities would remain as a short-term, major adverse impact. Noise impacts associated with operation-related activities from this alternative would have the	Because no new construction would occur under this alternative, no construction noise or ground-borne vibration would be generated by this alternative, which would result in no impact. Noise generated by the operation and maintenance of these components would not change.

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Noise and Vibration (cont.)	Noise impacts associated with operation-related activities would result in a negligible impact.		same impact determination as the proposed Project.	
Geologic and Paleontological Resources	The loss of up to 16,000 cubic feet of soils within the Colma and Merced Formations would be negligible to minor. After mitigation, the inadvertent discovery of a paleontological resource would result in a negligible impact.	The loss of up to 20,000 cubic feet of soils within the Colma and Merced Formations would be negligible to minor. Paleontological resources impacts would be the same as for the proposed Project.	Similar to the proposed Project.	Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. Therefore, no impact to geologic and paleontological resources would occur.
Recreation	Due to construction activities, the Project would affect a small area (less than 5 percent) of Fort Funston, and would result in short-term, moderate adverse impacts to recreation at Fort Funston. Operation of the Project would result in long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure.	Like the Project, the Tunnel Alignment Alternative would result in short-term, moderate adverse impacts to recreation associated with construction and long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure.	Like the Project, the Canal Configuration Alternative would result in short-term, minor adverse impacts to recreation.	Under this alternative, no physical component of the proposed Project would be constructed, and there would be no impact to recreation.
Environmental Justice	Given the limited nature of construction-related impacts in terms of both duration and intensity, any disproportionate adverse effect on a minority population would be negligible. Furthermore, disproportionate adverse effects on minority populations associated with odors or mosquitoes would be negligible.	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative, the Project would not be constructed. Therefore, there would be no beneficial effect on minority populations from improved conditions due to reduced flooding and no disproportionate adverse effects on minority populations associated with temporary construction impacts or with odors or mosquitoes due to wetland creation.
Socioeconomics	Any adverse or beneficial socioeconomic effects resulting from reduced flooding due to Project improvements would be minor	Same as for the proposed Project.	Same as for the proposed Project.	Under this alternative, the Project would not be constructed. Therefore, there would be no adverse or beneficial socioeconomic effects as a result of reduced flooding.
Transportation and Traffic	With mitigation, the Project would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads. The Project would have short-term, minor effects on access and	With mitigation, the Tunnel Alignment Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.	With mitigation, the Canal Configuration Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.	Under this alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation

TABLE 2-9 (Continued)
COMPARISON OF SIGNIFICANT IMPACTS OF PROJECT TO IMPACTS OF ALTERNATIVES UNDER NEPA

Impact	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Transportation and Traffic (cont.)	negligible effects on parking.			conditions on area roadways. However, maintenance activities would continue as well as occasional emergency repairs and other traffic-generating activities when the canal floods.

The Canal Configuration Alternative was fully analyzed in this Draft EIS/EIR to avoid or reduce the significant, unavoidable impact related to the destruction of a portion of the existing Canal, a part of the historic Vista Grande Canal and Tunnel system, and to avoid or reduce permanent impacts to jurisdictional other waters of the United States. This alternative would reduce impacts on the existing Canal by reducing the permanent impact of replacing the open Canal with covered concrete conveyance structures. This would reduce the impact on the Canal portion of the historic Canal and Tunnel system, but not to a level that would be less than significant; thus, the significant unavoidable impact of destroying a portion of the Canal would not be avoided. The Canal Configuration Alternative also would reduce short-term air pollutant emissions relative to the proposed Project, but not to a lesser degree of impact significance; mitigation still would be required to reach a less-than-significant impact. This alternative would result in additional significant and unavoidable impacts compared to the proposed Project with respect to both noise and vibration during construction. Impact pile driving would occur closer to residences near the mouth of the Canal and residents may experience noise and vibration levels exceeding applicable thresholds; mitigation measures would be required but may not be able to reduce these impacts to below the significance thresholds. Finally, the smaller constructed treatment wetland that would be possible under this alternative would reduce the amount of wildlife habitat and water treatment the Project would offer as environmental benefits. As a result of the decreased benefits and increased short-term significant and unavoidable impacts that would result from this alternative, as well as its inability to reduce significant and unavoidable impacts of the proposed Project, this alternative is not considered environmentally superior to the proposed Project.

Determining an environmentally superior alternative is difficult because of the many factors that must be balanced. Although this Draft EIR/EIS preliminarily identifies an environmentally superior alternative, it is possible that, with additional information received in or developed during the project approval process, Daly City could choose to balance the importance of each impact area differently or reach a different conclusion. Daly City preliminarily has identified the proposed Project as the environmentally superior alternative.

2.10 NEPA Lead Agency Preferred Alternative

Under NEPA, the “preferred alternative” is a preliminary indication of the Lead Agency’s preference of action among the proposed action and alternatives. A NEPA Lead Agency may select a preferred alternative for a variety of reasons, including the agency’s priorities, in addition to the environmental considerations discussed in the EIS. Although the Lead Agency may identify a preferred alternative in the Draft EIS, the NPS has not yet identified its preference of action among the Proposed Action and alternatives, and will identify the preferred alternative in the Final EIR/EIS in accordance with NEPA (40 CFR 1502.14(e)).

2.11 Regulatory Requirements, Permits, and Approvals

Private, local, state, and federal entities own the lands needed to construct, operate, and maintain the proposed project. Daly City would need to consult with relevant resource agencies and follow prescribed environmental review processes to evaluate project environmental effects and obtain construction and other permits for proposed components or improvements. The following table summarizes the agencies with regulatory oversight, the governing regulation(s), and the likely permits and approvals that could be necessary. It is noted that comments received on this EIR/EIS may also be taken into account in the resource agency consultation process. For instance, comments received regarding cultural resources may be taken into account in the process of compliance with Section 106 of the National Historic Preservation Act: compliance which is independent of, but coordinated with, compliance under CEQA and NEPA.

Agency	Governing Regulation	Potential Requirements
Federal		
U.S. National Park Service - Golden Gate National Recreation Area, Lead Agency (Federal)	National Environmental Policy Act (NEPA) and National Park Service Act	NEPA Compliance (EIS), Special Use Permit, easement amendment(s), right-of-way permit and/or other authorization
U.S. Army Corps of Engineers	Clean Water Act	Section 404 Authorization
	Rivers and Harbors Act	Section 10 Authorization
State		
California Coastal Commission	California Coastal Act; Coastal Zone Management Act	Coastal Development Permit
State Water Resources Control Board	Clean Water Act	General Construction Permit
San Francisco Bay Regional Water Quality Control Board	Clean Water Act	NPDES Stormwater coverage; Section 401 Water Quality Certification; Section 402 Policy on the Use of Constructed Wetlands for Urban Runoff (No. 94-201)
	Porter-Cologne Water Quality Control Act	Waste Discharge Requirements
California Department of Fish and Wildlife	Fish and Game Code Section 1602	Stream and Lakebed Alteration Agreement
	Fish and Game Code Section 2080	Incidental Take Permit
California Office of Historic Preservation	National Historic Preservation Act	Section 106 Consultation
California State Lands Commission	Management responsibility for sovereign lands	Lease Amendment
Local		
City of Daly City, Lead Agency (State)	California Environmental Quality Act (CEQA)	CEQA Compliance (EIR), approval of Daly City acceptance of Vista Grande Tunnel from San Francisco
City of Daly City; San Francisco Planning Department; San Mateo County	California Coastal Act	Coastal Development Permits for each jurisdiction
SFPUC Commission		Approval of Lake Management Project, necessary conveyances (e.g., easements, leases, and land transfers)
San Francisco Board of Supervisors		Conveyance of Vista Grande Tunnel and easement to Daly City
SFPUC Wastewater Enterprise		Discharge permit for construction-related discharges to the combined sewer system
San Francisco Department of Public Works		Approval of any necessary construction permits for work within roadways or tree removal
San Francisco Department of Parking and Traffic		Approval of any necessary construction permits for work within roadways

Agency	Governing Regulation	Potential Requirements
Local (cont.)		
San Francisco Recreation and Parks Department		Approval for work on lands around Lake Merced
San Francisco Municipal Transportation Agency (SFMTA), MUNI Street Operations Division		Review of any construction-related changes to transit service or facilities

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CHAPTER 3
Environmental Analysis

3.1 Introduction and Overview

This chapter assesses environmental consequences or impacts that would result from the implementation of the Project or the alternatives described in Chapter 2 on resources, resource uses, and other important topics (including public health and safety, social and economic considerations, and environmental justice conditions). These analyses consider both short-term impacts that would occur only during the construction period, such as impacts from construction-related truck traffic, and long-term impacts that would occur continuously or periodically throughout the operation period or that would persist after initial occurrence, such as removal of slow-growing vegetation or destruction of irretrievable or irreplaceable resources. Additionally, the analyses consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The impact assessment that follows focuses on direct, indirect, and cumulative effects that could occur as a result of implementing each of the alternatives. The methodology for this assessment conforms to CEQA Guidelines §15120 et seq. This methodology also conforms to the guidance found in the following sections of the CEQ regulations for implementing NEPA: 40 CFR §1502.24, *Methodology and Scientific Accuracy*; 40 CFR §1508.7, *Cumulative Impact*; and 40 CFR §1508.8, *Effects*. The CEQ regulations require agencies to "rigorously explore and objectively evaluate" the impacts of the alternatives. Therefore, the alternatives are analyzed to the same level of detail as the Project.

Some resources and processes are relevant to more than one section in Chapter 3, but are evaluated where most appropriate, with cross-references provided in other sections to alert the reader to related discussions. For example, impacts on fisheries in Lake Merced are discussed in Section 3.4, Biological Resources, though much of the underlying water quality analysis on which the fisheries analysis is based is located in Section 3.9, Hydrology and Water Quality. Coastal geologic processes including bluff erosion and beach nourishment also are discussed in Section 3.9, because coastal hydrology (including sea level rise) is a primary driver of these processes, while other erosion-related impacts are described in Section 3.6, Geology and Soils. That section focuses primarily on the geologic and soils-related hazards that may contribute to Project-related impacts, such as landslides, seismic shaking, and expansive or corrosive soils. In contrast, Section 3.12, Geologic and Paleontological Resources, focuses on geology as a resource that provides evidence of past geological processes and past life found in the geologic record, and evaluates the Project's potential to adversely affect these resources.

3.1.1 Baseline

The baseline for purposes of this EIR/EIS is March 1, 2013, the date the City of Daly City's Notice of Preparation/Notice of Intent was published by the State Clearinghouse. The National Park Service also published a Notice of Intent to prepare the Draft EIR/EIS in the Federal Register on May 8, 2013 (78 FR 26807). Where consideration of this date as the baseline would result in a more conservative analysis (e.g., if an applicable plan, policy, or regulation was adopted after March 1 but before May 8, 2013), the later date is used. The baseline is the affected environment and regulatory context described in Sections 3.2 through 3.16 and is intended to reflect the pre-project environmental conditions to which the potential impacts of the project and all alternatives are compared.

3.1.2 Impact Evaluation Criteria

The criteria used to evaluate impacts that could result from Project implementation are described below. The criteria used in the CEQA analysis derive from Appendix G of the CEQA guidelines, which contains a checklist of impact topics and questions to help guide the analysis. CEQA impact conclusion statements speak specifically to whether the impact would be significant. CEQA impact conclusion statements are presented in terms of whether the project's impact would be significant. Accordingly, conclusion statements are presented as: either "no impact," "less than significant," "less than significant with mitigation," or "significant and unavoidable." A significant impact would result if the Proposed Project implementation were to have a substantial adverse physical change on the environment.

The impact thresholds used in the NEPA analysis derive from the NEPA regulations (40 CFR 1508.27) and NPS Director's Order-12 Handbook, Appendix 1 – Environmental Screening Form. Under NEPA, impact conclusion statements are presented in terms of impact type, context, duration, and intensity, with determination of a project's environmental significance left up to the discretion of the decisionmaker. Potential impacts are described in terms of type, context, duration, and intensity, which are generally defined below. For this analysis, thresholds describing the impact have been categorized into negligible, minor, moderate, and major, and resource-specific thresholds are defined in more detail in each resource section. The resource-specific thresholds have been tailored to NPS' consideration of the Project and alternatives within the specific geographic, recreational, environmental, and social context of Fort Funston and the greater Project vicinity, including but not limited to the location of Fort Funston within a coastal environment and the specific recreational uses the park provides (e.g., dog walking and hang gliding).

Type of Impact—Impacts can be either beneficial or adverse. A beneficial impact would be a positive change in the condition or appearance of the resource. An adverse impact would be a change that would detract from its appearance or condition.

Context—Context describes the area or location (site-specific, local, parkwide, or regional) in which the impact would occur. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity of the study area, parkwide impacts would affect a greater portion of the park, and regional impacts would extend beyond park boundaries, including beyond the tideline.

Duration—Duration describes the length of time over which an effect would occur, and is characterized as either short-term or long-term. Short-term impacts are those that are not permanent and would occur only during a specific short-term activity (e.g., traffic caused by construction during the approximately construction period) and would not persist beyond these short-term activities. Long-term impacts would persist beyond the initial cause of the impact (e.g., during restoration of slow-growing vegetation) and/or for the life of the Project (e.g., ongoing maintenance activities or permanent visual changes).

3.1.3 Environmental Topics Removed from Consideration

3.1.3.1 Agriculture and Forestry Resources

Maps produced by the California Department of Conservation, Division of Land Resource Protection (DLRP) show that there is no Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland) in the Project area (DLRP, 2007, 2011, 2013), nor is any land in the Project area zoned for agricultural use or under a Williamson Act contract. Additionally, there is no forest land or timberland in the Project area (San Mateo County, 2007). Therefore, the Project could have no impact on agriculture and forestry resources, and the significance criteria listed in CEQA Guidelines Appendix G, section II, in addition to prime or unique farmlands as recommended by CEQ guidance (1980), are not discussed further.

3.1.3.2 Mineral Resources

The Project and alternatives would not be located within a significant mineral, oil, or gas resources area (California Department of Conservation, Division of Mines and Geology, 1987; U.S. Geological Survey, 2003; California Department of Conservation, Division of Oil, Gas, and Geothermal Resources, 2014). Furthermore, local land use plans do not indicate presence of locally important mineral resources on the Project site. Therefore, the Project and alternatives would not result in the loss of availability of a known mineral resource, nor would result in the loss of locally important mineral resource recovery site. The Project and alternatives could have no impact related to mineral resources, and the significance criteria listed in CEQA Guidelines Appendix G, section XI are not discussed further.

3.1.3.3 Public Services

During the construction period, up to 50 construction workers would be employed at the Project site, depending on the phase of construction and the construction activities taking place (see Section 2.4.5.1, Schedule and Workforce). It is expected that construction workers would come from any part of the Bay Area. While it is possible that some workers might temporarily relocate from other areas, the proposed Project would not result in a substantial increase in the local population. Potential incidents requiring law enforcement, fire protection, or emergency services could occur during construction; however, any temporary increase in incidents would not exceed the capacity of local law enforcement, fire protection, and emergency facilities such that new or expanded facilities would be required, because any temporary increase in the local population during Project construction would be negligible and could be accommodated by existing service providers. Construction of the proposed Project would not result in impacts related to the need for new or physically altered governmental facilities in order to maintain existing levels of public services, and no construction-related public service impacts would occur.

The proposed Project would not result in a permanent increase in the local population. Operation and post-construction maintenance activities would not require additional employees since Daly City and the SFPUC currently have employees that are responsible for management and maintenance of the Vista Grande system and Lake Merced. Therefore, the Project would not result in substantial increases in demand for public services, including fire protection, police protection, libraries, schools, hospitals, or other services, and no operational impact related to public services would occur.

The Project and alternatives would have no impact related to public services, and the significance criteria listed in CEQA Guidelines Appendix G, section XIV are not discussed further.

3.1.3.4 Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 established the national wild and scenic river system to protect the nation's highest quality natural rivers. No federal or state-designated Wild and Scenic Rivers or Study Rivers are located within or near the Project site (Caltrans, 2013). Therefore, the Project and alternatives could have no effect on designated rivers, and these resources are not discussed further.

3.1.3.5 Wilderness

No designated wilderness is located within or near the Project site (Wilderness.net, 2013). Therefore, the Project and alternatives could have no impact on designated wilderness, and this resource is not discussed further.

3.1.3.6 Indian Trust Resources

Department of Interior Compliance Memorandum 95-2 requires the NPS to address environmental impacts of its proposed actions on Indian trust resources. Indian trust resources are those assets owned by Native Americans but held in trust by the United States. Since the lands in the Project area are not trust resources, this topic was dismissed from further analysis.

3.1.4 Approach to Cumulative Projects Scenario and Cumulative Impact Analysis

As defined in CEQA Guidelines §15355, the term "cumulative impacts" refers to two or more individual effects, which, when considered together, are considerable or that compound or increase other environmental impacts. "The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." CEQA Guidelines §15355(b); see also, CEQA Guidelines §15130(a)(1). NEPA similarly requires the consideration of cumulative effects (40 CFR 1508.7).

This analysis uses a blend of two approaches to analyze cumulative effects: the "list-of-projects" approach and the "summary of projections" approach (CEQA Guidelines §15130(b)).

The list-of-projects approach considers the incremental effects of a proposed project viewed in combination with the effects of past, present, and reasonably foreseeable probable future projects that could cause environmental impacts that are closely related to those of the project proposed. Factors considered in determining whether to include a project on the list include whether it would cause impacts of the same nature as the proposed project, its location, the timing of its impacts, and the type of project. A list of projects, the impacts of which could interact with those of the Project, is provided in **Table 3.1-1**. Not all of the projects listed will complete the environmental review process, and not all projects will be funded and constructed; however, this analysis conservatively assumes that any or all of the projects could be constructed.

The summary of projections approach evaluates the impacts of a proposed project in the context of projections made in one or more local, regional, or statewide planning documents or environmental analysis that has been adopted or certified. The following adopted plans and analyses are considered in combination with the Project for assessing cumulative impacts. In most cases these plans comprise the preparing agencies' comprehensive, long-term visions for physical development or resource conservation within the region.

- Daly City General Plan
- San Francisco General Plan and Western Shoreline Area Plan
- San Mateo County General Plan
- San Mateo County Local Coastal Program
- San Francisco Regional Water Quality Control Board (RWQCB) Water Quality Control Plan (Basin Plan)
- National Park Service, Golden Gate National Recreation Area (GGNRA)/Muir Woods National Monument General Management Plan
- Ocean Beach Master Plan, San Francisco Planning and Urban Research Association (SPUR)
- Significant Natural Areas Management Plan, San Francisco Recreation and Park Department

TABLE 3.1-1
PROJECTS CONTRIBUTING TO THE CUMULATIVE SCENARIO FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Project Name and Proponent(s)	Location and Distance from Project Area	Project Description	Project Status and Schedule	Potential Contribution to Cumulative Environmental Impacts
Lake Merced Boathouse Renovations, SFPUC and SFRPD	Lake Merced	The first phase of the project includes demolition and cleanup work, including removing asbestos and lead floor tiles. The second phase would remodel the second floor of the boathouse to create space for a community room, exercise room, restrooms, SFRPD office space, and a concession area. (SFRPD, 2012a, 2012b)	Existing. Construction completed in 2014.	Short-term: Construction-related air quality, biological resources, hydrology and water quality, noise, and traffic impacts. Long-term: aesthetics, hydrology and water quality, noise, recreation, traffic and transportation.
San Francisco Westside Recycled Water Project, SFPUC	Great Highway, south of San Francisco Zoo. Adjacent to Lake Merced and approximately 0.8 miles from ocean outfall.	The project would include a new recycled water treatment plant that would provide an average of 2 million gallons per day (mgd) and a peak of 4 mgd of advanced level treated water for non-potable (non-drinking) purposes to a variety of customers on the west side of San Francisco. Elements of the project that would have effects within the cumulative impacts area include: • Construction of recycled water treatment facility to be located on a proposed site that combines land in the vicinity of the Oceanside Water Pollution Control Plant. • Reverse osmosis concentrate disposal pipeline to convey brine from the recycled water treatment facility to the Oceanside Water Pollution Control Plant outfall. • Belowground storage and above ground pump station at Central Reservoir in Golden Gate Park. • Distribution pipelines between the Water Pollution Control Plant and Lincoln Park/the Presidio.	Approved. EIR certified and project approved in September 2015. Construction is anticipated between 2016 and 2019 (SFPUC, 2104).	Short-term: Construction-related impacts on air quality; sensitive habitats and species; and water quality; cultural resources effects. Long-term: Operational impacts on hydrology and water quality.
Harding Park Recycled Water Project, Daly City and SFPUC	Harding Park Golf Course. Adjacent to Lake Merced and approximately 0.3 miles from Vista Grande Canal	Expansion of the North San Mateo County Sanitation District's recycled water distribution system to provide recycled water for irrigation purposes to Tournament Players Cup Harding Park and Fleming Golf Courses (collectively referred to as Harding Park). Recycled water replaced potable water from the SFPUC's Regional Water System currently being used for irrigation. The project facilities include: • A new pump station at the Harding Park Maintenance Yard; • Approximately 4,800 feet of 18-inch distribution pipeline along Lake Merced Boulevard; • A new 700,000 gallon underground recycled water storage tank at the Harding Park Maintenance Yard; and • A back-up connection to the SFPUC potable water distribution system.	Existing. Construction completed in 2012.	Long-term: hydrology and water quality, utilities.

TABLE 3.1-1 (Continued)
PROJECTS CONTRIBUTING TO THE CUMULATIVE SCENARIO FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Project Name and Proponent(s)	Location and Distance from Project Area	Project Description	Project Status and Schedule	Potential Contribution to Cumulative Environmental Impacts
Regional Groundwater Storage and Recovery Project, SFPUC	South Westside Groundwater Basin underlies a portion of the Project Area	The project would further the use of the South Westside Groundwater Basin as an underground storage reservoir by storing water in the basin during wet periods for subsequent recapture during dry periods. New dry-year water supply would be made available to the cities of Daly City and San Bruno, the California Water Service Company's (Cal Water) South San Francisco service area, and SFPUC wholesale water customers. The proposed facilities would include up to 16 new groundwater production well facilities within the South Westside Groundwater Basin. Each well facility site would contain a groundwater production well, pump station, underground distribution piping, utility connections, and disinfection unit. Well facilities would be connected to Daly City, San Bruno, Cal Water, or SFPUC distribution systems. In addition, the project includes upgrades to the existing Westlake Pump Station in Daly City. (SFPUC, 2014a)	Approved. under construction, scheduled for 2015 to 2018**.**	Short-term: Construction-related traffic impacts on access roads and associated air quality and noise impacts; sensitive habitats and species; water quality; cultural resources; and geology. Long-term: biological resources, hydrology and water quality, and recreation.
Groundwater Supply Project, SFPUC	Westside Groundwater Basin underlies Project Area; Lake Merced Pump Station located on Lake Merced Boulevard adjacent to South Lake	The project proposes to install four new wells near West Sunset Playground, South Sunset Playground, Lake Merced Pump Station and Golden Gate Park. These wells would be able to provide a total of about 2.8 million gallons of water per day (mgd). The well stations would include a building to house the well pump and electrical, testing and treatment equipment. The project would also convert two of the existing irrigation wells in Golden Gate Park to drinking water facilities, which would be able to provide another 1.2 mgd of supply to San Francisco. (SFPUC, 2014b)	Approved. Under construction, scheduled from 2014 to 2017. (SFPUC, 2014b)	Short-term: Construction-related air quality and noise impacts; sensitive habitats and species; water quality; and cultural resources. Long-term: biological resources, hydrology and water quality, recreation, and aesthetics.
Ocean Beach Master Plan, San Francisco Planning and Urban Research Association (SPUR)	Ocean Beach, approximately 0.8 miles from Ocean Outfall	This plan is a visioning document that presents recommendations for the management and protection of San Francisco's Ocean Beach, a 3.5-mile stretch of beach north of Fort Funston. The intent of the plan is to address the impact of rising seas, the physical and ecological processes shaping the beach, and improved integration with its natural, recreational, and urban contexts. Recommendations include rerouting the Great Highway behind the zoo via Sloat and Skyline Boulevards and restoring dunes through sand replenishment. The Plan was created with assistance from the Ocean Beach Task Force and Ocean Beach Vision Council, and funding from the California State Coastal Conservancy, SFPUC, and NPS.	Approved. Final plan published in May 2012. Implementation ongoing.	Short-term: Construction-related traffic impacts on access roads and associated air quality and noise impacts; sensitive habitats and species; water quality; aesthetics; recreation; and geology. Long-term: aesthetics, sensitive habitats and species, recreation, transportation.

TABLE 3.1-1 (Continued)
PROJECTS CONTRIBUTING TO THE CUMULATIVE SCENARIO FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Project Name and Proponent(s)	Location and Distance from Project Area	Project Description	Project Status and Schedule	Potential Contribution to Cumulative Environmental Impacts
GGNRA/Muir Woods National Monument General Management Plan, National Park Service (NPS)	All GGNRA park units, including Fort Funston	The Plan sets forth the basic management philosophy for the GGNRA and provides a framework for future decision making in the GGNRA units for the next 20 years. Under the Selected Alternative, Fort Funston will be managed to continue to support current recreational activities (e.g., dog walking and hang gliding); provide new visitor facilities near the parking lot; fence and protect Battery Davis; form a continuous habitat corridor that supports recovery of native dune habitat; protect shorebirds, coastal bluffs, and bank swallows; and allow natural coastal and marine processes to occur. (NPS, 2014)	Approved: Final Plan/Environmental Impact Statement published in April 2014, Record of Decision signed in January 2015.	Short-term: Construction-related traffic impacts on access roads and associated air quality and noise impacts; sensitive habitats and species; water quality; aesthetics; recreation; and geology. Long-term: aesthetics, sensitive habitats and species, recreation.
2800 Sloat Boulevard, private developer	2800 Sloat Boulevard, approximately 1.3 miles from Project site	The project includes the demolition of three existing commercial buildings and the construction of a new mixed-use building totaling approximately 117,000 gross square feet (gsf), and a one-story building dedicated to commercial use that together will provide approximately 23,000 gsf of commercial space and four levels of residential occupancy with 56 dwelling units (consisting of 19 one-bedroom units, 24 two-bedroom units, and 13 three-bedroom units). (San Francisco Planning Department, 2012)	Approved. Construction began in August 2015.	Short-term: Construction-related air quality and noise impacts Long-term: public services, recreation, traffic and circulation; utilities.
Significant Natural Areas Management Plan, San Francisco Recreation and Park Department (SFRPD)	Several parks including Lake Merced	The plan provides recommendations for management of the fragments of unique plant and animal habitats within San Francisco and Pacifica known as Significant Natural Resource Areas that have been preserved within parks that are managed by the SFRPD. Among these is Lake Merced. The plan identifies several conservation- and recreation-related issues for Lake Merced and provides recommendations developed for each of these issues to guide restoration, enhancement, and maintenance work. (SFRPD, 2006)	Pending. Final draft plan released 2006; Draft EIR published August 2011. Final EIR and approval of plan anticipated in early 2016.	Short-term: Construction-related impacts on sensitive species and sensitive habitats; aesthetics; recreation; and public services.
Lake Merced Pump Station Essential Upgrade, SPFUC	Lake Merced	The project consists of upgrades to the pump station to comply with new seismic standards, Americans with Disabilities Act (ADA) requirements, and current building codes and regulations. The new facility will consist of two new structures - a new pump building and an electrical utility building, each approximately 8,000 square feet. Site improvements include new landscaping and security fencing. An innovative flow-through planter system will naturally filter storm water runoff for diversion into the lake, instead of allowing it to enter the sanitary collection system.	Approved. Construction finished in 2014.	Short-term: Construction-related air quality and noise impacts; sensitive habitats and species; water quality; geology. Long-term: aesthetics, hydrology and water quality, utilities.
Parkmerced, private developer	3711 19th Avenue, adjacent to Lake Merced and approximately 0.5 mile from Project site	The project is a long-term mixed-use development program to redesign the existing Parkmerced site. The project would increase residential density, provide new commercial and retail services, modify transit facilities including rerouting the existing Muni Metro M Ocean View line from its current alignment along 19th Avenue, install renewable energy sources such as wind turbines and photovoltaic cells; and improve	Approved. Construction would occur over 20 to 30 years, beginning in 2015 (Weinberg, 2014).	Short-term: Construction-related air quality and noise impacts; sensitive habitats and species; water quality; cultural resources, land use; and geology.

TABLE 3.1-1 (Continued)
PROJECTS CONTRIBUTING TO THE CUMULATIVE SCENARIO FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Project Name and Proponent(s)	Location and Distance from Project Area	Project Description	Project Status and Schedule	Potential Contribution to Cumulative Environmental Impacts
Parkmerced, private developer (cont.)		utilities and open space within the development site including new school, day care, and fitness facilities; new open space uses; an approximately 2-acre organic farm; and community gardens. Over a period of approximately 20 years, 1,538 existing apartments would be demolished in phases and fully replaced, and an additional 5,679 new units would be added to the site, resulting in a total of about 8,900 units on the site. Stormwater runoff from buildings and streets would be captured and filtered through a series of bioswales, ponds, and other natural filtration systems. The filtered stormwater would then either percolate into the groundwater that feeds the North Westside Groundwater Basin and Lake Merced or be released directly into Lake Merced.		Long-term: Impacts on aesthetics, biological resources, hydrology and water quality, noise, recreation, and traffic and transportation.
San Francisco State University (SFSU) Campus Master Plan 2007 – 2020, SFSU	Adjacent to Lake Merced, approximately 0.4 miles from Project site	The plan proposes physical changes and improvements to the campus to address increased enrollment. Some existing buildings and facilities would be upgraded and expanded, while others would be demolished and replaced. Some new buildings and facilities would be constructed. In total, these proposed improvements would result in the net addition of approximately 972,400 square feet and approximately 660 dwelling units to the campus. A proposed 112,000-square-foot Recreation Wellness Center is planned for the former Sutro Library/Lot 25 site on Winston Drive. The facility would include a two-court gym, one-court multi- activity gym (for basketball, volleyball, badminton, soccer, and hockey), climbing wall, weight and fitness space, and elevated jogging track.	Ongoing. Implementation of the plan is currently under way. The renovation and expansion of the existing library was completed in March 2012.	Short-term: Construction-related air quality; sensitive habitats and species; hydrology and water quality; and noise. Long-term: hydrology and water quality, transportation and traffic, utilities.
Fort Funston Site Improvements, NPS	Fort Funston	Proposed site improvements include constructing a restroom, constructing a maintenance facility, and other minor visitor enhancements. The project would also upgrade and expand site utilities and infrastructure including expanding the capacity of the on-site sewage treatment system, widening and straightening the entrance road, lengthening the turn lane from Highway 35 into the site, repaving and restriping the parking area, accessibility improvements, and an upgrade of picnic facilities. (NPS, 2013a)	Pending. Environmental Assessment (EA) in preparation, anticipated Summer 2016 release.	Short-term: aesthetics, air quality, hydrology and water quality, recreation, noise, transportation and traffic. Long-term: aesthetics, vegetation, hydrology and water quality, recreation, transportation and traffic, utilities.
Dog Management Plan, NPS	All GGNRA park units, including Fort Funston	The purpose of the plan is to provide a clear, enforceable policy to determine the manner and extent of dog walking in appropriate areas of the park; promote the preservation and protection of natural and cultural resources and natural processes; provide a variety of visitor experiences, improve visitor and employee safety and reduce user conflicts; and maintain park resources and values for future generations. (NPS, 2013b)	Pending. Draft EIS published in January 2011, Supplemental Draft EIS published September 2013. Final rule anticipated early 2016.	Long-term: recreation, transportation and traffic.

TABLE 3.1-1 (Continued)
PROJECTS CONTRIBUTING TO THE CUMULATIVE SCENARIO FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Project Name and Proponent(s)	Location and Distance from Project Area	Project Description	Project Status and Schedule	Potential Contribution to Cumulative Environmental Impacts
Pacific Rod and Gun Club Upland Soil Remediation Project, SFPUC	Across John Muir Drive from Lake Merced Tunnel Portal, southwest bank of South Lake	The project consists solely of construction activities: site preparation, survey and excavation layout, soil excavation and removal, confirmation sampling, waste disposal, backfilling, and site restoration. No new structures would be constructed as part of the project, and all existing buildings would remain. Before construction, smaller structures, such as target launching stands and towers, would be moved temporarily in coordination with the Club, whose activities would be suspended due to site closure during construction. There are no operation or ongoing maintenance activities associated with the soil remediation.	Approved. Construction commenced in May 2015 and is expected to have a duration of up to 15 months.	Short-term: Construction-related air quality and noise impacts; sensitive habitats and species; water quality, aesthetics, historic resources. Long-term: none.
Lake Merced Aeration System Demonstration Project, SFPUC	Lake Merced	SFPUC is proposing a demonstration aeration project in Lake Merced. The identified technology for the demonstration is a bubble diffuser, consisting of an air compressor or blower, air feed pipelines, and diffusers. The air compressor or blower would be housed onshore in a pre-engineered masonry building. The self-weighted feed pipelines and diffuser laterals would be placed on the bottom of the lake, spread throughout the lake, using boats and divers. Between the air compressors located on the shore and the feed pipelines located in the lake, connecting feed pipelines would be buried.	Proposed. In initial planning phase.	Short-term: Construction-related noise; sensitive habitats and species; water quality, aesthetics. Long-term: Aesthetics, water quality.
John Muir Drive Erosion Control Project, SFPUC	Across John Muir Drive from Canal, bank of Lake Merced	The project would repair three severely eroded areas adjacent to John Muir Drive along the South Lake Merced shoreline. The South Lake Merced shoreline severely erodes when stormwater from the Vista Grande Watershed in Daly City overflows the Vista Grande Canal, crosses John Muir Drive, and flows down the shoreline embankment into South Lake Merced.	Approved. Installation of the erosion control features and repair of eroded areas is complete; removal of erosion control structures would be considered in the future, following completion of Vista Grande Drainage Basin Improvement Project.	Short-term: Construction-related noise; sensitive habitats and species; water quality, aesthetics. Long-term: Aesthetics, water quality.

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3.2 Aesthetics

This section evaluates potential impacts on aesthetic and visual resources that could result from implementation of the proposed Project and alternatives, and identifies mitigation measures to reduce or avoid impacts, as appropriate. For the purposes of this assessment, visual resources are generally defined as the natural and built features of the landscape that contribute to the public's experience and appreciation of the environment. Depending on the extent to which a project's presence would alter the perceived visual character and quality of the environment, a visual or aesthetic impact may occur. This section also describes regulations pertinent to the proposed Project.

Aesthetic and visual resources analyzed under CEQA examine the impact of the Project on aesthetic resources and the visual quality and character of an area. Under NEPA, the analysis would focus on how visual resources under federal jurisdiction, such as the National Park Service (i.e., Fort Funston in the Project area), would be affected by the proposed Project. Similar to CEQA, NEPA analysis under Director's Order 12 requires a description of the resources that could be affected by the proposed Project or alternatives to the Project.

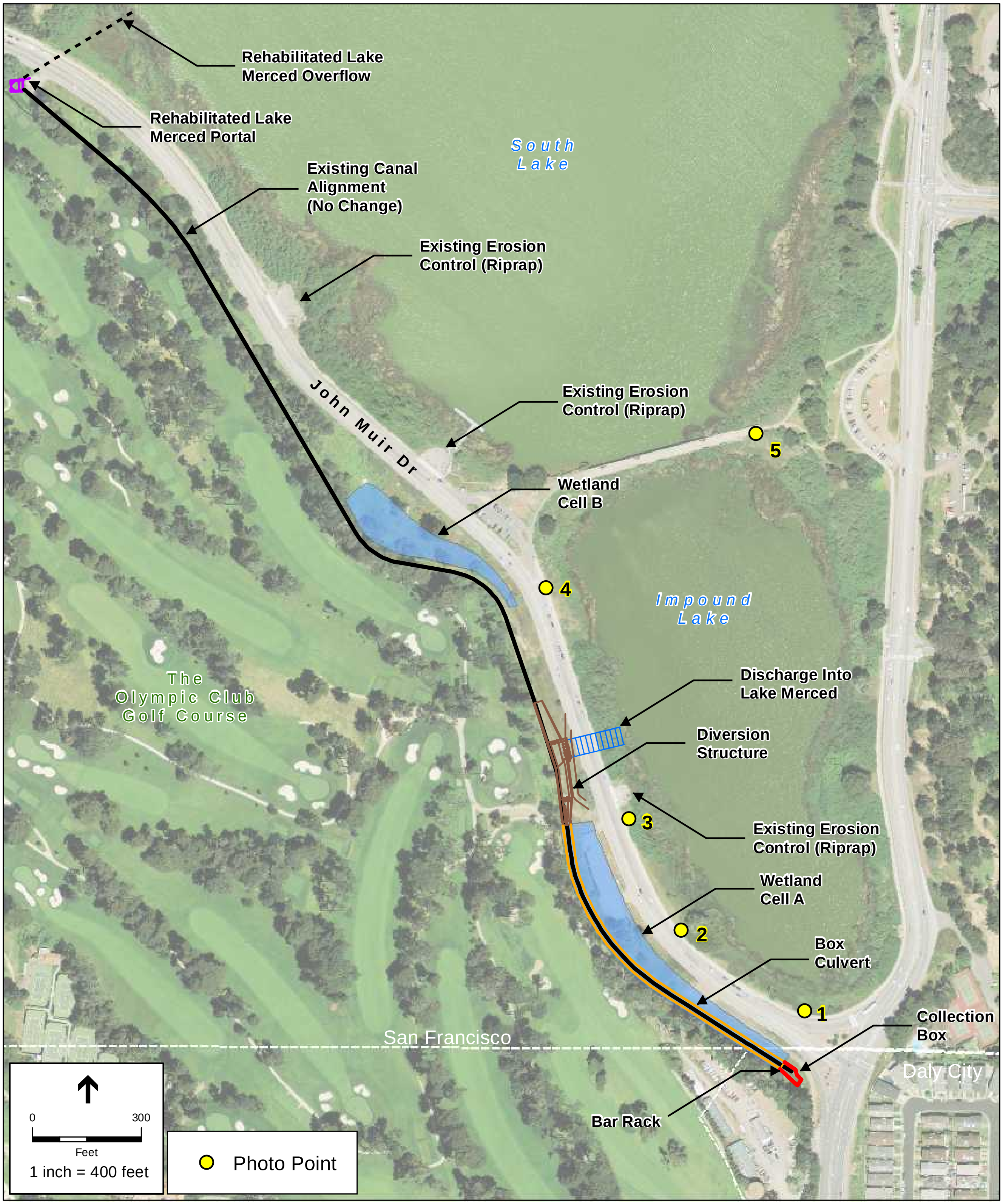
3.2.1 Affected Environment

For the purpose of the aesthetics evaluation, the visual study area includes the Project construction areas and the surrounding vicinity from which views could be affected temporarily and permanently.

Ten photos are included in this section to document the existing visual conditions of the Project sites and adjacent areas. **Figures 3.2-1** and **3.2-2** provide an overview of photo locations; **Figures 3.2-3** through **3.2-7** depict views of the Project sites and surrounding locations.

The study area for aesthetics includes public areas from which the proposed Project elements would be visible. The study area includes the Project site, Lake Merced, Fort Funston, and associated open and recreational spaces in the vicinity of the Project sites. Lake Merced and adjacent areas are closely bounded by the major thoroughfares of Lake Merced Boulevard, John Muir Drive, and Skyline Boulevard. Aside from golf courses, the Lake Merced area is not highly manicured or landscaped, but it does not have an untouched natural appearance due to the scattered presence of structures, utilities, roads, and a narrow band of vegetation which is highly contained by sidewalks and paths that run alongside the roads surrounding the lake.

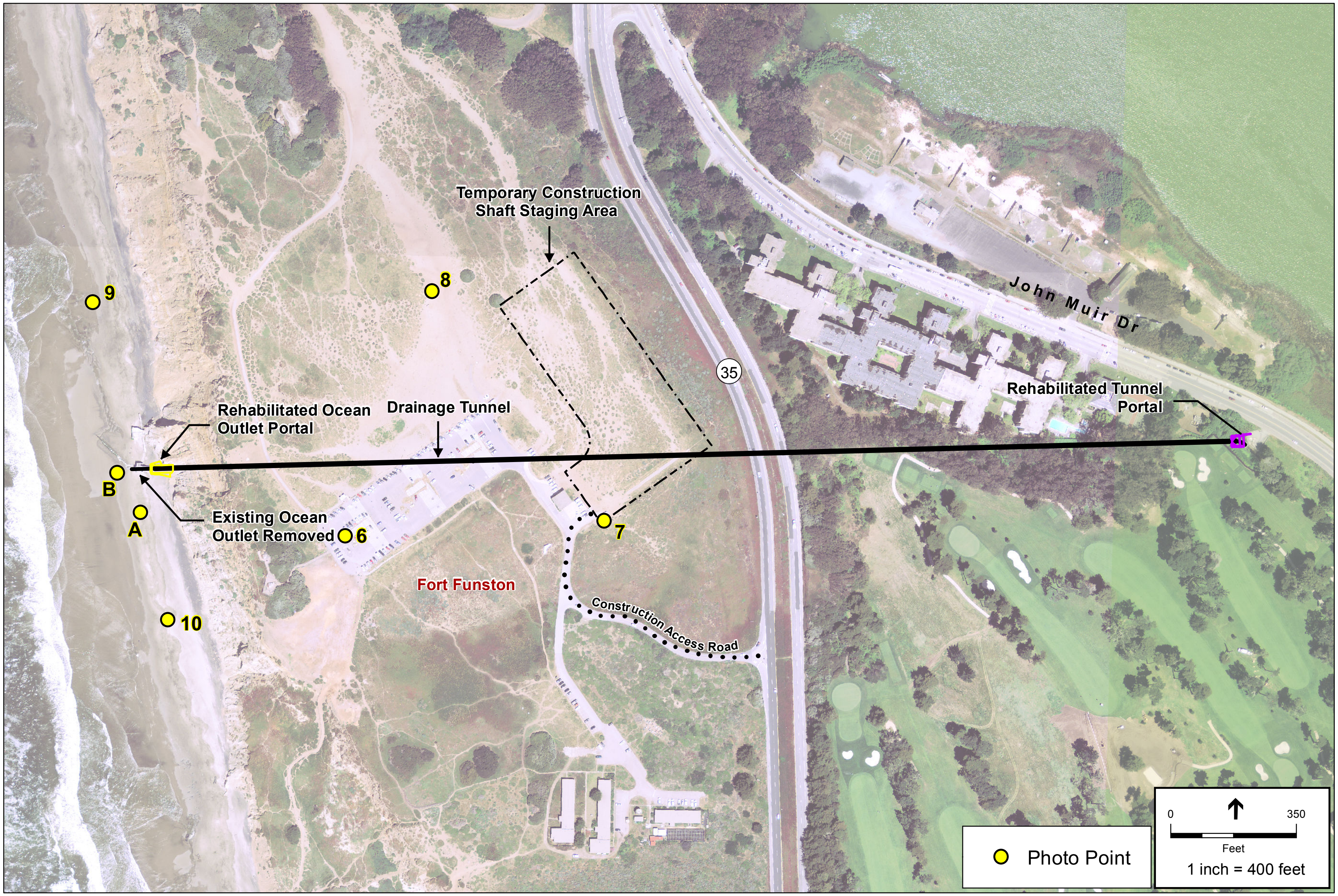
The Project sites located along John Muir Drive are in a developed area. Nevertheless, the overall Lake Merced area is largely undeveloped, with trees, water, and vegetation providing visual variety and a respite from San Francisco's urban setting. Because many of the surrounding roadways and neighborhoods are elevated relative to Lake Merced, the lake and the bordering open space are also important visual resources, offering aesthetically pleasing views for motorists, bicyclists, and pedestrians.



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.2-1
Photo Points - Impound Lake



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.2-2
Photo Points - Fort Funston

Photo 1 – Northwest facing view from John Muir Drive Pedestrian Path

Photo 2 - Northwest facing view from John Muir Drive Pedestrian Path

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.2-3
Public Views of Vista Grande Project Area

Photo 3 – Northwest facing view from John Muir Drive Pedestrian Path

Photo 4 - Northwest facing view from John Muir Drive Pedestrian Path and Lake Merced parking lot

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.2-4
Public Views of Vista Grande Project Area

Photo 5 – Southwest facing view from Pedestrian Bridge between Impound Lake and South Lake

Photo 6 - Northeast facing view from Fort Funston Parking Lot

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.2-5
Public Views of Vista Grande Project Area

Photo 7 – North facing view from Fort Funston Pedestrian Path

Photo 8 - Southeast facing view from Fort Funston Pedestrian Path

SOURCE: ESA

Figure 3.2-6
Public Views of Vista Grande Project Area

Photo 9 – South facing view from Fort Funston Beach

Photo 10 - North facing view from Fort Funston Beach

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.2-7

Public Views of Vista Grande Project Area

The Project sites within Fort Funston are located approximately 700 feet north of the Fort Funston Native Plant Nursery and approximately 600 feet south of Battery Davis. The existing Daly City and SFPUC outlet structures also are within Fort Funston. The Pacific Ocean lies to the west of the Fort Funston project sites, Lake Merced and Olympic Golf Club to the east, and undeveloped additional Fort Funston areas to the north and south. The upper portion of Fort Funston (above the cliff) is a recreational national park facility that is especially popular for dog-walking and hang-gliding use, and provides sweeping views of the Pacific Ocean. The Project staging area is adjacent to a large parking lot and NPS storage buildings, and primarily consists of sand dunes covered with ice plant. The lower portion of Fort Funston is at the base of the cliff and along a long stretch of beach. While dense urban development is visible from many locations in Fort Funston, it is a natural open space which provides respite from San Francisco's urban setting.

Figures 3.2-3 through 3.2-7 depict views of the Project sites and surrounding locations. Photos 1 through 4 provide views of the Project site near Lake Merced from the pedestrian path along John Muir Drive. Photo 5 provides a view of the Project site from the bridge that separates Impound Lake from South Lake. Photos 1 and 2 show the existing conditions where Wetland Cell A would be located on the western side of John Muir Drive. The proposed area of Wetland Cell A is currently in an unimproved condition with a few shrubs, in contrast with the manicured lawn and trees of the Olympic Golf Club visible in the background. Photo 3 shows the location where the diversion structure would be located on the west side of John Muir Drive, which is currently a low berm with weedy vegetation and a few scattered boulders, shrubs, and trees. Photo 4 shows the location where Wetland Cell B would be located, which includes an open area with weedy vegetation (grasses) with utility poles and scattered trees and shrubs. A parking lot is on the east side of John Muir Drive. Photo 5 shows the existing condition as viewed from the bridge between Impound Lake and Lake Merced.

A portion of the 49-Mile Scenic Drive, a San Francisco designated scenic road tour, partially encircles the lake, and it can be reasonably assumed that users of the pedestrian path in particular expect a high-quality environment, given that the streets that are included in the 49-Mile Scenic Drive are recognized for their aesthetic value. Thus, these pedestrian path users, motorists, and bicyclists are considered sensitive viewers when considering the potential for aesthetic impacts. Nevertheless, the Project site currently has low viewer exposure and is currently seen only briefly as viewers pass by.

Photos 6 through 8 provide views of the construction staging area and photos 9 and 10 provide views of the Vista Grande Tunnel site at Fort Funston. Photo 6 shows the Fort Funston parking area with the proposed construction staging area in the distance, behind the NPS service building. Photo 7 shows the existing conditions of the proposed construction staging area as viewed from a path that originates on the southern side of the NPS service building. The sand dunes and ice plant that are characteristic of this area are evident in the photo. Photo 8 shows the parking lot and proposed construction staging location. This photo also shows one of the more heavily used areas in the park, which is cleared of vegetation and fairly compacted from heavy use. Photos 9 and 10 show the existing conditions along the beach, including the existing structures in an otherwise relatively undeveloped landscape. The character of the landscape is partially enclosed with the tall and steep cliff on one side and panoramic with the Pacific Ocean on the other side.

3.2.2 Regulatory Setting

3.2.2.1 Federal

GGNRA/Muir Woods National Monument General Management Plan

The Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan (GMP) published in 2014 and adopted in 2015 requires that whenever possible, new facilities will be built in previously disturbed areas or in carefully selected sites with as small a construction footprint as possible and with a sustainable design (NPS, 2014, 2015). The GMP applies mitigation measures to the actions proposed in the plan, including those pertaining to visual resources. Those that may be relevant to management of Fort Funston in relation to the proposed Project include:

- Facilities would be designed, sited, and constructed to avoid or minimize visual intrusion into the natural environment or landscape;
- Limiting the use of artificial outdoor lighting to that which is necessary for basic safety requirements;
- Shielding all outdoor lighting to the maximum extent possible; and
- Keeping light on the intended subject and out of the night sky to the greatest degree possible.

National Park Service 2006 Management Policies

The 2006 Management Policies state that the purpose of NPS interpretive and educational programs is to provide memorable educational and recreational experiences that will (1) help the public understand the meaning and relevance of park resources, and (2) foster development of a sense of stewardship. The programs do so by forging a connection between park resources, visitors, the community, and the National Park System (NPS, 2006).

> **4.10 Lightscape Management**
>
> "The Service will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light." (NPS, 2006).
>
> The Service will:
>
> - restrict the use of artificial lighting in parks to those areas where security, basic human safety, and specific cultural resource requirements must be met;
> - use minimal-impact lighting techniques;
> - shield the use of artificial lighting where necessary to prevent the disruption of the night sky, natural cave processes, physiological processes of living organisms, and similar natural processes.

3.2.2.2 State

The California Department of Transportation (Caltrans) designates highways as scenic highways based on how much of the landscape can be seen by travelers, the scenic quality of the landscape, and the extent to which views are compromised by development. There are no state designated scenic highways in San Francisco (Caltrans, 2011). State Routes 1 and 35 are identified as eligible for designation as scenic highways.

3.2.2.3 Regional and Local

Designated Roads

In 1938, San Francisco's Downtown Association created the 49-mile Scenic Drive to highlight San Francisco's beauty and to promote the city as a tourist destination (San Francisco Travel Association, 2014).

This scenic roadway partially encircles Lake Merced, and the adjacent portion of John Muir Drive is part of the designated scenic roadway. Although there are no associated plans or policies related to 49-mile Scenic Drive, these streets are recognized for their aesthetic value.

San Francisco General Plan

The Urban Design Element of the *San Francisco General Plan* rates city streets as "excellent," "good," or "average" for the quality of their views. In the Project area, Lake Merced Boulevard is rated as having average-quality street views, with the exception of a small segment north of Brotherhood Way, and north of the Project area, where open views of Lake Merced are available. This segment of Lake Merced Boulevard is designated as having excellent-quality street views. John Muir Drive in the vicinity of the Project area is designated as having average street views, and Skyline Boulevard is designated as having good street views. The Urban Design Element also identifies streets that are important to the "perception" of San Francisco. A majority of San Francisco's streets have pleasing views of the bay, the ocean, distant hills, or other parts of San Francisco. However, where good views are not available, streets can still function as open space for use by neighborhood residents and for landscaping to bring a sense of nature to the area. Lake Merced Boulevard, John Muir Drive, and Skyline Boulevard are identified as "Streets that Extend[s] the Effect of Public Open Space." The Urban Design Element also identifies Lake Merced as an area where it is important to preserve the existing landscape (San Francisco, 2010).

The Urban Design Element identifies the following, which lend themselves to aesthetic and visual resources:

> OPEN SPACES AND LANDSCAPED AREAS, whose dark green patterns enrich the color of the city and define and identify hills, districts and places for recreation. These areas may be large, as at the Presidio, Lake Merced and Golden Gate Park, smaller but still prominent as at Bayview Hill and Alta Plaza, or mixed with buildings as on the slopes of Russian Hill and Buena Vista.
>
> STREETS AND ROADWAYS, which unify the pattern, emphasize the hills and valleys, provide vistas and open space and determine the character of development. Streets and roadways are of many types, each with its own functions and characteristics, and together they make up a system that accommodates man's movements and joins the districts of the city.

The Western Shoreline Area Plan (San Francisco, 1996), an area plan within the General Plan, is San Francisco's certified Local Coastal Program under the California Coastal Act of 1976. Policies related to the Lake Merced area include preserving recreational facilities, passive activities, playgrounds, and vistas of the Lake Merced area.

City of Daly City

The Daly City General Plan (2013) identifies roadways that have scenic quality, including roadways that contribute to the overall scenic quality of Daly City, or provide scenic views/vistas. Lake Merced Boulevard is identified as a roadway that provides scenic vistas.

3.2.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.2.3.1 CEQA Significance Criteria

Based on CEQA Guidelines Appendix G Section I, a project would have a significant impact on aesthetics if it would:

a) Have a substantial adverse effect on a scenic vista;

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;

c) Substantially degrade the existing visual character or quality of the site and its surroundings; or

d) Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area.

3.2.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook Environmental Screening Form (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have measurable impacts on visual resources to Fort Funston, with impact intensity based on the impact descriptions in the following table.

Impact Intensity	Impact Description
Negligible:	Would result in little or no detectable change in visual character or views of the site.
Minor:	Changes to the visual character and views of the site would be detectable, but the landscape has the capability to visually absorb and incorporate most of the changes. Changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality.
Moderate:	Changes to the visual character and views of the site would be readily noticeable. One or more secondary features of views of the site would be altered, but effects would be short-term and/or the keystone features of the views would remain intact.
Major:	Changes to the visual character and views of the site would be highly noticeable and severe, such as the original, pre-project landscape would be altered beyond recognition. Keystone features of views would change.

3.2.4 Methodology and Assumptions

The visual impact analysis is based on field observations of the Project area and surroundings conducted in June 2014, in addition to a review of Project drawings and technical data supplied by Kennedy/Jenks Consultants, Jacobs Associates, and Brown and Caldwell; in addition to aerial and ground-level photographs of the Project area, and public planning documents. The analysis identifies potential temporary or permanent visual impacts that the Project could have on aesthetic and visual resources, as seen from local scenic roads, or on other visual resources identified that are frequented by users who may have a high sensitivity to change, such as trail users. The Project's potential to substantially degrade the visual character or quality of the surrounding area was considered, as was the Project's potential to create a new source of light or glare.

3.2.4.1 Visual Simulations – Outlet Structure

The outlet structure portion of the Project was photographed from a range of publicly accessible vantage points. From these, two representative views were selected to show the change that would occur if the Project was developed (photo points A and B on Figure 3.2-2). These views are presented on **Figures 3.2-8** and **3.2-9**. The existing views represent the existing baseline visual condition of the outlet structure viewed from within the site, from elevated public vantage points to the north and south of the outlet structure. Below the image of existing conditions, a representative simulation of the proposed outlet structure is superimposed on the same view (denoted as "Proposed"). This allows the reader to compare existing photographic views with massing-level visualizations of the proposed outlet structure.

3.2.5 Impact Analysis

3.2.5.1 Proposed Project

CEQA Analysis

a, b, c) Impact AES-1: Project construction would not result in a substantial adverse impact on a scenic vista or scenic resource, or on the visual character or quality of the site or its surroundings. (Less than Significant)

The proposed Project would result in temporary construction-related impacts on the visual character of the Project sites and surrounding areas. Direct views of the Project sites, including views of construction work areas, would occur from public roadways and public areas in residential neighborhoods and outdoor recreational facilities in the area (including areas associated with potential Lake Management Plan components and potential facility upgrades associated with increased lake levels). Construction activities would occur over a 24- to 44-month period as described in Section 2.5.3, Construction Schedule, Workforce, and Equipment.

Construction areas adjacent to John Muir Drive would have a chain-link fence erected along John Muir Drive to exclude the public. An internally braced sheetpile excavation would cross John Muir Drive and traffic and pedestrian access would be temporarily rerouted around the excavation. Construction activities would include site clearing, potential tree removal, relocation

Existing Condition – North facing view of Ocean Outlet from Fort Funston Beach

Proposed Condition – North facing view of Ocean Outlet from Fort Funston Beach

SOURCE: ESA

Figure 3.2-8

Visual Simulation of Proposed Ocean Outlet Structure - North Facing View

Existing Condition – East facing view of Ocean Outlet from Fort Funston Beach

Proposed Condition – East facing view of Ocean Outlet from Fort Funston Beach

SOURCE: ESA

Figure 3.2-9
Visual Simulation of Proposed Ocean Outlet Structure - East Facing View

of utilities, demolition, excavation, grading, planting, and installation of structures associated with the proposed Project. Viewers traveling along John Muir Drive and the adjacent pedestrian path would notice construction activities as they pass the Project site; however, their viewing period would be brief as they move past the site.

Construction at the Ocean Outlet structure at Fort Funston would occur along the beach at the base of a steep cliff. Construction activities would include the installation of a cofferdam, shaft sheet piles, excavation of the tunnel and shaft, new tunnel lining, and two 24-inch effluent pipes. A concrete pump would be placed on the bluff above the Ocean Outlet for approximately one week to supply shotcrete for the portal wall. A hose connected to the pump would convey concrete to the construction area at the beach. Construction lighting would be used for the tunnel and beach work. Construction activities would have a temporary impact on the visual character of this location because the area would be visible and attract the attention of users with a high sensitivity to change in the landscape along this undeveloped stretch of beach. However, it is noted that the area currently includes views of the existing outlet structure, as well as the adjacent SFPUC structure. Users could experience longer views of the activity because they would be enjoying passive recreation activities such as walking, hiking, lounging, and taking in the scenery. The construction activities would be temporary, occurring over a 5- to 6-month period.

The construction staging area at Fort Funston is proposed northeast of the existing NPS service building and parking lot as shown in Figure 2-2b. The staging area would be approximately 4 acres in size and the use of chain-link fencing is proposed around the perimeter. It is estimated that the construction staging area would be in place for approximately 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston (see Table 2-2 in Section 2.5.3.1). Additionally, if staging activities for other Project components occur in this location, the staging area could be in place for several more months. The public would be not be able to access this area, but they would be able to view the fence, construction equipment, personnel, and activity. The staging area would not obstruct views of the ocean from the majority of the trails (with the exception of the southern end of the Horse Trail on the eastern side of the proposed staging area), and would be located adjacent to an existing park storage building and parking lot. Although not necessary to reduce this temporary construction-related impact to a less-than-significant level under CEQA, see the NEPA analysis below for a discussion of Mitigation Measure 3.2-1 which would require the use of an 8-foot-high green screening fence around the perimeter of the staging area and limit the height of materials stockpiles to 8 feet or less. The visual screening provided by this fence type and the restricted height of stockpiled materials would further reduce temporary construction-related aesthetic impacts at Fort Funston.

Construction and staging areas would be restored to conditions similar to existing conditions following completion of construction activities, with the exception of permanent changes made associated with the Project (discussed below). The Fort Funston staging area and other unpaved staging areas would be recontoured. Because the aesthetic effects of construction activities would be temporary, construction activities would not result in a substantial adverse impact on a scenic vista, resource, or on the visual character of a site or its surroundings. This impact would be *less than significant*.

Mitigation: None required.

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a, b, c) Impacts AES-2: Project operation would not result in a substantial adverse impact on a scenic vista, scenic resource, or on the visual character or quality of the site or its surroundings. (Less than Significant)

The proposed Canal improvements would partially replace the existing Canal and add new elements including two treatment wetland cells and a diversion structure that would be visible to the public. Trees may be removed to accommodate the canal improvements, treatment wetland cells, the portion of the diversion structure on the south side of John Muir Drive, and the Lake Merced Portal. No trees would be removed from NPS-managed lands at Fort Funston.

The design character of the treatment wetland cells would integrate the treatment wetlands and associated infrastructure with the existing visual environment of the Project site. The treatment wetland cells could be considered an aesthetic improvement to the area as they would be replacing undeveloped roadside areas with landscaping improvements. The treatment wetland cells would be planted with emergent reeds such as cattails or bulrush, which would reflect the character of the native vegetation located along the shoreline of Lake Merced. The chain-link fence that would surround the wetland cells would introduce additional human-made structures to the John Muir Drive area; however, such fencing would be similar in character to fencing in the vicinity of the adjacent Pacific Rod and Gun Club and the Olympic Club. Further, views of the fenced treatment wetlands would be brief as viewed by motorists, bicyclists, and pedestrians moving past the approximately 0.5-mile portion of John Muir Drive. There are picnic benches on the north side of the Lake Merced parking lot from which the fenced treatment wetlands could be viewed; however, views from this area are interrupted by the parking lot and other human-made structures. The Olympic Club currently includes a chain-link fence between the golf course and portions of the existing Canal. It is expected that views of the fenced treatment wetlands from the Olympic Club would blend into foreground views of Lake Merced.

The Impound Lake outlet structure, and flexible pipelines installed at the structure as well as the South Lake overflow structure would be visible from shoreline areas but would be small in scale as compared to the overall lake and shore areas. The treatment wetland cells and other canal improvements would be visible from John Muir Drive, which is part of San Francisco's 49-mile Scenic Drive. While the Project could remove trees along John Muir Drive, the Project components that would be installed along John Muir Drive, at the Canal and at Lake Merced would be low in profile and would not block views, while also enhancing the landscape with treatment wetland vegetation. Thus, the impact on scenic resources would be *less than significant.*

At Fort Funston, the outlet structure and a portion of the force main would be reconfigured. The existing Daly City Ocean Outlet structure juts out from the cliff approximately 90 feet and would be removed and replaced with a low-profile outlet structure set nearer to the existing cliff face to improve beach access. An existing wing wall that extends south from the SFPUC's outlet against the cliff face would be extended by 70 feet to connect to the rehabilitated Daly City outlet and an additional 100 feet to the south of the outlet. The new Ocean Outlet structure would be approximately 16 feet wide by 13 feet high, and would protrude from the cliff approximately 13 feet on the south side and be flush with the cliff on the north side. The wing walls would be less than 4 feet in height and would tie in with the wing walls of the existing SFPUC structure. A small portion of the submarine outfall pipeline, currently connected to the existing outlet structure and extending from the structure, would be replaced at the same elevation as the existing submarine outfall pipeline, and would continue to be exposed during some times of the year when sand levels recede. See simulations of the proposed outlet structures compared to the existing conditions in Figures 3.2-8 and 3.2-9. The manner in which the existing Ocean Outlet structure is exposed appears obtrusive to an otherwise undeveloped landscape, with the SFPUC structure, which is located closer to the cliff. In the context of an ocean beach at the base of exposed cliffs, the Project would reduce the contrast to a moderately low level by reducing the size of the structure and would provide better views of the surrounding scenery. Therefore, the impact on the visual character of the site and its surroundings would be *less than significant*.

As described in Section 2.6.5, Project Maintenance, as the bluff continues to recede after completion of construction, portions of the Ocean Outlet and Tunnel would again become exposed on the beach, though for a shorter distance than under existing conditions. At an estimated interval of approximately 25 years, Daly City would demolish and remove the exposed portions and reconstruct the Ocean Outlet structure. The construction methods for future removal and reconstruction of the Ocean Outlet are anticipated to be similar to those described for the currently proposed Ocean Outlet work under Impact AES-1. The reconstructed Ocean Outlet would appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure. Therefore, the impact on the visual character of the site and its surroundings would be *less than significant*.

Mitigation: None required.

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d) Impact AES-3: Project construction could result in a new source of substantial light or glare that would adversely affect day or nighttime views in the area. (Less than Significant with Mitigation)

As described in Section 2.3.4 Construction Schedule, Workforce, and Equipment; most construction activities would occur during the day from 7:00 a.m. to 7:00 p.m., Monday through Friday. The Project does not include use of equipment or materials that would produce daytime glare. However, it is anticipated that tunneling activities could occur 24 hours per day in two to three shifts. These activities would be staged from within an area of Fort Funston. Additionally, construction of the replacement pipe section and piers on the beach would require that work be completed during low tide, necessitating 24-hour work over a period of several days to one week, most likely in January or July.

Night lighting would be needed for the tunnel and beach work. Lighting at staging areas could also be required for security purposes. Tunnel and beach work occurring at night (overnight and/or evening work) and requiring lighting would be located in Fort Funston. There are no residential uses in the vicinity of these work areas. However, construction would create a new temporary source of nighttime lighting in the immediate area and the light and glare effects (including potential effects on night-time sky viewing) from Project construction could be substantial. Thus, the impact could be *significant*. **Mitigation Measure 3.4-9, Night Lighting Minimization**, described in Section 3.4, Biological Resources, would require that nighttime illumination be directed downward and no significant illumination passes beyond the work area or vertically into the sky and that light deflectors be erected between traffic and staging areas. Implementation of Mitigation Measure 3.4-9 would ensure that impacts associated with light and glare are reduced to *less than significant*.

Mitigation: Implement Mitigation Measure 3.4-9.

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d) Impact AES-4: Project operation would not result in a new source of substantial light or glare that would adversely affect day or nighttime views in the area. (No Impact)

The operational phase of the Project would not create a new source of light or glare as no lighting is proposed. Therefore, there would be no impact associated with Project operation.

Mitigation: None required.

NEPA Analysis

As described above in the CEQA analysis, Project-generated visual resource impacts would contribute to visual change in the landscape. Due to the short-term, non-permanent nature of construction, and because most views of construction areas at Lake Merced would be by viewers traveling along public roadways and pedestrian paths, who would only view construction areas in passing, little to no detectable change in visual character of views of Project sites are expected during construction. However, the extended presence of construction equipment and activities at the Fort Funston staging area would be readily noticeable from passive recreation areas adjacent to this site and from trails including the Horse Trail, Chip Trail, Sunset Trail, portions of the Coastal Trail, the wheelchair-accessible trail, and possibly portions of the Battery Davis Trail. The staging area would be in place for 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston (see Table 2-2 in Section 2.5.3.1). Additionally, if staging activities for other Project components occur in this location, the staging area could be in place for several more months. Views of the dunes in this area would be replaced by the equipment and fencing for the duration of construction at Fort Funston. While changes to the visual character and views of the dunes at the staging area would be readily noticeable the effects would be short-term and non-permanent. Views of the ocean and other areas of Fort Funston would remain intact. Hang gliders may experience angled views of the staging area behind the parking lot, but would be more than 1,000 feet from the staging area while gliding above the cliffs. Construction activities on the beach would be visible to hang gliders passing overhead. Implementation of **Mitigation Measure 3.2-1** would require that construction sites are maintained and kept clean, thereby reducing the visual intrusion of construction activities and equipment. An 8-foot-high green screening fence (rather than proposed chain-link fencing) would be installed around the perimeter of the staging area to screen the visual intrusion of the construction equipment and activities from public view. The height of the materials stockpile would be limited to no more than 8 feet in height. The construction crane located adjacent to the tunnel shaft would be visible above the screening fence at the Fort Funston staging area. With implementation of Mitigation Measure 3.2-1, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Thus, there would be a short-term, minor, adverse effect on scenic quality. As noted above, if 24-hour tunneling is not permitted, construction-related impacts at and near the Fort Funston staging area would occur for an additional year or more.

> **Mitigation Measure 3.2-1:** The contractor shall ensure that construction-related activity at the Fort Funston staging area is as clean and inconspicuous as practical by storing materials and equipment within the proposed construction staging areas or in areas that are generally away from public view and by removing construction debris promptly at regular intervals. An 8-foot-high green screening fence shall be installed around the perimeter of the staging area. Stockpiled materials shall not exceed 8 feet in height.

At Fort Funston, the replacement of the existing Ocean Outlet structure with a new structure would be detectable; however, views would be improved by removing the existing structure which intrudes into views of the beach and constructing a new structure against the bluffs. While the new structure would be visible, the landscape has the capability to visually absorb and incorporate most of the changes. See Figures 3.2-8 and 3.2-9. Changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. As described in Section 2.6.5, Project Maintenance, as the bluff continues to recede after completion of construction, portions of the Ocean Outlet and Tunnel would again become exposed. This would result in a minor site-specific impact as a portion of the structure is again lying across the beach. However, the rehabilitated structure would not become exposed for the same length as the existing structure. At an estimated interval of approximately 25 years, Daly City would demolish and remove the exposed portions and reconstruct the Ocean Outlet structure. The construction methods for future removal and reconstruction of the Ocean Outlet are anticipated to be similar to those described for the currently proposed Ocean Outlet work. The reconstructed Ocean Outlet would appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure.

3.2.5.2 Tunnel Alignment Alternative

The following describes the aesthetic effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.2.5.1, Proposed Project, or Section 3.2.5.3, Canal Configuration Alternative, depending on the option selected. Thus, aesthetic effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative would include the same types of temporary aboveground components and activities during construction as the proposed Project, and the methods and duration required to construct the Tunnel Alignment Alternative would be similar to the Tunnel portion of the proposed Project. The staging area shown in Figure 2-6 would be used during the construction period and would be the same as the staging area under the proposed Project. The duration of the construction period at Fort Funston would be similar to that for the proposed Project: 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston.

The new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to connect to the existing Ocean Outlet location is selected, the structure would be rehabilitated as described for the proposed Project, and all aesthetic impacts related to rehabilitation of that structure would be as described for the proposed Project.

If a new Ocean Outlet location is selected, the new structure would be similar in appearance to that described for the proposed Project and depicted in Figures 3.2-8 and 3.2-9. However, depending on the location of the new Ocean Outlet structure, the proposed wing walls may not be included in the structure design. Additionally, the extent to which the new outlet structure would protrude from the cliff face may differ from what is described for the proposed Project and would be dependent on the profile of the cliff face in the selected location, but it would be designed to be similarly low-profile. Under this option, the existing Ocean Outlet structure would be removed or abandoned in place. Thus, a third outlet structure (in addition to the existing Ocean Outlet structure and SFPUC's outlet structure) could be present along the beach and toe of the cliff below Fort Funston within an area of approximately 150 feet or less, and the existing submarine outfall pipeline may be more exposed. This would increase the overall level of visual contrast in this location and would not provide the benefit of removing an obstruction to views. Visual conditions would remain similar to existing conditions in the vicinity of the existing outlet structure, as under the proposed Project. For the reasons described for the proposed Project, impacts would be *less than significant*.

As described above for the proposed Project, at an estimated interval of approximately 25 years (depending on erosion rates), Daly City would demolish and remove the portions of the Ocean Outlet structure and Tunnel that become exposed due to erosion and reconstruct the Ocean Outlet structure. The construction methods for future removal and reconstruction of the Ocean Outlet are anticipated to be similar to those described for the currently proposed Ocean Outlet work. The reconstructed Ocean Outlet would appear similar to the initial rehabilitation of the structure, and long-term visual impacts would be as described for the proposed structure. However, because the Tunnel Alignment Alternative would construct a new tunnel that would either meet the terminus of the existing tunnel at the current extent of the bluff face, or exit the bluff at a new location to the south, as the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed. Demolishing and removing both tunnels and the initial outlet reconstruction would, over time, result in the presence of two structures along the beach: one replacement Ocean Outlet structure at the terminus of the new tunnel, and one at the terminus of the existing tunnel to prevent access and damage. This would result in a greater impact than the initial rehabilitation as over time the two tunnels become exposed and two structures are required to cap them. It is assumed that the existing and new structure would be removed periodically as bluff erosion continues. The reconstructed Ocean Outlet would appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure. Therefore, as described for the proposed Project, impacts would be *less than significant*.

NEPA Analysis

As described above in the CEQA analysis, Tunnel Alignment Alternative visual resource impacts (construction activities, lighting, and permanent structures) would contribute to visual change in the landscape, particularly related to construction activities at the Fort Funston staging area. Similar to the proposed Project, this would result in short-term, moderate adverse impact. Implementation of Mitigation Measure 3.2-1 would require that construction sites are maintained and kept clean, thereby reducing the visual intrusion of construction activities and equipment. An 8-foot-high green screening fence (rather than proposed chain-link fencing) would be installed around the perimeter of the staging area to screen the visual intrusion of the construction equipment and activities from public view, and would limit the height of stockpiled materials to 8 feet. With implementation of Mitigation Measure 3.2-1, changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Thus, after mitigation, there would be a short-term, minor, adverse effect on scenic quality.

At Fort Funston, the new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to terminate the new tunnel at the same location as the existing tunnel is selected, the replacement of the exiting Ocean Outlet structure with a new structure at the same location would be detectable; however, views would be improved by removing the existing structure which intrudes into views of the beach and constructing a new structure against the bluffs. See Figures 3.2-8 and 3.2-9. While the new structure would be visible, the landscape has the capability to visually absorb and incorporate most of the changes. Changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Alternatively, if the option to terminate the new tunnel in a new ocean outlet location is selected, the existing Ocean Outlet structure would be removed or abandoned in place. Thus, a third outlet structure (in addition to the existing Ocean Outlet structure and SFPUC's outlet structure) could be present along the beach and toe of the cliff below Fort Funston within an area of approximately 150 feet or less. This would increase the overall level of visual contrast in this location and would not provide the benefit of removing an obstruction to views. Changes to the visual character and views of the site may be readily noticeable. One or more secondary features of views of the site would be altered, but the keystone features of the views (i.e., the bluffs, beach, and ocean) would remain intact and the landscape likely has the capability to visually absorb and incorporate most of the changes given the existing presence of outfalls in this area. Impacts would be minor to moderate, site-specific, and long-term.

As described above for the proposed Project, at an estimated interval of approximately 25 years (depending on erosion rates), Daly City would demolish and remove the portions of the Ocean Outlet structure and Tunnel that become exposed due to erosion and reconstruct the Ocean Outlet structure. The construction methods for future removal and reconstruction of the Ocean Outlet are anticipated to be similar to those described for the currently proposed Ocean Outlet work. The reconstructed Ocean Outlet would appear similar to the initial rehabilitation of the structure, and long-term impacts would be as described for the proposed structure. However, because the Tunnel Alignment Alternative would construct a new tunnel that would either meet the terminus of the existing tunnel at the current extent of the bluff face, or exit the bluff at a new location to the south, as the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed. Demolishing and removing both tunnels and the initial outlet reconstruction would, over time, result in the presence of two structures along the beach: one replacement Ocean Outlet structure at the terminus of the new tunnel, and one at the terminus of the existing tunnel to prevent access and damage. This would result in a greater impact than the initial rehabilitation as over time the two tunnels become exposed and two structures are required to cap them. It is assumed that the existing and new structure would be removed periodically as bluff erosion continues. Changes to the visual character and views of the site may be readily noticeable; but are currently affected by the presence of manmade structures. One or more secondary features of views of the site would be altered, but the keystone features of the views (i.e., the bluffs, beach, and ocean) would remain intact and the landscape likely has the capability to visually absorb and incorporate most of the changes given the existing presence of outfalls in this area. Impacts would be minor to moderate, site-specific, and long-term.

3.2.5.3 Canal Configuration Alternative

The following describes the aesthetic effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.2.5.1, Proposed Project, or Section 3.2.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, aesthetic effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative is in a very similar location to the Project, except that the treatment wetlands would be a different shape and size, and the diversion structure and Lake Merced outlet would be located at the southernmost end of the Canal. The methods and duration to construct the Canal Configuration Alternative would not change compared to the proposed Project. Therefore, like the proposed Project, the Canal Configuration alternative would result in *less-than-significant* impacts on aesthetics during construction.

Like the proposed Project, the design character of the treatment wetland cell would integrate the treatment wetland and associated infrastructure with the existing visual environment of the Project site. The treatment wetland cell could be considered an aesthetic improvement to the area as it would be replacing undeveloped roadside areas with landscaping improvements. The treatment wetland cell would be planted with emergent reeds such as cattails or bulrush, which would reflect the character of the native vegetation located along the shoreline of Lake Merced. The chain-link fence that would surround the wetland cells would introduce additional human-made structures to the John Muir Drive area; however, such fencing would be similar in character to fencing in the vicinity of the adjacent Pacific Rod and Gun Club and the Olympic Club. Further, views of the fenced treatment wetlands would be brief as viewed by motorists, bicyclists, and pedestrians travel past the approximately 0.5-mile portion of John Muir Drive. There are picnic benches on the north side of the Lake Merced parking lot from which the fenced treatment wetlands could be viewed; however, views from this area are interrupted by the parking lot and other human-made structures. The Olympic Club currently includes a chain-link fence between the golf course and the existing canal. It is expected that views of the fenced treatment wetlands from the Olympic Club would blend into foreground views of Lake Merced.

The treatment wetland cell and other canal improvements would be visible from John Muir Drive, which is part of San Francisco's 49-mile Scenic Drive. While the Canal Configuration Alternative could remove trees along John Muir Drive, the components that would be replacing the trees would be low in profile and would not block views. Also, as described above for in Section 3.2.5.1, Proposed Project, the Canal Configuration Alternative has the potential to aesthetically enhance the area. Thus, the impact on the aesthetic character of the site and its surroundings would be *less than significant.*

NEPA Analysis

As described above in the CEQA analysis, Canal Alignment Alternative visual resource impacts (construction activities, lighting, and permanent structures) would contribute to visual change in the landscape. The physical features of this alternative would not be substantially different from the proposed Project areas adjacent to Lake Merced and as described under the proposed Project, the changes would not appreciably alter important landscape characteristics, and views would change only slightly, so as not to negatively affect scenic quality. Thus, there would be a short-term, minor, adverse effect on scenic quality.

As described above, the tunnel and ocean outlet components would be the same as described in Section 3.2.5.1, Proposed Project, or Section 3.2.5.2, Tunnel Alignment Alternative, depending on the option selected. Under all alternatives, effects associated with the Fort Funston staging area would be short-term, minor, and adverse with implementation of Mitigation Measure 3.2-1.

3.2.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no impacts to aesthetic resources. Ongoing periodic maintenance activities would not be noticeable or intrude on the visual character and quality of the Project area. Future uncontrolled flood events could damage public facilities and private properties in the vicinity of Lake Merced, which could degrade the visual character and quality of the area. The visual character and quality of the Ocean Outlet structure site would not be improved because the structure would not be rehabilitated.

3.2.6 Cumulative Effects

3.2.6.1 Geographic Extent/Context

The geographic scope for cumulative aesthetics impacts includes all areas that would be located within the publicly accessible viewshed of the proposed Project. The cumulative project sites do not necessarily need to be visible simultaneously with the proposed Project from one fixed vantage point; however, for an impact to occur, the sites must be visible in the same general vicinity by a viewer.

3.2.6.2 Past, Present and Reasonably Foreseeable Projects

Existing conditions reflect the contributions of past projects on aesthetic resources. The following present and reasonably foreseeable projects may result in impacts to aesthetic resources and are included in the analysis of the Project's cumulative impacts. In addition to project-related construction impacts identified, construction activities would contribute incrementally to aesthetic impacts in the geographic extent of the cumulative scenario.

For example, as presented in Table 3.1-1, the following cumulative projects are existing or expected to occur within the same vicinity and timeframe as other planned and proposed projects.

- *Lake Merced Boathouse Renovations* (SFPUC, SFRPD) was completed in 2014. The first phase of the project included demolition and cleanup work, including removing asbestos and lead floor tiles. The second phase included a remodel the second floor of the boathouse to create space for a community room, exercise room, restrooms, SFRPD office space, and a concession area.

- *San Francisco Westside Recycled Water Project* (SFPUC) is anticipated to be under construction between 2016 and 2019. Construction of recycled water treatment facility to be located on a proposed site that combines land in the vicinity of the Oceanside Water Pollution Control Plant.

- *Groundwater Supply Project* (SFPUC) Construction began in fall 2014 and is expected to be complete in early 2016. The project proposes to install a new well near Lake Merced Pump Station. The well stations would include a building to house the well pump and electrical, testing, and treatment equipment.

- *Ocean Beach Master Plan* (SPUR) is a visioning document that presents recommendations for the management and protection of San Francisco's Ocean Beach, a 3.5-mile stretch of beach north of Fort Funston. Recommendations include rerouting the Great Highway behind the zoo via Sloat and Skyline Boulevards and restoring dunes through sand replenishment.

- *GGNRA/Muir Woods National Monument General Management Plan* (NPS) examines a range of alternatives for management of the GGNRA parks for 20 years. The plan was published in 2014 and approved in 2015. The GMP indicates that Fort Funston will be managed to continue to support current recreational activities (e.g., dog walking and hang gliding); provide new visitor facilities near the parking lot; fence and protect Battery Davis; form a continuous habitat corridor that supports recovery of native dune habitat; protect shorebirds, coastal bluffs, and bank swallows; and allow natural coastal and marine processes to occur.

- *Significant Natural Areas Management Plan* (SFRPD) provides recommendations for management of the fragments of unique plant and animal habitats within San Francisco and Pacifica known as Significant Natural Resource Areas that have been preserved within parks that are managed by the SFRPD. Among these is Lake Merced. The plan identifies several conservation- and recreation-related issues for Lake Merced and provides recommendations developed for each of these issues to guide restoration, enhancement, and maintenance work.

- *Parkmerced Project* (Private Developer) could extend through 2030. Parkmerced is a long-term mixed-use development program to redesign the existing Parkmerced site. The project would increase residential density, provide new commercial and retail services, modify transit facilities including rerouting the existing Muni Metro M Ocean View line from its current alignment along 19th Avenue, install renewable energy sources such as wind turbines and photovoltaic cells; and improve utilities and open space within the development site including new school, day care, and fitness facilities; new open space uses; an approximately 2-acre organic farm; and community gardens.

- *San Francisco State University (SFSU) Campus Master Plan 2007 – 2020* (SFSU) proposes physical changes and improvements to the campus to address increased enrollment. The plan is ongoing. Some existing buildings and facilities would be upgraded and expanded, while others would be demolished and replaced. Some new buildings and facilities would be constructed. In total, these proposed improvements would result in the net addition of approximately 972,400 square feet and approximately 660 dwelling units to the campus. A proposed 112,000-square-foot Recreation Wellness Center is planned for the former Sutro Library/Lot 25 site on Winston Drive. The facility would include a two-court gym, one-court multi- activity gym (for basketball, volleyball, badminton, soccer, and hockey), climbing wall, weight and fitness space, and elevated jogging track.

- *Fort Funston Site Improvements (NPS)* include constructing a restroom, constructing a maintenance facility, and other minor visitor enhancements. The environmental assessment is pending and expected in 2016. The project would also upgrade and expand site utilities and infrastructure including expanding the capacity of the on-site sewage treatment system, widening and straightening the entrance road, lengthening the turn lane from Highway 35 into the site, repaving and restriping the parking area, accessibility improvements, and an upgrade of picnic facilities.

- *Pacific Rod and Gun Club Upland Soil Remediation Project* (SFPUC) began construction in 2015. The project consists solely of construction activities: site preparation, survey and excavation layout, soil excavation and removal, confirmation sampling, waste disposal, backfilling, and site restoration. No new structures would be constructed as part of the project, and all existing buildings would remain. Before construction, smaller structures, such as target launching stands and towers, would be moved temporarily in coordination with the Club, whose activities would be suspended due to site closure during construction.

3.2.6.3 Construction

The construction areas of the cumulative projects listed in 3.2.6.2, Past, Current, and Reasonably Foreseeable Projects, would not be under construction at the same time as the proposed Project and within the same viewshed as the proposed Project. Thus, cumulative construction phase effects are not expected. Further, construction activities would not substantially affect the visual character or quality of project areas, or otherwise result in long-term scenic resources effects.

3.2.6.4 Operation and Maintenance

The proposed update to the SNRAMP generally seeks to maintain or eventually improve the visual character of the Lake Merced area, so it would is not likely to contribute adversely to a permanent cumulative aesthetic impact. The other projects are not within the same viewshed as project components. The Rod and Gun Club project would remove vegetation that currently screens views of that site. However, the area of disturbance that would be visible in the same general vicinity as the proposed project would be small. Thus, the projects would not combine to create a significant adverse visual environment as compared to existing conditions and, therefore, the cumulative aesthetic impact of these projects considered together would be less than significant under CEQA. The long-term visual effects of the rehabilitated Ocean Outlet structure are expected to be beneficial. None of the cumulative projects proposes changes that would be visible within the same portion of the beach as the proposed rehabilitated Ocean Outlet structure. The long-term effects on scenic resources at Fort Funston are not expected to combine with the effects of other projects to result in detectable long-term changes in the visual character and views of the site.

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3.3 Air Quality

This section addresses the air quality impacts that could result from Project implementation, including increases in criteria air pollutants. The analysis of emissions focuses on whether the Project would cause an exceedance of a California or national ambient air quality standard (AAQS). Impacts specific to greenhouse gases and climate change are evaluated in Section 3.7, Greenhouse Gas Emissions.

3.3.1 Affected Environment

3.3.1.1 Physical Setting

Climate and Meteorology

Air quality is affected by the rate, amount, and location of pollutant emissions and the meteorological conditions that influence pollutant movement and dispersal. Atmospheric conditions, including wind speed, wind direction, and air temperature, in combination with local surface topography (i.e., geographic features such as mountains, valleys, and San Francisco Bay), determine the effect of air pollutant emissions on local air quality.

The Project site is located in Daly City, San Francisco, and unincorporated San Mateo County. The site is within the boundaries of the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB encompasses all of Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, Marin, and Napa counties, and the southern portions of Solano and Sonoma counties. The climate of the SFBAAB is determined largely by a high-pressure system that is almost always present over the eastern Pacific Ocean off the West Coast of North America. During winter, the Pacific high-pressure system shifts southward, allowing more storms to pass through the region, clearing away ambient air pollution. During summer and early fall, when few storms pass through the region, emissions generated within the SFBAAB can combine with abundant sunshine under the restraining influences of topography and subsidence inversions[1] to create conditions that are conducive to the formation of photochemical pollutants,[2] such as ozone, and secondary particulates, such as nitrates and sulfates.

The Project site is within the Peninsula climatological subregion of the SFBAAB, with specific topographic and climatological conditions described in the CEQA Air Quality Guidelines published by the Bay Area Air Quality Management District (BAAQMD) (2012a). This climatological subregion extends from northwest of San Jose to the Golden Gate. The Santa Cruz Mountains run up the center of the peninsula, with elevations exceeding 2000 feet at the southern end, decreasing to 500 feet in South San Francisco. Coastal towns experience a high incidence of cool, foggy weather in the summer. Cities in the southeastern peninsula experience warmer

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1 An increase in temperature with height that develops aloft as a result of air gradually sinking over a wide area and being warmed by compression.

2 Air pollutants that are formed in the atmosphere under the presence of sunlight from precursor molecules that are directly emitted.

temperatures and fewer foggy days because the marine layer is blocked by the ridgeline to the west. San Francisco lies at the northern end of the peninsula. Because most of San Francisco's topography is below 200 feet, marine air is able to flow easily across most of the city, making its climate cool and windy.

The blocking effect of the Santa Cruz Mountains can be seen in the summertime maximum temperatures. For example, at Half Moon Bay and San Francisco, the maximum daily temperatures in June through August are 62 to 64 degrees Fahrenheit (F), while on the eastern side at Redwood City, the maximum temperatures are in the low 80s for the same period. Daily maximum temperatures throughout the peninsula during the winter months are in the high 50s. Large temperature gradients are not seen in the minimum temperatures. Average minimum temperatures at Half Moon Bay are about 43 degrees F in winter and 50 to 52 degrees F in summer. The east peninsula, represented by Redwood City, reports winter minimum temperatures of 40 degrees F, and summer minimum temperatures of 52 to 54 degrees F.

Annual average wind speeds range from 5 to 10 miles per hour (mph) throughout the peninsula. The tendency is for the higher wind speeds to be found along the western coast. However, winds on the east side of the peninsula can also be high in certain areas because low-lying areas in the mountain range, at San Bruno Gap and Crystal Springs Gap, commonly allow the marine layer to pass across the peninsula.

The prevailing winds are westerly along the peninsula’s west coast. Individual sites can show significant differences, however. For example, Fort Funston shows a southwest wind pattern, while Pillar Point in San Mateo County to the south shows a northwest wind pattern. Sites on the east side of the mountains also show a westerly pattern, although their wind patterns show influence by local topographic features. That is, a few hundred feet rise in elevation will induce flow around that feature instead of over it during stable atmospheric conditions. This can change the wind pattern by as much as 90 degrees over short distances. On mornings without a strong pressure gradient, areas on the east side of the peninsula often experience eastern flow in the surface layer, induced by upslope flow on the east-facing slopes and by the bay breeze. The bay breeze is rarely seen after noon because the stronger sea breeze dominates the flow pattern.

3.3.1.2 Existing Air Quality

Criteria Air Pollutants

As required by the federal Clean Air Act (CAA) passed in 1970, the USEPA has identified six criteria air pollutants that are pervasive in urban environments, and for which health-based AAQSs have been established (in California, CAAQS, and nationally, NAAQS). The USEPA calls these pollutants “criteria air pollutants” because the agency has regulated them by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. Ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, and lead are the six criteria air pollutants. Notably, particulate matter is measured in two size ranges: PM10 for particles less than 10 microns in diameter, and PM2.5 for particles less than 2.5 microns in diameter.

The BAAQMD and the California Air Resources Board (CARB) operate a regional air quality monitoring network that measures the ambient concentrations of the six criteria air pollutants. Data from these stations record existing air pollutant levels. Probable future levels of air quality in the Project area can generally be inferred from ambient air quality measurements conducted at the nearest monitoring stations by examining trends over time. The closest monitoring station is in San Francisco on Arkansas Street. **Table 3.3-1** shows a 5-year (2009 through 2013) summary of monitoring data for ozone, CO, PM10, and PM2.5 recorded at the San Francisco station.

TABLE 3.3-1
SUMMARY OF AIR QUALITY MONITORING DATA (2009-2013), SAN FRANCISCO – ARKANSAS STREET STATION

Pollutant	Applicable AAQS	2009	2010	2011	2012	2013
Ozone						
Days 1-hour CAAQS Exceeded	>0.09 ppm[a]	0	0	0	0	0
Max. 1-hour Concentration (ppm)		0.072	0.079	0.70	0.069	0.069
Days 8-hour NAAQS Exceeded	>0.075 ppm[b]	0	0	0	0	0
Days 8-hour CAAQS Exceeded	>0.07 ppm[a]	0	0	0	0	0
Max. 8-hour Concentration (ppm)		0.057	0.051	0.054	0.049	0.059
Carbon Monoxide (CO)						
Days 8-hour CAAQS Exceeded	>9.0 ppm[a]	0	0	0	0	0
Days 8-hour NAAQS Exceeded	>9.0 ppm	0	0	0	0	0
Max. 8-hour Concentration (ppm)		2.86	1.37	1.20	1.19	1.4
Suspended Particulates (PM10)						
Measured Days Over 24-hour NAAQS[c]	>150 µg/m^3[b]	0	0	0	0	0
Measured Days Over 24-hour CAAQS[c]	>50 µg/m^3[a]	0	0	0	1	0
Max. 24-hour Concentration (µg/m^3)		36.0	39.7	45.6	**50.6**	44.3
Annual Average (µg/m^3)	>20 µg/m^3[a]	18.6	19.9	19.5	17.5	9.7
Suspended Particulates (PM2.5)						
Measured Days Over 24-hour NAAQS[c]	>35 µg/m^3[b]	1	3	2	1	2
Max. 24-hour Concentration (µg/m^3)		**35.5**	**45.3**	**47.5**	**35.7**	**48.5**
Annual Average (µg/m^3)	>12 µg/m^3[a]	9.7	10.6	9.5	8.2	10.1

NOTES:
Bold values are in excess of applicable standard.
ppm = parts per million
µg/m3 = micrograms per cubic meter

a CAAQS.
b NAAQS.
c PM10 and PM2.5 are sampled every sixth day; therefore, actual days over the standard can be estimated to be six times the numbers listed in the table.

SOURCE: CARB, 2014

While the data gathered at these monitoring stations may not necessarily reflect the unique meteorological environment of the Project site nor the proximity of site-specific stationary and street sources, they do present the nearest available benchmark and provide a reference point for the pollutants of greatest concern in the region and the degree to which the area is out of attainment with specific air quality standards.

Ozone

Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG, also sometimes referred to as volatile organic compounds or VOC by some regulating agencies) and nitrogen oxides (NOx). The main sources of ROG and NOx, often referred to as ozone precursors, are combustion processes (including motor vehicle engines) and the evaporation of solvents, paints, and fuels. In the Bay Area, automobiles are the single largest source of ozone precursors. Ozone is referred to as a regional air pollutant because its precursors are transported and diffused by wind concurrently with ozone production through the photochemical reaction process. Ozone causes eye irritation, airway constriction, and shortness of breath and can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema. Table 3.3-1 shows that, according to published data from the San Francisco – Arkansas Station, the 1-hour CAAQS of 0.09 ppm for ozone was not exceeded between 2009 and 2013.

Carbon Monoxide

CO is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The single largest source of CO is motor vehicles; the highest emissions occur during low travel speeds, stop-and-go driving, cold starts, and hard acceleration. Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and can cause headaches, nausea, dizziness, and fatigue; impair central nervous system function; and induce angina (chest pain) in persons with serious heart disease. Very high levels of CO can be fatal. As shown in Table 3.3-1, the 8-hour CO CAAQS and NAAQS were not exceeded between 2009 and 2013.

Particulate Matter (PM10 and PM2.5)

PM10 and PM2.5 are also termed respirable particulate matter and fine particulate matter, respectively, and are a class of air pollutants that consists of heterogeneous solid and liquid airborne particles from manmade and natural sources. In the Bay Area, motor vehicles generate about one-half of the air basin's particulates, through tailpipe emissions as well as brake pad and tire wear. Wood burning in fireplaces and stoves, industrial facilities, and ground-disturbing activities such as construction are other sources of such particulates. These particulates are small enough to be inhaled into the deepest parts of the human lung and can cause adverse health effects. Among the criteria pollutants that are regulated, particulates represent a serious ongoing health hazard. As long ago as 1999, BAAQMD was reporting in its CEQA Guidelines that studies had shown that elevated particulate levels contribute to the death of approximately 200 to 500 people per year in the Bay Area (BAAQMD, 2012a). Compelling evidence suggests that PM2.5 is by far the most harmful air pollutant in the Bay Area Air in terms of the associated impact on public health. A large body of scientific evidence indicates that both long-term and short-term exposure to PM2.5 can cause a wide range of health effects (e.g., aggravating asthma and bronchitis, causing visits to the hospital for respiratory and cardiovascular symptoms, and contributing to heart attacks and deaths) (BAAQMD, 2012a).

Table 3.3-1 shows that an exceedance of the state PM10 standard occurred on one monitored occasion between 2009 and 2013 in San Francisco. It is estimated that the state 24-hour PM10 standard of 50 micrograms per cubic meter ($\mu g/m^3$) was exceeded on up to 6 days per year between 2009 and 2013.[3] The BAAQMD began monitoring PM2.5 concentrations in San Francisco in 2002. The federal 24-hour PM2.5 standard was not exceeded until 2006, when the standard was lowered from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. The federal 24-hour PM2.5 standard was exceeded on up to 9 days per year between 2009 and 2013. The state annual average standard was not exceeded between 2009 and 2013.

Nitrogen Dioxide (NO_2)

NO_2 is a reddish brown gas that is a byproduct of combustion processes. Automobiles and industrial operations are the main sources of NO_2. Aside from its contribution to ozone formation, NO_2 can increase the risk of acute and chronic respiratory disease and reduce visibility. NO_2 may be visible as a coloring component on high pollution days, especially in conjunction with high ozone levels. No NO_2 monitoring was conducted in the Project vicinity. However, the entire SFBAAB, including the Project area, is in attainment for the state and federal NO_2 standards.

The USEPA has also established requirements for a new monitoring network to measure NO_2 concentrations near major roadways in urban areas with a population of 500,000 or more. Sixteen new near-roadway monitoring sites are required in California, three of which will be in the Bay Area. These monitors are planned for Berkeley, Oakland, and San Jose. The Oakland station commenced operation in February 2014 while the other two are not yet operational but will be by January 2015. The new monitoring data may result in a need to change area designations in the future. The CARB will revise the area designation recommendations, as appropriate, once the new monitoring data become available.

Sulfur Dioxide (SO_2)

SO_2 is a colorless acidic gas with a strong odor. It is produced by the combustion of sulfur-containing fuels such as oil, coal, and diesel. SO_2 has the potential to damage materials and can cause health effects at high concentrations. It can irritate lung tissue and increase the risk of acute and chronic respiratory disease (BAAQMD, 2012a). No SO_2 monitoring was conducted in the Project vicinity. However, the entire SFBAAB, including the Project area, is in attainment for the state and federal SO_2 standards.

In 2010, the USEPA implemented a new 1-hour SO_2 standard presented in **Table 3.3-2**. The USEPA has initially designated the SFBAAB as an attainment area for SO_2. Similar to the new federal standard for NO_2, the USEPA has established requirements for a new monitoring network to measure SO_2 concentrations to be operational by January 2013 (USEPA, 2010a). No additional SO_2 monitors are required for the Bay Area because BAAQMD jurisdiction has never been designated as non-attainment for SO_2 and no SIP or maintenance plans have been prepared for SO_2 (BAAQMD, 2013).

[3] PM10 and PM2.5 are sampled every sixth day; therefore, actual days over the standard can be estimated to be six times the numbers listed in the table.

TABLE 3.3-2
STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS AND ATTAINMENT STATUS

Pollutant	Averaging Time	CAAQS[a] Standard	CAAQS[a] Attainment Status	NAAQS[b] Standard	NAAQS[b] Attainment Status
Ozone	1 hour	0.09 ppm	N	NA	NA[c]
	8 hour	0.07 ppm	N[d]	0.075 ppm	N/Marginal
Carbon Monoxide (CO)	1 hour	20 ppm	A	35 ppm	A
	8 hour	9 ppm	A	9 ppm	A/M
Nitrogen Dioxide (NO_2)	1 hour	0.18 ppm	A	0.100 ppm	U
	Annual	0.030 ppm	NA	0.053 ppm	A
Sulfur Dioxide (SO_2)	1 hour	0.25 ppm	A	0.075 ppm	A
	24 hour	0.04 ppm	A	0.14 ppm	A
	Annual	NA	NA	0.03 ppm	A
Particulate Matter (PM10)	24 hour	50 µg/m^3	N	150 µg/m^3	U
	Annual	20 µg/m^3	N[f]	NA	NA
Fine Particulate Matter (PM2.5)	24 hour	NA	NA	35 µg/m^3	N[g]
	Annual	12 µg/m^3	N[f]	15 µg/m^3	A
Sulfates	24 hour	25 µg/m^3	A	NA	NA
Lead	30 day	1.5 µg/m^3	A	NA	NA
	Cal. Quarter	NA	NA	1.5 µg/m^3	A
Hydrogen Sulfide	1 hour	0.03 ppm	U	NA	NA
Visibility-Reducing Particles	8 hour	See Note h	U	NA	NA

NOTES:
A = Attainment; N = Nonattainment; U = Unclassified; M = Maintenance; NA = Not Applicable, no applicable standard; ppm = parts per million; µg/m^3 = micrograms per cubic meter.

[a] CAAQSs = state ambient air quality standards (California). CAAQSs for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, particulate matter, and visibility-reducing particles are values that are not to be exceeded. All other state standards shown are values not to be equaled or exceeded.
[b] NAAQSs = national ambient air quality standards. NAAQSs, other than ozone and particulates, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The 8-hour ozone standard is attained when the three-year average of the fourth highest daily concentration is 0.08 ppm or less. The 24-hour PM10 standard is attained when the three-year average of the 99th percentile of monitored concentrations is less than the standard. The 24-hour PM2.5 standard is attained when the three-year average of the 98th percentile is less than the standard.
[c] The USEPA revoked the national 1-hour ozone standard on June 15, 2005.
[d] This 8-hour ozone CAAQS was approved in April 2005 and became effective in May 2006.
[e] State standard = annual geometric mean; national standard = annual arithmetic mean.
[f] In June 2002, The California Air Resources Board (CARB) established new annual standards for PM2.5 and PM10.
[g] On January 9, 2013, EPA issued a final rule to determine that the Bay Area attains the 24-hour PM2.5 national standard. This EPA rule suspends key SIP requirements as long as monitoring data continues to show that the Bay Area attains the standard. Despite this EPA action, the Bay Area will continue to be designated as “non-attainment” for the national 24-hour PM2.5 standard until such time as the Air District submits a “redesignation request” and a “maintenance plan” to EPA, and EPA approves the proposed redesignation.
[h] Statewide visibility reducing particle standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

SOURCE: BAAQMD, 2013; USEPA, 2012

Lead

Leaded gasoline (phased out in the United States beginning in 1973), lead-based paint (on older houses and cars), smelters (metal refineries), and manufacture of lead storage batteries have been the primary sources of lead released into the atmosphere. Lead has a range of adverse neurotoxic health effects, which puts children at special risk. Some lead-containing chemicals cause cancer in animals. Lead levels in the air have decreased substantially since leaded gasoline was eliminated. Ambient lead concentrations are only monitored on an as-warranted, site-specific basis in California. On October 15, 2008, the USEPA strengthened the national ambient air quality standard for lead by lowering it from 1.5 μg/m^3 to 0.15 μg/m^3. The USEPA revised the monitoring requirements for lead in December 2010. These requirements focus on airports and large urban areas and resulted in an increase in 76 monitors nationally (USEPA, 2010b).

Toxic Air Contaminants

Toxic air contaminants (TACs) are air pollutants that may lead to serious illness or increased mortality, even when present in relatively low concentrations. Federal laws use the term "Hazardous Air Pollutants" (HAPs) to refer to the same types of compounds that are referred to as TACs under California law. Potential human health effects of TACs include birth defects, neurological damage, cancer, and death. There are hundreds of different types of TACs with varying degrees of toxicity. Individual TACs vary greatly in the health risk they present. At a given level of exposure, one TAC may pose a hazard that is many times greater than another.

No AAQSs have been promulgated for TACs. The BAAQMD regulates them using a risk-based approach. This approach uses a health risk assessment to determine what sources and pollutants to control as well as the degree of control. A health risk assessment is an analysis in which human health exposure to toxic substances is estimated and considered together with information regarding the toxic potency of the substances, to provide quantitative estimates of health risks.[4]

In addition to monitoring criteria pollutants, both BAAQMD and the CARB operate TAC monitoring networks in the Bay Area. Regionally, ambient concentrations of TACs are similar throughout the urbanized areas of the SFBAAB. The BAAQMD provides two public source inventories of TAC emissions sources within its jurisdiction. The first is its TAC Annual Report, the latest of which was published in 2009. The most recent source is BAAQMD's May 2012 Google Earth-based inventory of stationary source risks and hazards. This source indicates no permitted TAC sources within the Project site or within 1,000 feet of the Project site. The closest TAC source is a generator located at 991 Lake Merced Boulevard, approximately 1,950 feet northeast of the Project site.

Diesel Particulate Matter

The CARB identified diesel particulate matter (DPM) as a toxic air contaminant in 1998, primarily based on evidence demonstrating cancer effects in humans. The exhaust from diesel engines includes hundreds of different gaseous and particulate components, many of which are toxic. Mobile sources such as trucks and buses are among the primary sources of diesel emissions, and concentrations of DPM are higher near heavily traveled highways and rail lines with diesel locomotive operations. The estimated lifetime cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other toxic air pollutant routinely measured in the region. The risk from diesel particulate matter as determined by the CARB declined from 750 in one

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4 In general, a health risk assessment is required if BAAQMD concludes that projected emissions of a specific air toxic compound from a proposed new or modified source suggest a potential public health risk, then the applicant is subject to a health risk assessment for the source in question. Such an assessment generally evaluates chronic, long-term effects, calculating the increased risk of cancer as a result of exposure to one or more TACs.

million in 1990 to 570 in one million in 1995; by 2000, the CARB estimated the average statewide cancer risk from DPM at 540 in one million (CARB, 2009). This calculated cancer risk values from ambient air exposure in the Bay Area can be compared against the lifetime probability of being diagnosed with cancer in the United States, from all causes, which is more than 40 percent (based on a sampling of 17 regions nationwide), or greater than 400,000 in one million, according to the National Cancer Institute (2012).

Existing Sources of TACs in the Project Vicinity

In an effort to identify areas of San Francisco most adversely affected by sources of TACs, San Francisco partnered with the BAAQMD to inventory and assess air pollution and exposures from mobile, stationary, and area sources within San Francisco. Areas with poor air quality, termed "Air Pollution Exposure Zones," were identified based on two health-protective criteria: (1) excess cancer risk from the contribution of emissions from all modeled sources greater than 100 per 1 million population, and/or (2) cumulative PM2.5 concentrations greater than 10 $\mu g/m^3$. Land use projects within the Air Pollutant Exposure Zones require special consideration to determine whether the project's activities would expose sensitive receptors to substantial air pollutant concentrations or add emissions to areas already adversely affected by poor air quality.

Within Air Pollutant Exposure Zones, additional construction activity may adversely affect populations that are already at a higher risk for adverse long-term health risks from existing sources of air pollution. The proposed project facilities are located outside of localized Air Pollutant Exposure Zones mapped by the San Francisco Planning Department (SFPD, 2014).

A small portion of the proposed Project facilities are located within Daly City. A review of BAAQMD's May 2012 Google Earth-based inventory of stationary source risks and hazards indicates that there are no permitted TAC sources within 1,000 feet of Project facilities in Daly City.

3.3.1.3 Odor Emissions

As described by the BAAQMD in its revised *CEQA Air Quality Guidelines* (BAAQMD, 2012a), odors are generally regarded as an annoyance rather than a health hazard. Manifestations of a person's reaction to odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting and headache). The ability to detect odors varies considerably among the population and overall is quite subjective. People may have different reactions to the same odor. An odor that is offensive to one person may be perfectly acceptable to another (e.g., coffee roaster). An unfamiliar odor is more easily detected and is more likely to cause complaints than a familiar one. Known as odor fatigue, a person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity. The occurrence and severity of odor impacts depend on the nature, frequency, and intensity of the source; wind speed and direction; and the sensitivity of receptors. Odor impacts should be considered for any proposed new odor sources located near existing receptors, as well as any new sensitive receptors located near existing odor sources. Generally, increasing the distance between the receptor and the odor source will mitigate odor impacts.

3.3.1.4 Sensitive Receptors

Air quality does not affect every individual in the population in the same way, and some groups are more sensitive to adverse health effects than others. Population subgroups sensitive to the health effects of air pollutants include the elderly and the young, those with higher rates of respiratory disease such as asthma and chronic obstructive pulmonary disease, and with other environmental or occupational health exposures (e.g., indoor air quality) that affect cardiovascular or respiratory diseases. Land uses such as schools, children's day care centers, hospitals, and nursing and convalescent homes are considered to be more sensitive than the general public to poor air quality because the population groups associated with these uses have increased susceptibility to respiratory distress. Parks and playgrounds are considered moderately sensitive to poor air quality because persons engaged in strenuous work or exercise also have increased sensitivity to poor air quality; however, exposure times are generally far shorter in parks and playgrounds than in residential locations and schools, which typically reduces overall exposure to pollutants. Residential areas are considered more sensitive to air quality conditions compared to commercial and industrial areas because people generally spend longer periods of time at their residences, with associated greater exposure to ambient air quality conditions.[5]

BAAQMD defines sensitive receptors as children, adults, and seniors occupying or residing in residential dwellings, schools, colleges and universities, daycares, hospitals, and senior-care facilities. Workers are not considered sensitive receptors because all employers must follow regulations set forth by the Occupation Safety and Health Administration (OSHA) to ensure the health and well-being of their employees (BAAQMD, 2012b).

There are sensitive land uses surrounding the Project, including residences and several schools. The nearest existing residences are located near the Tunnel's Lake Merced (eastern) Portal, on the south side of John Muir Drive approximately 350 feet from the Lake Merced Portal, as well as just east and southeast of the Project area across Lake Merced Boulevard, approximately 200 feet from the collection box. The nearest school is Westlake Elementary School, located approximately 2,000 feet southeast of the collection box. The work area at Avalon Canyon access road is greater than 1,000 feet from the nearest residences, but a church providing day care services is located within approximately 850 feet.

5 The factors responsible for variation in exposure are also often similar to factors associated with greater susceptibility to air quality health effects. For example, poorer residents may be more likely to live in crowded substandard housing and be more likely to live near industrial or roadway sources of air pollution.

3.3.2 Regulatory Setting

3.3.2.1 Federal

Criteria Pollutants

The 1970 CAA (last amended in 1990) required that regional planning and air pollution control agencies prepare a regional air quality plan to outline the measures by which both stationary and mobile sources of pollutants will be controlled in order to achieve all standards by the deadlines specified in the CAA.

The current attainment status for the SFBAAB, with respect to federal standards, is summarized in Table 3.3-2. In general, the SFBAAB experiences low concentrations of most pollutants when compared to federal standards, except for ozone and particulate matter, for which standards are exceeded periodically.

The USEPA lowered the national 8-hour ozone standard from 0.080 to 0.075 parts per million (ppm) effective May 27, 2008. In April 2012, the USEPA designated the SFBAAB as a marginal nonattainment area[6] for the 2008 0.75 ppm ozone standard (USEPA, 2012). In addition, the USEPA lowered the 24-hour PM2.5 standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ in 2006. On January 9, 2013, the USEPA issued a final rule to determine that the Bay Area attains the 24-hour PM2.5 national standard. This USEPA rule suspends key SIP requirements as long as monitoring data continues to show that the Bay Area attains the standard. Despite this USEPA action, the Bay Area will continue to be designated as “non-attainment” for the national 24-hour PM2.5 standard until such time as the Air District submits a “redesignation request” and a “maintenance plan” to USEPA, and USEPA approves the proposed redesignation. Although the AAQS for CO has not been exceeded in the SFBAAB for over 20 years, the SFBAAB is designated as a “maintenance” area with respect to the federal CO standard and the SIP for maintaining CO levels below the standard is still active until such time that USEPA changes the designation.

The SFBAAB is designated “attainment” or “unclassified” for the other federal criteria pollutants. “Unclassified” is defined by the CAA Amendments as any area that cannot be classified, on the basis of available information, as meeting or not meeting the national primary or secondary AAQS for the pollutant.

Section 176(c) of the CAA, also known as the General Conformity Rule, requires federal agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the CAA and SIPs (40 CFR 51.851 and 40 CFR Part 93). The General Conformity Rule requires federal agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the air quality plans established in the applicable state implementation plans for these pollutants. Implementation of the General Conformity Regulations fall into three phases: applicability analysis, conformity determination, and review process. The regulations

6 “Marginal nonattainment area” means an area designated marginal nonattainment for the one (1) hour national ambient air quality standard for ozone.

recognize that the vast majority of federal actions do not result in a significant increase in emissions and, therefore, include a number of exemptions, the most predominantly implemented of which is the *de minimis* emission levels based on the type and severity of the nonattainment problem. If the action will cause emissions above the *de miminis* in any nonattainment or maintenance area and the action is not otherwise exempt, "presumed to conform," or included in the existing emissions budget of the SIP, the agency must conduct a conformity determination before it takes the action. The General Conformity Rule applicability thresholds[7] for the SFBAAB are presented below in **Table 3.3-3**.

TABLE 3.3-3
GENERAL CONFORMITY RULE DE MINIMIS THRESHOLDS FOR THE SAN FRANCISCO BAY AREA AIR BASIN

Pollutant	Applicability Threshold
VOC or ROG (ozone precursor)	100 tons per year
NOx (ozone precursor)	100 tons per year
PM2.5	100 tons per year
Carbon Monoxide	100 tons per year

SOURCE: USEPA Title 40 CFR, Part 93, 1993

Hazardous Air Pollutants

The 1977 CAA Amendments required the USEPA to identify National Emission Standards for Hazardous Air Pollutants (NESHAPs) to protect public health and welfare. These substances include certain volatile organic chemicals, pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. Under the 1990 CAA Amendments, 189 substances are regulated as HAPs.

3.3.2.2 State

Criteria Pollutants

Although the CAA established NAAQSs, individual states retain the option to adopt more stringent standards and to include other pollution sources. California had already established its own air quality standards when federal standards were established, and because of the unique meteorology in California, there is considerable diversity between the CAAQSs and NAAQSs, as shown in Table 3.3-2. CAAQSs tend to be at least as protective as NAAQSs and are often more stringent.

In 1988, California passed the California Clean Air Act (CCAA) (California Health and Safety Code §39600 et seq.), which, like its federal counterpart, called for the designation of areas as attainment or nonattainment, but based on CAAQSs rather than NAAQSs. As indicated in

7 Applicability thresholds are federally defined pollutant emission rates specific to a given air basin's attainment status that, if exceeded, would require a detailed General Conformity Assessment to determine if the proposed action would be consistent with the State Implementation Plan and the federal CAA.

Table 3.3-2, the SFBAAB is designated as "nonattainment" for state ozone, PM10, and PM2.5 standards. The SFBAAB is designated as "attainment" or "unclassified" for all other pollutants listed in the table.

The CCAA requires each air district in which CAAQSs are exceeded to prepare a plan that documents reasonable progress towards attainment. A 3-year update is required. In the Bay Area, this planning process is incorporated into its Clean Air Plan (CAP).

Toxic Air Contaminants

The California Health and Safety Code (§39655) defines TACs as air pollutants that may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. The State Air Toxics Program was established in 1983 under Assembly Bill (AB) 1807 (Tanner). A total of 243 substances have been designated TACs under California law; they include the 189 federal HAPs adopted in accordance with AB 2728. The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not regulate air toxics emissions. TAC emissions from individual facilities are quantified and prioritized. "High-priority" facilities are required to perform a health risk assessment and, if specific thresholds are violated, are required to communicate the results to the public in the form of notices and public meetings.

In 2000, the CARB approved a comprehensive Diesel Risk Reduction Plan to reduce diesel emissions (i.e., DPM) from both new and existing diesel-fueled vehicles and engines. The regulation is anticipated to result in an 80 percent decrease in statewide diesel health risk in 2020 as compared with the diesel risk in 2000. Additional regulations apply to new trucks and diesel fuel. Subsequent regulations of diesel emissions by the CARB include the On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation, the On-Road Heavy Duty (New) Vehicle Program, the In-Use Offroad Diesel Vehicle Regulation, and the New Offroad Compression Ignition Diesel Engines and Equipment Program. All of these regulations and programs have timetables by which manufacturers must comply and existing operators must upgrade their diesel powered equipment.

3.3.2.3 Regional and Local

BAAQMD

BAAQMD is the regional agency responsible for air quality regulation within the SFBAAB. BAAQMD regulates air quality through its planning and review activities. BAAQMD has permit authority over most types of stationary emission sources and can require stationary sources to obtain permits, and can impose emission limits, set fuel or material specifications, or establish operational limits to reduce air emissions. BAAQMD regulates new or expanding stationary sources of toxic air contaminants.

For state air quality planning purposes, the Bay Area is classified as a serious non-attainment area for ozone. The "serious" classification triggers various plan submittal requirements and transportation performance standards. One such requirement is that the Bay Area update the CAP every three years to reflect progress in meeting the air quality standards and to incorporate new information regarding the feasibility of control measures and new emission inventory data. The Bay Area's record of progress in implementing previous measures must also be reviewed. On September 15, 2010, BAAQMD adopted the most recent revision to the CAP (BAAQMD, 2010). The three primary goals of the 2010 CAP are to:

- Attain air quality standards;
- Reduce population exposure and protect public health in the Bay Area; and
- Reduce greenhouse gas emissions and protect the climate.

In furtherance of these goals, the 2010 CAP is designed to update the Bay Area 2005 Ozone Strategy in accordance with the requirements of the CCAA to implement "all feasible measures" to reduce ozone; consider the impacts of ozone control measures on PM10 and PM2.5, TACs, and GHGs in a single integrated plan; review progress in improving air quality in recent years; and establish emission control measures adopted or implemented in the 2009-2012 timeframe. An update to the 2010 CAP has been initiated by BAAQMD and is under development.

The 2010 CAP control strategy includes revised, updated, and new measures in the three traditional control measure categories, including stationary source measures, mobile source measures, and transportation control measures. In addition, the 2010 CAP identifies two new categories of control measures, including land use and local impact measures, and energy and climate measures (BAAQMD, 2010).

City of Daly City

Daly City General Plan

The Daly City General Plan was adopted in March 2013 and includes several policies aimed at protecting air resources that are relevant to the Project:

> ***Policy RME-5*: **Assess projected air emissions from new development and associated construction and demolition activities in conformance with the Bay Area Air Quality Management District (BAAQMD) CEQA Guidelines, and relative to state and federal standards.
>
> ***Policy RME-6*: **Minimize exposure of residents to objectionable smoke and odors by proactively regulating potential sources.

Daly City Grading Permit Requirements

Daly City requires that a grading permit be issued for grading activities within the city. Conditions of the permit include requiring dust control by watering or other methods, suspension of grading activities if nuisance dust emissions are reported, and submission to the city of a dust nuisance control plan for review and approval. Dust and grading material deposited on city streets, sidewalks, walkways are required to be removed by sweeping at the end of daily operations and must be controlled too prevent deposition to drainage ways. (Daly City, 2010).

San Francisco

San Francisco General Plan

The San Francisco General Plan Air Quality Element includes objectives that are designed to reduce the impact of air pollution on the environment and are relevant to the Project (CCSF, 1996):

> ***Objective 1*:** Adhere to state and federal air quality standards and regional programs.
>
> ***Objective 4*:** Minimize particulate matter emissions from road and construction sites.

San Francisco Construction Dust Control Ordinance

The San Francisco Health Code Article 22B and San Francisco Building Code Section 106.A.3.2.6 collectively constitute the Construction Dust Control Ordinance (adopted in July 2008). The ordinance requires that all site preparation work, demolition, or other construction activities within San Francisco that have the potential to create dust or to expose or disturb more than 10 cubic yards or 500 square feet of soil comply with specified dust control measures whether or not the activity requires a permit from the Department of Building Inspection (DBI). For projects larger than 0.5 acre that are located within 1,000 feet of a sensitive receptor, the Dust Control Ordinance requires that the project sponsor submit a Dust Control Plan for approval by the San Francisco Department of Public Health (DPH) prior to construction.

The Construction Dust Control Ordinance requires project sponsors and contractors responsible for construction activities to control construction dust on the site or implement other practices that result in equivalent dust control that are acceptable to the Director of Public Health.

Dust suppression activities may include watering of all active construction areas sufficiently to prevent dust from becoming airborne; increased watering frequency may be necessary whenever wind speeds exceed 15 miles per hour. Reclaimed water must be used if required by Article 21, Section 1100 et seq. of the San Francisco Public Works Code. The Project would disturb greater than 0.5 acre and would be located within 1,000 feet of a sensitive receptor; therefore, it is assumed that the Project sponsor (Daly City) would be required to prepare a Dust Control Plan.

3.3.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.3.3.1 CEQA Significance Criteria

Based on CEQA Guidelines Appendix G, Section III, a project would have a significant impact on air quality if it would:

a) Conflict with or obstruct implementation of the applicable air quality plan;

b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation;

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);

d) Expose sensitive receptors to substantial pollutant concentrations; or

e) Create objectionable odors affecting a substantial number of people.

3.3.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook, the Project and alternatives are evaluated to determine whether they would have adverse impacts to air quality (NPS, 2001). From a federal perspective, a project would have a major adverse impact on air quality if the actions taken by a federal agency in a nonattainment or maintenance area were inconsistent with the CAA and SIPs or would otherwise cause or contribute to an existing violation of the NAAQS. Pursuant to the CAA Amendments, this could occur if a project in the SFBAAB were to exceed 100 tons per year of any criteria pollutant or precursor for which the SFBAAB is designated as either non-attainment or maintenance of the NAAQS: ROG, NOx, CO, or PM2.5.

Minor and moderate adverse impacts on air quality are based on thresholds developed for consideration by BAAQMD in its 2009 *Air Quality Thresholds Justification Report*. These lesser thresholds were developed by BAAQMD based upon the trigger levels for the federal New Source Review Program and BAAQMD's Regulation 2, Rule 2 for new or modified sources. These levels, 54 pounds per day of ROG, NOx, or PM2.5 from exhaust emissions and 82 pounds per day of PM10 from exhaust emissions, represent a cumulatively considerable contribution. The table below presents a description for each level of impact with respect to NEPA.

Impact Intensity	Impact Description
Negligible:	Alternative would not result in the generation of diesel emissions, and would not otherwise contribute detectable levels of ROG, NOx, PM2.5, or PM10 emissions.
Minor:	Alternative would result in average construction exhaust emissions of less than 54 pounds per day of ROG, NOx, or PM2.5 and less than 82 pounds per day of PM10.
Moderate:	Alternative would result in average construction exhaust emissions of more than 54 pounds per day of ROG, NOx, or PM2.5 or more than 82 pounds per day of PM10, but would not exceed the USEPA's CAA General Conformity de minimis threshold of 100 tons per year for any criteria air pollutant or precursor.
Major:	Alternative would result in annual construction emissions that exceed the USEPA's CAA General Conformity de minimis threshold of 100 tons per year for any criteria air pollutant.

3.3.3.3 Criteria and Thresholds with No Impact or Not Applicable

Because of the nature of the Project and its physical setting, the Project and alternatives would not result in impacts related to the following significance criteria; these criteria are not discussed in the impact analysis for the following reasons:

a) ***Conflict with or obstruct implementation of the applicable air quality plan.*** The applicable air quality plan for the Project area is the 2010 CAP. BAAQMD recommends when considering whether to approve a project where an air quality plan consistency determination is required, the lead agency analyze the project with respect to the following questions: 1) does the project support the primary goals of the air quality plan; 2) does the project include applicable control measures from the air quality plan; and 3) does the project disrupt or hinder implementation of any 2010 CAP control measures? If the project does each of these things, BAAQMD considers the project consistent with air quality plans prepared for the Bay Area (BAAQMD, 2012a). Any project that would not support the 2010 CAP goals would be considered inconsistent with the 2010 CAP. If approval of the project would not result in significant and unavoidable air quality impacts after the application of mitigation, then the project would be considered consistent with the 2010 CAP.

As presented in Section 3.3.5.1, the Project would result in minimal new long-term operational emissions. Operation of motorized pumps to convey water to treatment wetlands would be electrically powered and would have no direct pollutant emissions. Approximately twice a year a vacuum truck would remove debris from the gross solids screening device and transport the debris to Ox Mountain Landfill which would result in negligible operational emissions. The Canal Configuration Alternative would have approximately the same operational emissions, and no operational emissions above existing conditions are associated with the Tunnel portion of the Project or with the Tunnel Alignment Alternative. Given the limited emissions associated with Project operations (i.e., well below significance thresholds), the Project's and alternatives' operational emissions would be consistent with the 2010 CAP (the most recently adopted regional air quality plan). Thus, the Project and alternatives would not conflict with or obstruct implementation of the applicable air quality plan, and no impacts would occur. Therefore, this issue is not addressed further in this EIR/EIS.

3.3.4 Methodology and Assumptions

This air quality impact analysis considers short-term construction impacts associated with the Project. Construction-related emissions were estimated using emission factors for ROG, NOx, CO, PM10, and PM2.5 from CARB's Offroad2011 Emissions Inventory. As noted in Section 3.3.2.3, Regional and Local Regulations, the Construction Dust Control Ordinance requires that Daly City designate an individual to monitor compliance with dust control requirements. This analysis assumes compliance with the ordinance.

During Project construction, direct emissions of criteria air pollutants and precursor emissions would be generated by construction equipment, trucks, worker vehicles, and ground-disturbing activities. In addition, diesel-operated equipment and vehicles would result in emissions of DPM, a known TAC.

The construction equipment inventory and use assumptions that were applied to estimate construction emissions were developed based on the assumed weekly construction schedule for the Project combined with equipment types and duration of use information provided by Daly City. For purposes of analysis, the Project is divided into three components: the Canal, Tunnel and Ocean Outlet. Construction of the Canal components is expected to last approximately 27 months, in part overlapping with the 17- to 37-month Tunnel construction period and 5.5-month construction of the Ocean Outlet. Construction activities would include site demolition, tree and vegetation removal, excavation, tunneling, grading, pile driving, drilling, backfilling, and material loading.

Truck and vehicle trips associated with Project construction would include vendor (concrete), haul, and worker vehicle trips. Expected construction vehicle trip data were obtained from Daly City's engineering consultant, and vehicle emission factors were obtained from EMFAC 2011, using context-specific parameters (see Appendix C). Trip length information assumed CalEEMod default factors for San Mateo County, which are 24.8, 40, and 14.6 miles for round trips for light-duty, heavy-duty haul, and heavy-duty vendor vehicles, respectively.

Calculated emissions were compared against BAAQMD's CEQA significance thresholds and NPS's NEPA impact thresholds. For construction emissions, the BAAQMD thresholds[8] are 54 pounds per day for ROG, NOx, and PM2.5 from exhaust emissions, and 82 pounds per day for PM10 from exhaust emissions. The NEPA thresholds for a major adverse air quality impact are 100 tons per year for ROG, NOx, PM2.5, and CO.

The BAAQMD CEQA Guidelines recommended evaluation of risks and hazards associated with TAC emissions from an individual project undergoing environmental review pursuant to CEQA. Construction-related emissions of DPM are assessed by considering the duration of construction activity in proximity to sensitive receptors and guidance provided by BAAQMD and the California Office of Environmental Health Hazard Assessment (OEHHA).

3.3.5 Impact Analysis

3.3.5.1 Proposed Project

CEQA Analysis

b) Impact AIR-1: The Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. (Less than Significant with Mitigation)

Emissions significance thresholds recommended in the BAAQMD's *Revised Draft Options and Justification Report* (2009) were used to determine the significance of impacts related to air quality standard violations. The justification report provides substantial evidence to support the recommended thresholds and, therefore, they are appropriate for use in this analysis. Based on the following, construction and operation of the Project would not result in a violation of an air

8 Although the BAAQMD's adoption of significance thresholds for air quality analysis in 2010 and 2011 are the subject of recent judicial actions, Appendix D of the BAAQMD *CEQA Air Quality Guidelines*, in combination with BAAQMD's *Revised Draft Options and Justification Report,* provide substantial evidence to support the BAAQMD recommended thresholds. Therefore, they are appropriate for use in this analysis as standards of significance.

quality standard or contribute significantly to an existing or projected air quality violation. Therefore, the associated impact would be *less than significant*.

Construction

The majority of Project-related exhaust emissions would be generated on-site due to the use of the heavy-duty off-road equipment shown in Table 2-3. Exhaust emissions also would be generated by heavy-duty diesel material haul, concrete vendor trucks and, to a lesser extent by construction worker daily commute trips, as shown in Table 2-4. Criteria pollutant exhaust emissions of ROG, NOx, PM10, and PM2.5 from construction equipment and vehicles would incrementally add to the regional atmospheric loading of these pollutants during Project construction.

Impacts related to violating an air quality standard or contributing to an existing or projected air quality violation are judged by comparing estimated direct and indirect project exhaust emissions to the significance thresholds, which are average daily emissions of 54 pounds per day for ROG, NOx, and PM2.5; and 82 pounds per day for PM10. Only the exhaust portion of PM2.5 and PM10 emissions are compared against the construction thresholds. For non-exhaust (fugitive) particulate emissions, BAAQMD recommends that analyses focus on implementation of dust control measures rather than comparing estimated levels of fugitive dust to a quantitative significance threshold. BAAQMD considers implementation of the BAAQMD-recommended basic mitigation measures for fugitive dust sufficient to ensure that construction-related fugitive dust is reduced to a *less-than-significant* level.

Air pollutant emissions, including ROG, NOx, PM10, and PM2.5, that would be generated by off-road construction equipment (i.e., excavators, graders, loaders, and dump trucks) were estimated using CARB emission factors. CARB's Off-road emissions inventory database was used to develop specific construction equipment emission factors for calendar year 2016 for ROG, NOx, PM (PM2.5 and PM10 were derived from PM emission results).[9]

Tables 3.3-4 shows the estimated total average daily exhaust emissions associated with construction of the Project. For all assumptions and calculations used to estimate the Project-related construction emissions, refer to **Appendix C**. As indicated in the tables, the total average daily construction exhaust emissions would not exceed the BAAQMD's significance thresholds. Therefore, impacts associated with construction-related exhaust emissions would be *less than significant*.

9 These average daily construction emissions were estimated based on the conservative assumption that construction activities would commence in early 2016. Although this construction schedule no longer is feasible, the estimated emissions are conservative because construction in later years would benefit from a cleaner fleet of off-road equipment as a result of CARB's In-Use Offroad Diesel Vehicle Regulation, and the New Offroad Compression Ignition Diesel Engines and Equipment Program.

TABLE 3.3-4
CONSTRUCTION CRITERIA POLLUTANT EXHAUST EMISSIONS

Emissions Source	Average Daily Construction Emissions (pounds/day)			
	ROG	**NOx**	**PM10**	**PM2.5**
Construction Activities	2.8	23.1	1.5	1.5
Vehicle Trips	1.1	21.5	0.5	0.4
Average Daily (pounds/day)	**3.9**	**44.6**	**1.9**	**1.9**
BAAQMD Significance Threshold	54	54	82	54
Significant Impact?	No	No	No	No

NOTES: Emissions were estimated using emission factors from the Off-road emissions inventory database and EMFAC 2011. Numbers may not sum due to rounding. Refer to Appendix C for details on the emissions estimates.

The estimates provided in Table 3.3-4 reflect the most intensive construction schedule among the possible options related to tunneling (i.e., concurrent tunnel drive construction, 24 hours per day). These daily estimates would be reduced if the tunnel drives were constructed sequentially and/or if tunnel construction was limited to between 7:00 a.m. and 7:00 p.m. because construction would be spread out over a greater number of months (up to 44 months in total). While the daily emissions would be reduced because construction activities would be more spread out under these circumstances, the overall construction emissions would be similar. Under all circumstances, impacts associated with construction-related exhaust emissions would be *less than significant*.

In addition to exhaust emissions, emissions of fugitive dust would also be generated by Project construction activities associated with earth disturbance, travel on paved and unpaved roads, and other dust-generating activities. With regard to fugitive dust emissions, the BAAQMD recommends that lead agencies focus on implementation of dust control measures to ensure that impacts would be less than significant rather than comparing estimated levels of fugitive dust to quantitative significance thresholds (BAAQMD, 2009).

For all areas of Project construction within San Francisco (a majority of Project construction), Daly City would be required to comply with San Francisco's construction Dust Ordinance by submitting a Dust Control Plan to the San Francisco Department of Public Health for approval. The site-specific Dust Control Plan would require Daly City to water active construction areas sufficiently to prevent dust from becoming airborne; provide as much water as necessary to control dust without creating runoff in disturbed areas; wet sweep or vacuum streets, sidewalks, paths, and intersections where work is in progress at the end of the workday; cover inactive (for more than 7 days) stockpiles greater than 10 cubic yards or 500 square feet of material; and use dust enclosures, curtains, and dust collectors as necessary to control dust in the excavation area. Additional site-specific measures may be included as needed to accomplish the goal of minimizing visible dust. These measures include Best Management Practices identified by BAAQMD for the purposes of controlling fugitive dust relative to CEQA (BAAQMD 2011) and would ensure that impacts related to fugitive dust would be *less than significant.*

Daly City requires that a grading permit applicant submit a dust nuisance control plan for review and approval. This plan must include both dust suppression through watering or other techniques and daily sweeping of public streets and sidewalks and, similar to San Francisco requirements, would also represent Best Management Practices identified by BAAQMD for the purposes of controlling fugitive dust and would ensure that impacts related to fugitive dust would be *less than significant.*

The area of proposed work at the west tunnel portal at Fort Funston is not under the jurisdiction of either San Francisco or Daly City and therefore has no dust control or grading permit requirements. Without appropriate dust controls, dust emissions generated at this location could contribute to the SFBAAB's existing PM10 and PM2.5 non-attainment status, a potentially significant impact. Therefore, Mitigation Measure 3.3-1, Dust Control Plan, is recommended, which would ensure that the dust nuisance control plan prepared for work at Fort Funston includes the same requirements, at minimum, as the Dust Control Plan prepared in accordance with San Francisco requirements. Implementation of this mitigation measure would reduce potential impacts associated with fugitive dust emissions within federally administered areas to a *less-than-significant* level.

Mitigation Measure 3.3-1: Dust Control Plan Implementation

All elements of the Dust Control Plan required for work within San Francisco shall also be implemented for work occurring at Fort Funston. At a minimum this Plan shall include watering of exposed surfaces, covering of haul trucks, and sweeping of visible mud or dirt on adjacent public roads.

Operation

Once construction is complete, the Project would result in minimal new long-term operational emissions. Motorized pumps to convey water to treatment wetlands would be electrically powered and would have no direct pollutant emissions. Approximately twice a year a vacuum truck would remove debris from the gross solids screening device and transport the debris to Ox Mountain Landfill which would result in negligible operational emissions from vacuum truck operations. Additionally, periodic replacement of the Ocean Outlet (approximately 25 years) as bluff erosion proceeds would require construction activities similar to those for the proposed Ocean Outlet reconstruction, resulting in a similar less-than-significant criteria pollutant emissions. Given the limited emissions associated with Project operations, the Project's operational emissions would be *less than significant.*

Significance after Mitigation: Less than significant.

c) Impact AIR-2: The Project could result in a cumulatively considerable net increase of ozone, PM10, or PM2.5 (for which the SFBAAB is in non-attainment), including releasing emissions which exceed quantitative thresholds for ozone precursors. (Less than Significant with Mitigation)

Based on BAAQMD guidance, if a project would result in an increase in ROG (ozone precursor), NOx (ozone precursor), PM10, or PM2.5 of more than its respective average daily mass significance thresholds, then it would also be considered to contribute considerably to a significant cumulative impact. In developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project would exceed the identified significance thresholds, its emissions would be cumulatively considerable, and if a project would not exceed the significance thresholds, its emissions would not be cumulatively considerable. As presented in above, short-term construction exhaust emissions would not exceed the applicable significance thresholds for ozone precursors or particulate matter, and adherence to the San Francisco Construction Dust Ordinance, Daly City grading permit dust nuisance control plan requirements, and Mitigation Measure 3.3-1 would ensure that impacts associated with fugitive dust emissions would be *less than significant*. In addition, the Project would result in no long-term operational emissions. Therefore, the Project would not result in a cumulatively considerable net increase of ozone, PM10, or PM2.5 during operation.

Significance after Mitigation: Less than significant.

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d) Impact AIR-3: The Project would not expose sensitive receptors to substantial pollutant concentrations. (Less than Significant)

The BAAQMD recommends that lead agencies assess the incremental TAC exposure risk to all sensitive receptors within a 1,000-foot radius of a project's fence line. Long-term Project operation would result in no new TAC emissions. However, Project construction activities would generate DPM, which is considered a TAC. The majority of DPM exhaust emissions that would be generated during construction would be due to the use of diesel off-road equipment.

The closest sensitive receptors to the Project would be the Lakewood Apartments along the south of John Muir drive and north of the Tunnel's Lake Merced Portal. These apartments are located 300 feet from the Lake Merced Portal and 600 feet from the proposed staging area within Fort Funston. There also are residences in the Westlake neighborhood just east and southeast of the collection box and eastern end of the proposed box culvert, across Lake Merced Boulevard, approximately 150 feet from the mouth of the Canal. Additional sensitive receptors are located approximately 700 feet away from proposed road repair construction activities in Avalon Canyon (which is located within Daly City), though the canyon walls would provide protection from dust generated by construction activities from reaching the church and residences on the bluffs above. None of the Project elements or nearby sensitive receptors are located within an Air Pollution Exposure Zone, as designated by the San Francisco Health Department.

Off-road equipment (which includes construction-related equipment) is a large contributor to DPM emissions in California, although, since 2007, CARB has found the emissions to be substantially lower than previously expected (CARB, 2010). Newer and more refined emission inventories have substantially lowered the estimates of DPM emissions from off-road equipment such that off-road equipment is now considered the sixth largest source of DPM emissions in California (CARB, 2010). This reduction in emissions is due, in part, to effects of the economic recession and refined emissions estimation methodologies. For example, revised PM emission estimates for the year 2010, for which DPM is a major component of total PM, have decreased by 83 percent from previous estimates for the SFBAAB (CARB, 2012). Approximately half of the reduction can be attributed to the economic recession, and approximately half can be attributed to updated assumptions independent of the economic recession (i.e., updated methodologies used to better assess construction emissions) (CARB, 2010).

Additionally, a number of federal and state regulations are requiring cleaner off-road equipment. Specifically, both the USEPA and California have set emissions standards for new off-road equipment engines, ranging from Tier 1 to Tier 4. Tier 1 emission standards were phased in between 1996 and 2000 and Tier 4 Interim and Final emission standards for all new engines will be phased in between 2008 and 2015. To meet the Tier 4 emission standards, engine manufacturers will be required to produce new engines with advanced emission-control technologies. Although the full benefits of these regulations will not be realized for several more years, the USEPA estimates that by implementing the federal Tier 4 standards, NOx and PM emissions will be reduced by more than 90 percent (USEPA, 2004). Furthermore, California regulations limit maximum idling times to 5 minutes, which further reduces public exposure to DPM emissions (13 Cal. Code Regs. §2485).

In addition, construction activities do not lend themselves to analysis of long-term health risks because of their temporary and variable nature. As explained in the BAAQMD's *CEQA Air Quality Guidelines*:

> Due to the variable nature of construction activity, the generation of TAC emissions in most cases would be temporary, especially considering the short amount of time such equipment is typically within an influential distance that would result in the exposure of sensitive receptors to substantial concentrations. Concentrations of mobile-source diesel PM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (CARB, 2005). In addition, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. This results in difficulties with producing accurate estimates of health risk. (BAAQMD, 2011, p. 8-6)

Therefore, project-level analyses of construction activities have a tendency to produce overestimated assessments of long-term health risks. However, within Air Pollutant Exposure Zones, as discussed in Section 3.3.1, Affected Environment, additional construction activity may adversely affect populations that are already at a higher risk for adverse long-term health risks from existing sources of air pollution.

Project facility sites are not located within any identified Air Pollutant Exposure Zones. For the Project, DPM emissions that would be generated in the vicinity of any one sensitive receptor location would be limited to 9 months in the vicinity of the box culvert and eastern extent of the wetland and 4 months in the vicinity of the rehabilitated Lake Merced portal. Although off-road equipment and on-road heavy-duty diesel vehicles on designated truck routes would be used during these months of construction, emissions would be temporary and variable in nature and would not be expected to expose sensitive receptors to substantial air pollutants in areas outside Air Pollutant Exposure Zones. Furthermore, the project would be subject to, and would comply with, California regulations limiting idling to no more than 5 minutes, which would further reduce nearby sensitive receptors exposure to temporary and variable DPM emissions. The impact would be *less than significant*.

Mitigation: None required.

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e) Impact AIR-4: The Project would not create objectionable odors affecting a substantial number of people. (Less than Significant)

Diesel equipment used to construct the Project may emit objectionable odors associated with combustion of diesel fuel. However, these emissions would be temporary and intermittent in nature, thus odor impacts associated with diesel combustion during construction activities would be *less than significant*.

The Project would create a constructed treatment wetland for storm water in an area between John Muir Drive and the southern edge of the Canal. During periods of very low or no flow, a recirculating pump would draw water from Lake Merced and replenish the wetland, which would prevent water from stagnating in the treatment wetland cells. Further, as discussed in Section 2.6.5, Project Maintenance, operation of the treatment wetlands would require mosquito control using bacterial methods and trash removal on an annual basis, harvesting of bio mass approximately every 5 years, and removal of silt and other organic material every 10 to 20 years. Therefore, substantial decomposed organic material would not be present. The wetland cells are not located in immediate vicinity of residential areas; people that would be in the vicinity of the wetland cells would include bicyclists and motorists passing the treatment wetland, pedestrians on the north side of John Muir Drive, and Olympic Golf Course users. None of these uses are stationary and people would not be in the vicinity of the treatment wetland for an extended period of time. Therefore, impacts associated with the potential creation of objectionable odors affecting a substantial number of people would be *less than significant*.

Mitigation: None required.

NEPA Analysis

As noted above, the SFBAAB is currently designated as non-attainment for the federal 8-hour ozone standard and the federal PM2.5 standard, and as a maintenance area with respect to the federal CO standard. The General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet NAAQS. To determine whether federal conformity rule analysis is required, annual exhaust emissions from the Project construction activities were calculated for ozone precursors (ROG and NOx), PM2.5, and CO and compared to the *de minimis* thresholds for the SFBAAB (100 tons per year of any of these pollutants). **Table 3.3-5** below provides the estimated tons of ROG, NOx, PM2.5, and CO emissions that would be generated from Project construction. Construction equipment emissions were calculated for each year of construction. As illustrated in the table, construction emissions of ROG, NOx, PM2.5, and CO are estimated to be well under the annual *de minimis* threshold levels applicable to the Project area. The Project therefore would be exempt from General Conformity determination requirements, and would not have a major adverse impact on air quality.

TABLE 3.3-5
NEPA-RELEVANT CONSTRUCTION CRITERIA POLLUTANT EMISSIONS OF THE PROPOSED PROJECT

Emissions Source	Total Annual Construction Emissions (tons/year)*			
	ROG	**NOx**	**PM2.5**	**CO**
Year 1				
Construction Activities	0.2	1.8	0.1	1.1
Vehicle Trips	0.1	2.5	0.0	0.9
Total Annual	**0.4**	**4.3**	**0.2**	**2.0**
De Minimis Level	100	100	100	100
Exceeds De Minimis Level?	No	No	No	No
Year 2				
Construction Activities	0.5	4.1	0.3	2.8
Vehicle Trips	0.2	3.5	0.1	1.4
Total Annual	**0.7**	**7.5**	**0.3**	**4.2**
De Minimis Level	100	100	100	100
Exceeds De Minimis Level?	No	No	No	No
Year 3				
Construction Activities	0.1	1.2	0.1	0.8
Vehicle Trips	0.0	0.6	0.0	0.2
Total Annual	**0.2**	**1.8**	**0.1**	**1.0**
De Minimis Level	100	100	100	100
Exceeds De Minimis Level?	No	No	No	No

* NOTE: numbers may not sum due to rounding. These annual construction emissions were estimated based on the conservative assumption that construction activities would commence in early 2016. Although this construction schedule no longer is feasible, the estimated emissions are conservative because construction in later years will benefit from a cleaner fleet of off-road equipment as a result of CARB's In-Use Offroad Diesel Vehicle Regulation, and the New Offroad Compression Ignition Diesel Engines and Equipment Program.

Further, as shown above in Table 3.3-4 the Project would result in average construction exhaust emissions of less than 54 pounds per day of ROG, NOx, or PM2.5 and less than 82 pounds per day of PM10, and therefore would have a minor adverse impact on air quality.

The estimates provided in Tables 3.3-4 and 3.3-5 reflect the most intensive construction schedule among the possible options related to tunneling (i.e., concurrent tunnel drive construction, 24 hours per day). Some of these estimates would be reduced if the tunnel drives were constructed sequentially and/or if tunnel construction was limited to between 7:00 a.m. and 7:00 p.m. because construction would be spread out over a greater number of months (up to 44 months in total). While some daily and annual emissions would be reduced because construction activities would be more spread out under these circumstances, the overall construction emissions would be similar. Under all circumstances, the Project would be exempt from General Conformity determination requirements and would have a minor adverse impact on air quality.

3.3.5.2 Tunnel Alignment Alternative

The following describes the air quality effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.3.5.1, Proposed Project, or Section 3.3.5.3, Canal Configuration Alternative, depending on the option selected. Thus, air quality effects for the canal portion would be as described in those sections.

CEQA Analysis

Construction

The Tunnel Alignment Alternative would have similar construction characteristics of the Project. The construction methods and duration to construct this alternative would not change compared to the Tunnel portion of the Project, as described in Chapter 2, except that a digger shield or micro tunnel boring machine would be used in place of a mini excavator. From an air quality perspective, this would represent replacing one type of diesel engine with another. Both types of equipment engines would operate over the same construction phase duration and have similar engine load factors and would not meaningfully change the emissions estimated for the proposed Project which are primarily determined by these characteristics.

Like the proposed Project, this alternative is anticipated to take a total of approximately 24 to 44 months to complete (including a 17- to 37-month tunnel construction period). The details of the construction activities and methods for the Project, which are also applicable for the Tunnel Alignment Alternative, are summarized in Table 2-1, which includes demolition; project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. The locations of construction associated with the Tunnel Alignment Alternative are illustrated in Figure 2-6. Additionally, work at Avalon Canyon access road would be the same as for the proposed Project, and would be subject to Daly City's dust nuisance control plan.

The distance to the nearest residential receptor from tunnel work and staging area would slightly increase under this alternative, resulting in reduced potential for nuisance impacts from fugitive dust generation. Additionally, the Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the proposed Project, which would reduce the number of truck trips required and their associated emissions. Because of these marginal reductions, like the proposed Project, the Tunnel Alignment Alternative would have average daily construction exhaust emissions that would not exceed the BAAQMD's significance thresholds. Therefore, construction-related impacts associated with the Tunnel Alignment Alternative would be *less than significant*. However, like the proposed Project, the Tunnel Alignment Alternative would result in construction dust within Fort Funston, where the San Francisco Construction Dust Ordinance would not apply. Implementation of Mitigation Measure 3.3-1, which would require that all elements of the Dust Control Plan required for work within San Francisco also be implemented for work occurring in Fort Funston, would reduce potential impacts to *less than significant.*

Operation

There would be no difference in operational emissions under the Tunnel Alignment Alternative compared to the Tunnel portion of the Project. Operational pumping and maintenance truck trips associated with the Canal portion would be the same as described in Section 3.3.5.1, Proposed Project, or Section 3.3.5.3, Canal Configuration Alternative, depending on the option selected. Given the limited emissions associated with Project operation and maintenance, operational criteria air pollutant emissions under the Tunnel Alignment Alternative would be *less than significant.*

Based on BAAQMD guidance, if a project would result in an increase in ROG, NOx, PM10, or PM2.5 of more than its respective average daily mass significance thresholds, then it would also be considered to contribute considerably to a significant cumulative impact. As discussed above, the Tunnel Alignment Alternative would result in negligible long-term operational emissions. Therefore, the Tunnel Alignment Alternative would not result in a cumulatively considerable net increase of ozone, PM10, or PM2.5.

Regarding exposure of sensitive receptors to pollutant concentrations, the Tunnel Alignment Alternative would have many similar construction characteristics of the Project. The construction methods and duration to construct the tunnel would not change compared to the Project, as described in Chapter 2.

The distance to the nearest residential receptor tunnel work and staging area would increase under this Alternative, resulting in reduced potential for DPM exposure to nearby sensitive receptors. Because there would be reduced exposure potential, like the Project, the Tunnel Alignment Alternative would not expose sensitive receptors to substantial pollutant concentrations in the project vicinity which is not within an Air Pollutant Exposure Zone. Therefore, pollutant exposure-related impacts associated with the Tunnel Alignment Alternative would be *less than significant*.

Regarding odor generation, the operational effects of the constructed treatment wetland associated with the Canal portion would be the same as described in Section 3.3.5.1, Proposed

Project, or Section 3.3.5.3, Canal Configuration Alternative, depending on the option selected. As indicated in those sections, impacts associated with the potential creation of objectionable odors affecting a substantial number of people would be *less than significant*.

NEPA Analysis

The construction methods and duration to construct the Tunnel Alignment Alternative would not change compared to the Project, except that a digger shield or micro tunnel boring machine would be used in place of a mini excavator. From an air quality perspective, this would represent replacing one type of diesel engine with another and would not meaningfully change the emissions estimated for the proposed Project. Construction under the Tunnel Alignment Alternative would include demolition; project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas.

The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Consequently, like the proposed Project, construction emissions of ROG, NOx, PM2.5, and CO under the Tunnel Alignment Alternative would also be well under the annual de minimis threshold levels applicable to the SFBAAB, and emissions of ROG, NOx, PM2.5, and PM10 also would be under the applicable daily thresholds. The Tunnel Alignment Alternative therefore would be exempt from General Conformity determination requirements and would have a minor adverse impact on air quality. Additionally, implementation of Mitigation Measure 3.3-1, recommended to reduce impacts relative to CEQA significance thresholds, would further reduce construction air emissions.

The air emissions associated with operation and maintenance of the Tunnel Alignment Alternative would be similar to those described for the proposed Project.

3.3.5.3 Canal Configuration Alternative

The following describes the air quality effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.3.5.1, Proposed Project, or Section 3.3.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, air quality effects for the tunnel portion would be as described in those sections.

CEQA Analysis

Construction

The Canal Configuration Alternative would have many similar construction characteristics of the Project. The construction methods for Canal Configuration Alternative would not change compared to the Project, as described in Chapter 2, except that the collection box and box culvert would not be constructed. This would result in reduced duration of construction activity as removal of approximately 1,500 feet of the Canal structure and installation of culverts under the proposed Project would not occur, resulting in fewer annual emissions. Additionally, truck transport of excavated materials and clean fill associated with the box culvert would not be required under this alternative that would occur under the proposed Project, also reducing annual and daily emission rates. The details of the construction activities and methods for the Project, which would be substantially similar for this alternative, are summarized in Table 2-1 and include demolition and tree removal; project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. The location of this alternative is shown in Figure 2-7.

The distance to the nearest residential receptor from the diversion structure work would decrease under this alternative, as compared to the Project, resulting in a somewhat greater potential for fugitive dust generation from construction activities. However, the dust control requirements of the Dust Control Ordinance would still be required, which would ensure that the location of the nearest sensitive receptors are identified and that fugitive dust impacts would be controlled and maintained at a *less-than-significant* level.

Emissions of ozone precursors (ROG and NOx) from equipment used to construct the diversion structure would be generated closer to sensitive receptors but these are precursors to ozone which is a regional pollutant and would not have localized effects. However, particulate matter (exhaust) emissions would occur in closer proximity to receptors (approximately 300 feet) under this Alternative. Although off-road equipment and on-road heavy-duty diesel would be used during these months of construction, emissions would be temporary and variable in nature and would not be expected to expose sensitive receptors to substantial air pollutants in areas outside Air Pollutant Exposure Zones. Furthermore, the project would be subject to, and would comply with, California regulations limiting idling to no more than 5 minutes, which would further reduce nearby sensitive receptors exposure to temporary and variable particulate and DPM emissions. Therefore, construction-related air quality impacts associated with the Canal Configuration Alternative would be *less than significant.*

Operation

There would be no differences in operational emissions under the Canal Configuration Alternative compared to the Project. Like the Project, the Canal Configuration Alternative would require occasional operation of motorized pumps to convey water to treatment wetlands that would be electrically powered and would have no direct pollutant emissions. Approximately twice a year a vacuum truck would remove debris from the gross solids screening device and transport the debris to Ox Mountain Landfill which would result in negligible operational emissions from vacuum truck operations. Given the limited emissions associated with project operations (four annual truck trips), operational criteria air pollutant emissions under the Canal Configuration Alternative would be *less than significant.*

Based on BAAQMD guidance, if a project would result in an increase in ROG, NOx, PM10, or PM2.5 of more than its respective average daily mass significance thresholds, then it would also be considered to contribute considerably to a significant cumulative impact. As discussed above, the Canal Configuration Alternative would result in negligible long-term operational emissions.

Therefore, the Canal Configuration Alternative would not result in a cumulatively considerable net increase of ozone, PM10, or PM2.5.

Regarding odor generation, like the Project, the Canal Configuration Alternative would create a constructed treatment wetland for storm water in an area between John Muir Drive and the southern edge of the canal. During periods of very low or no flow, a recirculating pump would draw water from Impound Lake and replenish the wetland, which would prevent water from stagnating in the wetland cells. Further, as discussed in Section 2.6.5, Project Maintenance, operation of the treated wetlands would require mosquito control using bacterial methods and trash removal on an annual basis, harvesting of bio mass approximately every 5 years, and removal of silt and other organic material every 10 to 20 years. Therefore, substantial decomposed organic material would not be present. The wetland cells are not located in immediate vicinity of residential areas; people that would be in the vicinity of the wetland cells would include bicyclists and motorists passing the treatment wetland, pedestrians on the north side of John Muir Drive, and Olympic Golf Course users. None of these uses are stationary and people would not be in the vicinity of the treatment wetland for an extended period of time. Therefore, impacts associated with the potential creation of objectionable odors affecting a substantial number of people would be *less than significant.*

NEPA Analysis

The Canal Configuration Alternative would have many similar construction characteristics of the Project, except that the collection box and box culvert would not be installed. This would result in reduced duration of construction activity as removal of approximately 1,500 feet of the canal structure and installation of box culverts described for the proposed Project would not occur, resulting in fewer annual emissions than the proposed Project. Additionally, truck transport of excavated materials and clean fill associated with the box culvert would not be required under this Alternative that would occur under the proposed Project, also reducing annual emission rates. The construction methods and duration to construct the Alternative would not change compared to the Project. Consequently, the Canal Configuration Alternative construction emissions of ROG, NOx, PM2.5, and CO, like the proposed Project, are estimated to be well under the annual *de minimis* threshold levels applicable to the SFBAAB, and emissions of ROG, NOx, PM2.5, and PM10 also would be under the applicable daily thresholds. The Canal Configuration Alternative therefore would be exempt from General Conformity determination requirements and would have a minor adverse impact on air quality.

3.3.5.4 No Project/No Action Alternative

Because no new construction would occur under the No Project/No Action Alternative, no construction emissions would be generated by this alternative, which would result in no impact with respect to creating or contributing substantially to air quality violations. Regarding operational emissions, there would be no changes to the existing operations of the project site. Air pollutant emissions would not change and no new emissions sources would be added to the project site. Therefore, the No Project/No Action Alternative would result in no impact with respect to creating or contributing substantially to air quality violations, increase in criteria air pollutants, exposure of sensitive receptors to substantial pollutant concentration, or odor generation.

3.3.6 Cumulative Effects

3.3.6.1 Geographic Extent/Context

The geographic extent of cumulative effects of a project with respect to air quality varies, depending on the type of pollutant considered. Ozone is generally not directly emitted to the atmosphere but is formed under favorable photochemical conditions from precursor compounds (ROG and NOx) and is therefore considered a regional pollutant. Under the CAA, California is divided into air basins and the project is located within the SFBAAB which is non-attainment for ozone and particulate matter. To respond to the regional nature of pollutants within the SFBAAB, the BAAQMD has developed significance thresholds which represent cumulatively considerable contributions to the existing pollutant loads for ROG, NOx, PM10, and PM2.5. Consequently, for criteria air pollutants, the SFBAAB represents the geographic extent of impact assessment.

Assessment of TACs, however, is done at the local level depending on the existing air quality conditions in and around the project site. The BAAQMD has generally established a perimeter of 1,000 feet as the geographic extents for assessing impact related to TACs. The Project vicinity is not located within an Air Pollutant Exposure Zone as determined by the San Francisco Planning Department. Consequently, excess cancer risk from the contribution of emissions from all modeled sources in the area are less than 100 per 1 million population, and cumulative PM2.5 concentrations are less than 10 $\mu g/m^3$.

3.3.6.2 Existing Cumulative Conditions

The regulatory context of air quality includes required state and federal improvements to vehicle mileage such that emissions per vehicle arte predicted to improve over time. Consequently, anticipated increases in vehicle miles travelled within the SFBAAB from future growth will be partially offset due to improvements in the basin's vehicle fleet and improvements to on-road fuel composition.

3.3.6.3 Past, Present, and Reasonably Foreseeable Projects

The existing conditions reflect the contributions of past projects. The following present and reasonably foreseeable projects are located within 0.25 mile (1,300 feet) of the Project site and are expected to occur with the same vicinity and time frame as the Project, which could result in cumulative localized air quality impacts. These projects are discussed in more detail in **Table 3.1-1**.

- Regional Groundwater Storage and Recovery Project (SFPUC)
- Groundwater Supply Project (SFPUC)
- 2800 Sloat Boulevard (Private Developer)
- Pacific Road and Gun Club Upland Soil Remediation Project (SFPUC)
- Fort Funston Site Improvement Project (NPS)

3.3.6.4 Construction

Cumulative TAC and PM2.5 concentration impacts in the site vicinity could occur if there are concurrent construction activities in the site vicinity. Cumulative projects could overlap, to some extent, with construction of the proposed Project or alternatives. Of the projects listed above, the Fort Funston Site Improvements project is closest to the site. The improvement activities may occur in close proximity (less than 0.25 mile) of the Project's construction activities at Fort Funston. Construction at these two sites could pose cumulative DPM and PM2.5 impacts on residences near Fort Funston if construction of these two projects were to occur at the same time. However, there is an intervening hill between the nearest residential receptor and the Fort Funston site, and the construction schedule for the Fort Funston project has not yet been determined. The intervening distance and topography would reduce the potential for cumulative effects from construction-related DPM and PM2.5 emissions even if construction of these two projects were to coincide. The other cumulative projects are located further than 1,000 feet away and would not contribute to a potential cumulative DPM and PM2.5 impacts on nearby receptors.

3.3.6.5 Operation and Maintenance

Operational emissions from the proposed Project and alternatives would be minimal and would not represent a cumulatively considerable contribution to air quality. The proposed Project and alternatives would require occasional operation of motorized pumps to convey water to treatment wetlands that would be electrically powered and would have no direct pollutant emissions. Approximately twice a year a vacuum truck would remove debris from the gross solids screening device and transport the debris to Ox Mountain Landfill. In addition, other routine maintenance activities would be required, which would result in negligible operational emissions from truck operations. Given the limited emissions associated with project operations, operational criteria air pollutant emissions would not contribute considerably to cumulative air quality conditions. In regards to vector-borne diseases, the cumulative projects located in the Project vicinity do not include constructed wetlands or other features that could result in large areas of standing water.

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3.4 Biological Resources

This section describes the existing conditions for biological resources present in the vicinity of the proposed Project. This section identifies a Project study area, defined as the Project sites and relevant areas of similar habitat composition surrounding the individual Project sites, and assesses potential impacts on biological resources in the study area resulting from construction and operation of the Project. The section also presents regulations and guidelines relevant to analysis of biological resources impacts and identifies mitigation measures to avoid, minimize, or mitigate impacts.

The information on natural communities, plant and animal species, and sensitive biological resources used in the preparation of this section was obtained from: the California Natural Diversity Database (CNDDB, 2016), the California Native Plant Society (CNPS) Electronic Inventory (CNPS, 2015a and 2015b), the U.S. Fish and Wildlife Service (USFWS, 2015), standard biological literature, eBird.org (eBird, 2015a and 2015b), and focused and reconnaissance-level surveys of the Project sites. On February 5, 2014, reconnaissance botanical and wildlife surveys of the Project study area were conducted in order to characterize existing conditions, assess habitat quality, and assess the potential presence of special-status species and sensitive natural communities. A focused reconnaissance survey of the proposed staging area and adjacent areas at Fort Funston was conducted on June 4, 2015.

3.4.1 Affected Environment

This section describes the regional and Project area setting, including a description of habitats and species known or likely to occur in the Project study area. In addition, several scoping comments were received regarding biological resources that requested that the USFWS, CDFW, and National Oceanic and Atmospheric Administration’s (NOAA) Fisheries Service be contacted regarding information on species that may be present. Consultation with biological resources agencies is described in this section and in Chapter 5, Consultation and Coordination.

3.4.1.1 Regional Setting

The Project is located in the Bay Area–Delta Bioregion,[1] as defined by the State of California’s Natural Communities Conservation Program. This bioregion consists of a variety of natural communities that range from the open waters of San Francisco Bay and Delta to salt and brackish marshes to grassland, chaparral, and oak woodlands. The temperate climate is Mediterranean in nature, with relatively mild, wet winters and warm, dry summers. The high diversity of vegetation and wildlife found in the region is a result of soil, topographic, and microclimate variations that

[1] A *bioregion* is an area defined by a combination of ecological, geographic, and social criteria and consists of a system of related, interconnected ecosystems. The Bay-Delta Bioregion is considered the immediate watershed of the Bay Area and the Delta, not including the major rivers that flow into the Delta. It is bounded on the north by the northern edge of Sonoma and Napa Counties and the Delta, and extends east to the edge of the valley floor; on the south, it is bounded by the southern edge of San Joaquin County, the eastern edge of the Diablo Range, and the southern edge of Santa Clara and San Mateo Counties.

combine to promote relatively high levels of endemism.[2] This, in combination with a long history of uses that have altered the natural environment and the increasingly rapid pace of development in the region, has endangered some of the local flora and fauna.

3.4.1.2 Project Setting

The Project is located on the western portion of the San Francisco peninsula, at the southern edge of San Francisco and northern edge of Daly City, and includes three main sites at: Lake Merced, Fort Funston, and the Avalon Canyon access road. These three sites are collectively referred to throughout this document as the Project site. Their surrounding relevant vicinity make up the larger biological resources study area as presented in **Figure 3.4-1**.

The Lake Merced site includes a western segment of Impound and South Lake, John Muir Drive, and Vista Grande Canal from the confluence of Lake Merced Boulevard and John Muir Drive north to the northern edge of the Olympic Golf Club. This site is surrounded to the north and east by Lake Merced and to the south and west by Olympic Golf Club. The larger study area includes Lake Merced, the largest natural freshwater lake in San Francisco and comprised of four lakes: North, East, South, and Impound Lakes. Lake Merced was historically a lagoon fed by five relatively small streams and groundwater, with occasional connection to the Pacific Ocean (SFPUC, 2011). Lagoons typically form along the California coast in areas where sand is regularly deposited on beaches, and streams only flow during the rainy months. Because the Lake Merced watershed is relatively small and the streams that historically fed it had small watersheds themselves, it was likely rare that flows were great enough to breach the sand bar that blocked them. Beginning in the 1870s the lake was used as a municipal water supply for San Francisco and by the late 1880s the lake was completely separated from the ocean due in large part to water diversions for municipal use and urban development. In 1895, earthen dams were constructed to divide the lagoon into separate lakes and permanently sever the connection to the ocean.

The Fort Funston site consists of Fort Funston Road, an existing paved road and the proposed staging area of approximately 4 acres, located in disturbed dune vegetation, north and east of the main parking lot. The Fort Funston site also includes the existing Daly City and SFPUC outlet structures, submarine outfall pipe, beach, and a small staging area on the bluffs above the outlet structures. The larger study area includes Fort Funston north of the Fort Funston Native Plant Nursery to approximately Battery Davis. The Pacific Ocean lies to the west of this site, Lake Merced and Olympic Golf Club to the east, and undeveloped coastline parks to the north and south. Fort Funston is a former defense installation located in southwestern San Francisco.

The Avalon Canyon site consists of a paved access road and adjacent (restored) coastal scrub habitat, a transitional area between upland and beach zones of coastal dune scrub, and the beach from end of the access road north to the Ocean Outlet. Large and severe landslides have occurred adjacent to and within this site and complete revegetation of disturbed portions of the canyon

[2] *Endemism* refers to the degree to which organisms or taxa are restricted to a geographical region or locality and thus are individually characterized as endemic to that area.

SOURCE: ESA, 2015

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Figure 3.4-1
Biological Resources Project Study Areas

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followed extensive grading and realignment of the roadway in 2000 and 2005, leaving little undisturbed, naturally-occurring vegetation (Terra Engineers, 2015). Residential development surrounds the site on the north, east, and south. To the west of the site is the Pacific Ocean.

The western edge of San Francisco, including Fort Funston and areas surrounding Lake Merced, was in a natural state of sand dunes with a sparse covering of chaparral for most of recorded history. Development in San Francisco has almost entirely removed sand dune habitat within the city boundaries, and thus sand dunes and native sand dune vegetation are restricted to protected areas such as those within Fort Funston (north, east, and south of the Project site) and in the Presidio. Today, native vegetation within the study area is either the result of restoration efforts or consists of remnant naturally occurring native plant communities that have been severely degraded by human disturbance and the introduction of invasive vegetation. Both restored and degraded areas of central dune scrub, a regionally specific designation of the coastal dune scrub vegetation community, are present within the study area at Fort Funston, Lake Merced, and Avalon Canyon access road.

San Francisco's climate is strongly influenced by its proximity to the Pacific Ocean and San Francisco Bay, which moderates temperature swings and helps produce its characteristic fog, in particular in the western part of San Francisco where the Project is located. Data from the Western Regional Climate Center for the San Francisco–Richmond weather station indicate that average annual precipitation is 20 inches in the study area. The average maximum annual temperature is 61.5 degrees Fahrenheit, and average minimum annual temperature is 49.4 degrees Fahrenheit (Western Regional Climate Center, 2014).

Topographical elevations within the study area range from sea level to approximately 200 feet above mean sea level. The majority of the study area is relatively flat to shallowly sloped. However, steep coastal cliffs approximately 200 feet in height occupy the west edge of the study area near the Pacific Ocean.

3.4.1.3 Vegetation Communities and Wildlife Habitats

Natural communities are assemblages of plant and wildlife species that occur together in the same area, which are defined by species composition and relative abundance. The study area contains several upland plant communities which were identified during the reconnaissance site visit on February 25, 2014. These vegetation communities include developed/landscaped/ruderal, annual grassland, central dune scrub, disturbed dune vegetation, coastal scrub, and arroyo willow riparian scrub, freshwater marsh, and open water. Lake Merced's aquatic habitat and resident fish species also are described below. Three wetland communities also are present within the study area, as identified during the formal wetland delineation performed in November and December of 2012 (ESA, 2014). These three wetland communities include bulrush and knotweed emergent wetlands and arroyo willow wetland. Each of these communities is described briefly below, and a summary of the location(s) within the Project site where each community is found is presented in **Table 3.4-1**.

TABLE 3.4-1
VEGETATION COMMUNITIES WITHIN THE PROJECT SITE

Vegetation Community	Project Site Location			
	Lake Merced	Vista Grande Canal	Fort Funston	Avalon Canyon Access Road
Developed/Landscaped/Ruderal		x		x
Annual Grassland	x	x		
Non-native Forest	x	x		x
Central Dune Scrub	x	x	x	x
Disturbed Dune Scrub			x	
Coastal Scrub	x	x		x
Willow Scrub	x	x		
Freshwater Marsh	x	x		

Developed/Landscaped/Ruderal

Developed and landscaped areas within and adjacent to the study area include the Olympic Club Golf Course, roads and parking lots, and existing facilities. These areas support a variety of ornamental shrubs and trees, with blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) being the most common trees at Lake Merced and throughout the golf course. Few Monterey cypress trees occur within the Fort Funston study area and stands of blue gum eucalyptus occur north of the study area along Skyline Boulevard. Non-native ornamental shrubs are planted in several places on the golf course side of Vista Grande Canal, and Monterey pine and cypress line portions of the canal. While the vegetation surrounding Avalon Canyon access road was essentially landscaped through restoration efforts, the vegetative composition is native coastal scrub, which is discussed below.

Areas dominated by often temporary assemblages of opportunistic non-native plants that thrive in disturbed areas were characterized as ruderal habitat. Within and adjacent to the study area, this vegetation type occurs adjacent to developed areas such as sidewalks, roads, and golf course edges. Non-native plant species typical of ruderal vegetation in this area include soft chess (*Bromus hordeaceus*), hare barley (*Hordeum murinum* ssp. *leporinum*), Italian ryegrass (*Festuca perennis*), wild radish (*Raphanus sativus*), black mustard (*Brassica nigra*), poison hemlock (*Conium maculatum*), and iceplant (*Carpobrotus edulis*).

Landscaped and ruderal areas can provide cover, foraging, and nesting habitat for a variety of bird species as well as reptiles and small mammals, especially those that are tolerant of disturbance and human presence. Birds commonly found in such areas include non-native species such as house sparrow (*Passer domesticus*) and European starling (*Sturnus vulgaris*) as well as birds native to the area, including American robin (*Turdus migratorius*), house finch (*Haemorhous mexicanus*), and western scrub jay (*Aphelocoma californica*). Other wildlife present in urban landscaped areas include striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), grey fox (*Urocyon cinereoargenteus*), and common bats, as well as the non-native Virginia opossum (*Didelphis virginiana*). Red-tailed and red-shouldered hawks

(*Buteo jamaicensis; B. lineatus*) prey on Botta's pocket gophers (*Thomomys bottae*) and other small rodents and were observed in the vicinity of Vista Grande Canal and the adjacent golf course during the reconnaissance site visit.

Annual Grassland

Annual grassland within the study area occurs on the upper bank of Impound Lake and between Vista Grande Canal and John Muir Drive. Dominant species include non-natives such as ripgut brome (*Bromus diandrus*), wild oats (*Avena fatua*), rattlesnake grass (*Briza maxima*), Italian ryegrass, English plantain (*Plantago lanceolata*), sheep sorrel (*Rumex acetosella*), black mustard, and wild radish. Native herb associates include telegraph weed (*Heterotheca grandiflora*), beach strawberry (*Fragaria chiloensis*), and annual lupine (*Lupinus bicolor*). Scattered native shrubs are also present, including coyote brush (*Baccharis pilularis*) and dune bush lupine (*Lupinus chamissonis*). Annual grassland would support a similar set of wildlife species as described above for ruderal or landscaped areas.

Non-native Forest

The non-native forest throughout the study area primarily consists of blue gum eucalyptus, Monterey pine, and Monterey cypress trees (Monterey pine and Monterey cypress are native to California but not to the San Francisco area). These forest support occasional individuals of native coast live oak (*Quercus agrifolia*), but it is not a dominant species. The Vista Grande Canal and the Avalon Canyon access road are adjacent to and support non-native forest. Few Monterey cypress trees occur within the Fort Funston study area.

Native species such as American robin, chestnut-backed chickadee (*Poecile rufescens*), pygmy nuthatch (*Sitta pygmaea*), Anna's hummingbird, California towhee (*Melozone crissalis*), western grey squirrel (*Sciurus griseus*) and the non-native eastern fox squirrel (*Sciurus niger*) may occur in non-native forest.

Central Dune Scrub

Central dune scrub is present at Lake Merced, between John Muir Drive and the Vista Grande Canal, Fort Funston, and the Avalon Canyon access road within the study area.

Dune scrub vegetation at Lake Merced is located in restoration areas managed by the San Francisco Parks and Recreation Department as part of the Significant Natural Areas Program, where dune species have been planted; on the north east side of North Lake, on the north and east sides of East Lake, on the east and south sides of South Lake, and on the north side of Impound Lake. Dune scrub at Lake Merced is characterized by a mix of dune species with varying cover, including dune bush lupine (*Lupinus chamissonis*), yellow bush lupine (*Lupinus arboreus*), coast buckwheat (*Eriogonum latifolium*), coyote brush (*Baccharis pilularis*), coastal sagewort (*Artemisia pycnocephala*), California goldenbush (*Ericameria ericoides*), lizard-tail (*Eriophyllum staechadifolium*), and common yarrow (*Achillea millefolium*). Characteristic herbs include California acaena (*Acaena pinnatifida* var. *californica*), contorted sun cup (*Camissonia contorta*), and beach evening primrose (*Camissonia cheiranthifolia* ssp. *cheiranthifolia*). Central dune scrub at

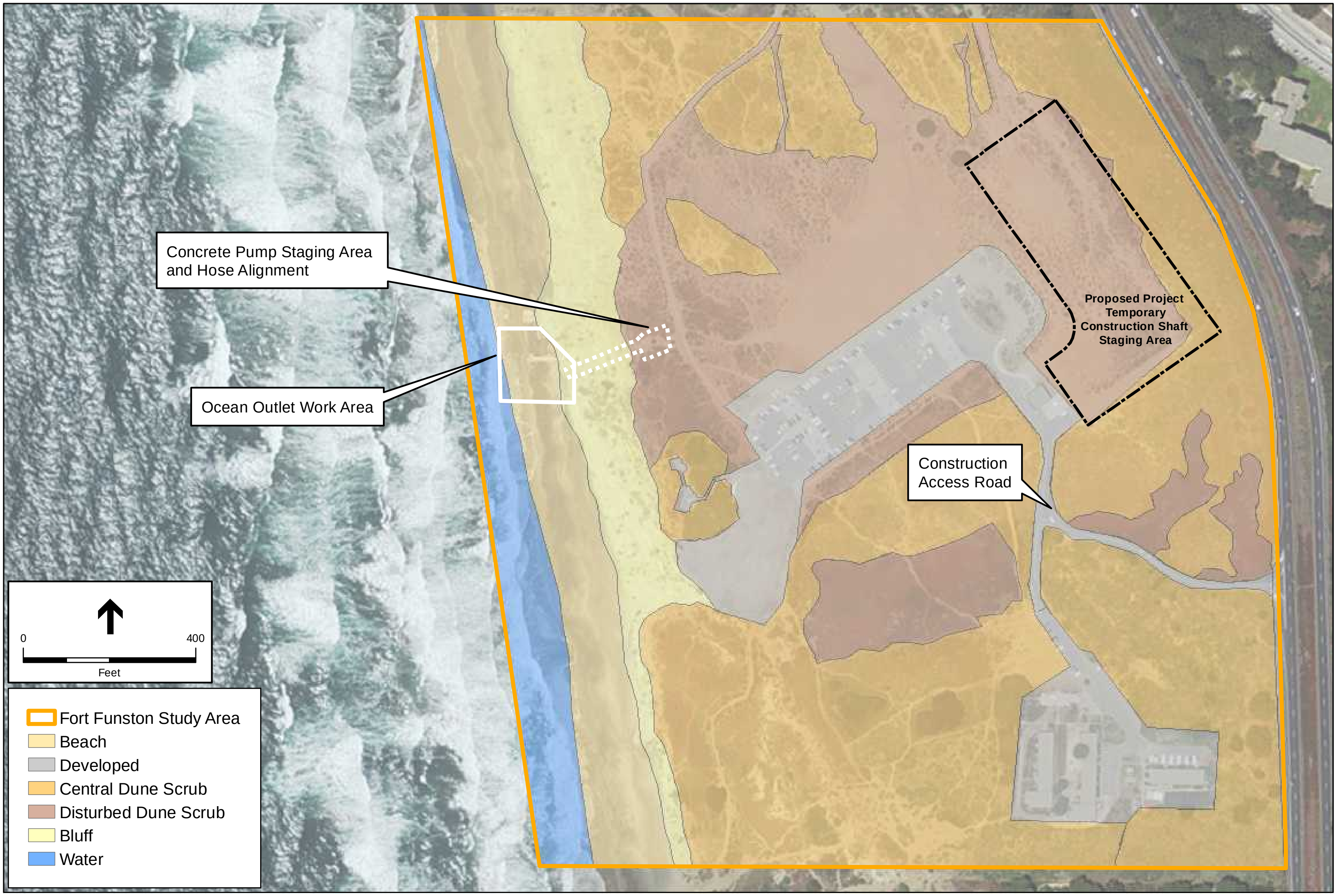
Lake Merced supports several sensitive, but not federally listed, plant species, including blue coast gilia (*Gilia capitata* subsp. *chamissonis*; CRPR 1B.1), San Francisco spineflower (*Chorizanthe cuspidata* var. *cuspidata*; CRPR 1B.2), San Francisco wallflower (*Erysimum franciscanum*; CRPR 4.2, locally rare), and dune tansy (*Tanacetum bipinnatum*; locally rare). Remnant dune vegetation occurs in the disturbed area between the Vista Grande Canal and John Muir Drive among non-native annual grassland vegetation. Opportunistic yellow bush lupine is the dominant species from the dune scrub alliance here; however, San Francisco spineflower has been documented at this location on multiple occasions during previous surveys (May and Associates, 2009; Nomad, 2011). Iceplant may have encroached on spineflower populations in this area since surveys were conducted.

Several types of dune vegetation occur at Fort Funston such as foredune, back dune, central dune scrub, and disturbed dune; however, only central dune scrub and areas of highly disturbed dune scrub occur within the Project site at Fort Funston (see **Figure 3.4-2**). Central dune scrub within the Fort Funston study area includes a similar species composition as described for Lake Merced that also support San Francisco spineflower and San Francisco wallflower populations. Central dune scrub occurs along the south and eastern fringes of the proposed Project staging area. The central dune scrub at the Avalon Canyon access road is present in the lower portion of the access road where coastal scrub vegetation transitions into sandier soils, and is comprised of similar species described above. Special-status plant populations are not previously documented in the Avalon Canyon study area, which has been highly disturbed during landslides and subsequent repair or restoration efforts over the past 17 years.

Central dune scrub within the study area supports northern alligator lizard (*Elgaria coerulea*), southern alligator lizard (*Elgaria multicarinata*), western fence lizard (*Sceloporus occidentalis*), and gopher snakes (*Pituophis catenifer*); small rodents such as deer mouse (*Peromyscus maniculatus*), vagrant shrew (*Sorex vagrans*), and California vole (*Microtus californicus*); and a variety of birds including white-crowned sparrow (*Zonotrichia leucophrys*), Bewick’s wren (*Thryomanes bewickii*), American robin, common bushtit (*Psaltriparus minimus*), house finch, and mourning dove (*Zenaida macroura*) (Russell et al., 2009).

Disturbed Dune Scrub

Disturbed dune scrub occurs within the Fort Funston study area and comprises the majority of the proposed staging area. Disturbed dune scrub occurs where native dune vegetation alliances have been largely displaced by non-native iceplant that was introduced by the U.S. Army to control erosion while Fort Funston was an active military defense installation. Disturbed dune scrub is characterized by a mosaic of unvegetated sand dune deflation planes and non-native iceplant hummocks, interspersed with remnant native species that include coastal buckwheat, California coffeeberry (*Frangula californica*), deerweed (*Acmispon glaber*), California yarrow, silver bush lupine, dune strawberry, and coyote bush. These areas are regularly traversed by the public which in combination with wind erosion, has resulted in small patches of vegetation among the loose sand and “blowouts”. Large areas of exposed, unvegetated sand combined with strong onshore winds results in a dynamic environment where the composition of open areas and vegetation is constantly changing. Disturbed dune scrub occurs within the proposed Project staging area at Fort Funston,



SOURCE: ESA, 2015; GGNRA Rare Plant Monitoring Data, 2013 (updated by ESA 2015)

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Figure 3.4.2
Fort Funston Study Area Vegetation Communities

open areas to the south, and the concrete pump staging area. The concrete pump staging area, as shown in Figure 2-3b and Figure 3.4-2, is located at the edge of the bluff face above the Ocean Outlet construction area. Vegetation along the bluff face within the concrete hose alignment is generally sparse and limited to small patches of iceplant and yellow bush lupine. Similar animals can be found using disturbed dune vegetation as central dune scrub vegetation; however, this community by comparison provides marginal habitat value.

Coastal Scrub

Coastal scrub within the study area consists of several different vegetation types classified according to their dominant species, including native California blackberry scrub, California sagebrush scrub, and coyote brush scrub. Shrubs are dominant in this vegetation type, which may be monotypic, as is generally the case for California blackberry scrub, or supporting a mix of shrubs and herbaceous species. California blackberry scrub occurs on the banks of South and Impound Lakes at elevations well above the water line and also occurs with swamp knotweed as a co-dominant. Other herbaceous species are generally lacking due to the dense cover of blackberry. Coyote brush scrub occurs in sandy soils around the lakes and is commonly associated with toyon (*Heteromeles arbutifolia*), lizard-tail, and California coffeeberry, non-native annual grasses, and bracken fern (*Pteridium aquilinum*). California sagebrush scrub occurs adjacent to the Avalon Canyon access road and consists of a mixture of low shrubs and herbaceous species planted in 2000 during the restoration phases of emergency landside repair at the Avalon Canyon access road and again in 2005 following realignment of the upper portion of the road (Terra Engineers, 2015). Vegetation here is dominated by California sagebrush (*Artemisia californica*), with coyote brush, toyon, and bush monkeyflower (*Mimulus aurantiacus*) occurring as associates. Coastal scrub at Lake Merced and surrounding the Avalon Canyon access road supports a similar set of wildlife species as described above for landscaped areas, central dune scrub, and annual grasslands.

Willow Scrub

This vegetation community is present on the banks of South and Impound Lakes, forming dense thickets with a continuous canopy of native arroyo willow (*Salix lasiolepis*). Arroyo willow riparian scrub is typically adjacent and upslope from bulrush wetland or swamp knotweed wetland. Some willow scrub at Lake Merced occurs in wetlands and some is considered non-wetland riparian scrub. Additional native species, such as California blackberry (*Rubus ursinus*), California bulrush (*Schoenoplectus californicus*), swamp knotweed (*Persicaria amphibia*), bracken fern (*Pteridium aquilinum* var. *pubescens*), and California manroot (*Marah fabaceus*) are also present. Arroyo willow riparian scrub at Lake Merced is important habitat for migratory and resident birds, including Townsend's warbler (*Setophaga townsendi*), ruby-crowned kinglet (*Regulus calendula*), green heron (*Butorides virescens*), western kingbird (*Tyrannus verticalis*), and warbling vireo (*Vireo gilvus*).

Freshwater Marsh

Bulrush wetland is the most abundant wetland herbaceous vegetation type mapped at South Lake and Impound Lake and occurs at elevations that remain inundated all to most of the year. Bulrush wetland forms an emergent, almost continuous band along the lake margins. California bulrush is dominant, with swamp knotweed and scattered tule (*Schoenoplectus acutus* var. *occidentalis*) also present. Stinging nettle (*Urtica dioica* ssp. *holosericea*), Pacific rush (*Juncus effusus* var. *pacificus*), and Pacific oenanthe (*Oenanthe sarmentosa*) occur along the upland margins of bulrush wetlands.

Swamp knotweed wetland also occurs along the margins of the lakes, growing as emergent vegetation and often interspersed with bulrush wetland. Swamp knotweed is the dominant species in this community. Similar to bulrush wetlands, associates include California bulrush, stinging nettle, Pacific rush, and Pacific oenanthe. Swamp knotweed has a phenotypic plasticity that allows it to grow in a wide variety of conditions. Within the study area this species can be found in seasonally to permanently inundated wetlands and it also occurs in monotypic stands or mixed with California blackberry in adjacent habitats at higher elevations, where soils may be at least seasonally moist but are never inundated.

The freshwater marshes at Lake Merced support a diversity of wintering and breeding birds such as marsh wren (*Cistothorus palustris*), San Francisco common yellowthroat (*Geothlypis trichas sinuous*), red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), ruddy duck (*Oxyura jamaicensis*), and mallard (*Anas platyrhynchos*).

Open Water

Lake Merced

Lake Merced provides aquatic habitat for a variety of resident and seasonal wildlife, including native species such as double-crested cormorant (*Phalacrocorax auritus*), American coot (*Fulica americana*), great blue heron (*Ardea herodias*), grebe (*Podiceps* spp.), snowy egret (*Egretta thula*), and Sierran treefrog (*Pseudacris sierra*), as well as non-native red-eared slider (*Trachemys scripta elegans*) and several fish species discussed below. Rookeries supporting colonial nesting double-crested cormorant, heron and egret species occur around Lake Merced. Western pond turtle (*Emys marmorata*), a California species of special concern, has been observed in East Lake, and suitable habitat for this species is present throughout the greater lake system. Bank swallow (*Riparia riparia*), a California threatened species, forage insects over the Lake waters. California red-legged frog (*Rana draytonii*) was known to occur historically at Lake Merced, but the species is now considered extirpated from the lake based on a lack of recent sightings, survey results since 2000, and the presence of predators and competitors, such as American bullfrog (*Lithobates catesbeianus*) and red-eared slider (Jones and Stokes, 2007; SFPD, 2011).

Vista Grande Canal

Vista Grande Canal is a trapezoidal, man-made channel originally constructed over a century ago to capture and redirect stormwater and agricultural waters from Lake Merced. Historical maps show that the Canal was excavated in dry land and did not follow any natural drainage course or otherwise intersect natural tributaries or drainages. The channel bed and banks consist of bricks and cement. At the time of the reconnaissance survey the Canal consisted of open water with occasional unvegetated sediment deposits of silt and sand-sized grains. Mosses and trapped sediment provide a substrate on the banks for annual grasses and other opportunistic herbaceous species. The upper banks above the lined channel support annual grasses, non-native trees, and primarily horticultural shrubs. Few, if any species occurring are native riparian species and none are actually supported by water conveyed in the Canal. Trees and shrubs overhang the Canal in some areas, most of which are located on the Olympic Club Golf Course side of the Canal.

Although a few wetland species, such as cattail (*Typha latifolia*), bulrush (*Schoenoplectus* sp.), willow herb (*Epilobium* sp.), and rabbitsfoot grass (*Polypogon monspeliensis*) can colonize the sediment deposits in the Canal, sediment and wetland vegetation are likely to be scoured out each year by high flows in the Canal. The Canal offers marginal habitat to common wildlife that might be found in the Developed/Landscaped/Ruderal habitat, such as striped skunk, raccoon, and Norway rat (*Rattus norvegicus*). Birds of the greater Lake Merced area such as black phoebe (*Sayornis nigricans*) likely sally insects that occur over the low flowing water, and Pacific tree frog may also forage in the Canal.

Pacific Ocean and Intertidal Zone

The intertidal zone and the shore zone include the beach area exposed during the lowest low tide up to the start of terrestrial vegetation or bluff faces within the Project study area. This habitat supports amphipods, polychaetes (marine worms), and flies that provide food for shorebirds including the western snowy plover a federally threatened species and California species of special concern. Other shorebird species that frequent this habitat during migration or overwinter within the Project study area include sanderling (*Calidris alba*), willet (*Tringa semipalmata*), marbled godwit (*Limosa fedoa*), and whimbrel (*Numenius phaeopus*) (GFNMS, 2006).

Numerous species of waterbird occur in the open water marine and rocky intertidal habitats offshore of the Project study area. These species include a mix of migrant, wintering, and breeding species, such as surf scoter (*Melanitta perspicilllata*), black oyster catcher (*Haematopus bachmani*), red-throated loon (*Gavia stellata*), Pacific loon (*Gavia pacifica*), common murre (*Uria aalge*), western grebe (*Aechmophorus occidentalis*) and Clark's grebes (*A. clarkii*), and a variety of gulls and terns (GFNMS, 2006) (eBird, 2015b). Fish species such as English sole (*Pleuronectes vetulus*), speckled sand dab (*Citharichthys stigmaeus*), white croaker (*Genyonemus lineatus*), shiner surfperch (*Cymatogaster aggregate*), barred surfperch (*Amphistichus argenteus*), and striped bass (*Morone saxatilis*) are likely to use nearshore ocean waters adjacent the Project study area (McCormick, 1992). Dungeness crab (*Cancer magister*), California shrimp (*Crangon franciscorum*), blackspotted bay shrimp (*C. nigromaculata*), smooth bay shrimp (*Lissocrangon stylirostris*), sand dollar (*Dendraster excentricus*), and sand crab (*Emerita analoga*) are several invertebrates common to the local intertidal and shallow subtidal areas (McCormick, 1992). Marine mammals such as the common Pacific harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*), as well as the delisted Steller sea lion (*Eumetopias jubatus*) use nearshore waters and shorelines of the Project study area, including rocky, intertidal habitat; however, no haul-out sites are located within or nearby Project study area.

Aquatic Habitat and Lake Merced Fish Species

Lake Merced supports a wide range of native and non-native fish species. Throughout its history Lake Merced has undergone a number of changes in fish species composition due to changes in surrounding land use and vigorous management of its fisheries resources, including the establishment of a recreational fishery (EDAW, 2004). In general, native species such as rainbow trout are considered coldwater fish while the non-native species such as largemouth bass are warmwater species. Similarly, many species require relatively high DO concentrations while others are capable of utilizing very low-DO environments. Thus, the fish assemblage in Lake Merced would not occur naturally and is only present here due to decades of intensive management for recreational fishing. Although the total number of species known to have occurred in Lake Merced at one time or another varies somewhat among the authors of prior assessments, EDAW (2004) summarized confirmed species observations from sporadic sampling efforts over the period of 1939 through 1989 (**Table 3.4-2**). Of these, only seven were observed by Maristics in 2004 during a comprehensive biological survey of fish species present in Lake Merced (Maristics, 2007).

TABLE 3.4-2
CONFIRMED FISH SPECIES OCCURRENCES IN LAKE MERCED

Common Name	Scientific Name	Native	Present in 2004
Rainbow trout	*Oncorhynchus mykiss*	x	x
Kokanee	*Oncorhynchus nerka*	x	
Brook trout	*Salvelinus fontinalis*		
Brown trout	*Salmo trutta*		
Sacramento sucker	*Catostomus occidenotalis*	x	
Hitch	*Lavinoia exilicauda*	x	
Sacramento blackfish	*Orthodono microlepidotus*	x	x
Hardhead	*Mylopharodono conoocephalus*	x	
Tule perch	*Hysterocarpus traskii*	x	x
Prickly sculpin	*Cottus asper*	x	x
Threespine stickleback	*Gasterosteus aculeatus*	x	
Largemouth bass	*Micropterus salmoides*		x
Green sunfish	*Lepomis cyanoellus*		
Bluegill	*Lepomis macrochirus*		
Channel catfish	*Ictalurus punoctatus*		x
White catfish	*Ameiurus catus*		
Brown bullhead	*Ameiurus noebulosus*		
Black bullhead	*Ameiurus melas*		
Goldfish	*Carassius auratus*		
Common carp	*Cyprinous carpio*		x

SOURCE: EDAW, 2004; Maristics, Inc., 2007.

Based on the results of 2004 seining surveys, the Lake Merced fish assemblage is currently dominated by largemouth bass, Sacramento blackfish, and rainbow trout, while tule perch, common carp, and smaller native species such as sculpin also are present (Maristics, 2007). Many of the native species in Lake Merced also are present as a result of human-mediated introductions (described in detail below). Since much of the interest in Lake Merced is in recreational fishing, Maristics (2007) conducted creel surveys (i.e., angler polling) and determined that four species represented over 95 percent of the fish specifically targeted by anglers at Lake Merced. These are, in order of most frequently targeted by anglers, rainbow trout (48.3 percent targeted), largemouth bass (20.7 percent), common carp (19.5 percent), and channel catfish (6.9 percent). However, as described below, the habitat requirements among these species are quite different and the fish assemblage in Lake Merced would not occur naturally and only exists here due to decades of intensive management for recreational fishing. This presents a unique challenge regarding the application of water quality objectives (WQOs) for the protection of beneficial uses relating to a fisheries community whose species composition would not occur naturally. Based on documented fish assemblage and the species most targeted by anglers for recreational fishing, the habitat requirements for rainbow trout, largemouth, common carp, and channel catfish species are described below (summarized from ESA, 2015). The habitat requirements relating to water quality, foraging, vegetation, and water depth for these species overlap with and are generally representative of the requirements for other warm and cold water fish species and other aquatic wildlife in Lake Merced.

Rainbow Trout

Rainbow trout are native to California, but not to Lake Merced. They are essentially a freshwater stream-dwelling species requiring flowing water over gravel substrates for successful spawning. Although some rainbow trout populations occur naturally in lakes, such lake systems that have a self-sustaining population present a range of habitat types to support the requirements of the full species life-cycle. Adults migrate into tributary streams with suitable riffle habitat to spawn, and juveniles may subsequently migrate downstream to the lake to grow and mature following emergence and early life-stage rearing in stream habitat. Since Lake Merced has no tributaries with suitable reproductive habitat for trout, the existing population is not self-sustaining and is maintained entirely through a relatively extensive CDFW stocking program. CDFW stocks about 2,000 pounds of trout per month in North Lake at an average seize of about a half pound and 8 to 12 inches in length. A few additional fish plants occur throughout the year to coincide with community events and to reach CDFW’s distribution goals. South Lake has a much smaller distribution allotment and is only stocked once or twice per year, usually in the spring. Rainbow trout in Lake Merced are apparently quickly caught by anglers and cormorants (Maristics, 2007) and their populations likely fluctuate widely between stocking events.

Because habitat supporting the migratory, spawning, and early life-stage requirements of rainbow trout is entirely absent in Lake Merced, the only life-cycle stage Lake Merced supports is the juvenile and adult rearing life stage. Lake Merced contains several appropriate food items for rainbow trout, including mysid shrimp, cladoceran zooplankton, and small fish of other species (Maristics, 2007). A 1977 CDFW[3] fish diet study found that trout were feeding heavily on polychaete worms, mysid shrimp, and cladocerans (EDAW, 2004). Because polychaete worms are benthic invertebrates, their presence in the rainbow trout diet indicates that trout were feeding on the bottom of the Lake. Lake Merced DO levels are documented to regularly drop below 5 mg/L near lake bottom during periods of stratification (see Section 3.9, Hydrology and Water Quality). Concentrations under 5 mg/L are typically considered stressful with metabolic rate, swimming performance, and growth impaired, reducing overall survival (Barnhart, 1986; Bjornn and Reiser, 1991). However, rainbow trout have been documented to utilize habitat with

[3] The California Department of Fish and Game (CDFG) changed its name on January 1, 2013 to the California Department of Fish and Wildlife (CDFW). In this document, references to literature published by CDFW before Jan. 1, 2013, are cited as ‘CDFG, [year]’. The agency is otherwise referred to by its new name, CDFW.

potentially stressful (<5 mg/L) DO levels for temporary periods as a refuge from high-temperature areas (such as surface waters during summer months). The presence of polychaete worms in the rainbow trout diet demonstrates the ability of trout in Lake Merced to successfully utilize habitat with potentially stressful DO levels.

Largemouth Bass

Largemouth bass are native to the eastern United States where they typically occur in lakes with extensive shallow areas and submerged vegetation. Optimal conditions in lakes include extensive areas (25 percent of surface area or more) that are less than 18 feet deep to support extensive emergent vegetation, and approximately 40 to 60 percent of surface area with depths greater than 18 feet to provide optimal overwintering habitat in northern latitudes. South Lake is currently approximately 23 feet deep and therefore provides suitable overwintering conditions for bass. However, due to the steepness of the banks, shallow areas supporting emergent vegetation are relatively sparse. Adult bass are most abundant in areas with vegetation and other forms of cover such as tree trunks, brush, or large boulders. Conditions are optimal for adults when 40 to 60 percent of the littoral area[4] has some form of cover and for fry when the littoral area has 45 to 80 percent cover. Excessive cover reduces the quality spawning and rearing habitat. In Lake Merced, cover in the littoral zone is limited. Where present, cover consists of thick stands of tules (*Scirpus* sp.) with nearly 100 percent coverage. Only the edge of the tule stands provides good cover conditions for adults, while some less dense areas may provide good cover for fry (EDAW, 2004). Estimates of useable cover in the littoral area of Lake Merced in 2004 ranged from about 5 percent for adults to about 10 percent for fry (EDAW, 2004). Adults and juveniles prefer shallow water near beds of aquatic plants for foraging where they hunt by day with a peak of activity at dusk. Soon after hatching, the larvae feed on rotifers and zooplankton changing to aquatic insects and other fish, including their own species, as they get older.

Common Carp

The common carp is a native species of Asia, but is currently found in all 48 contiguous states. Carp thrive in reservoirs, lakes, bayous, estuaries, farm ponds, and sewage lagoons (Edwards and Twomey, 1982). In lacustrine habitats, adults are usually found in association with abundant vegetation. Waters with a diversity of both shallow and deep areas represent optimum habitat (Edwards and Twomey, 1982). Carp generally spawn in spring, but in warmer southern climates, spawning can occur from March to June, and in cooler northern climates, from May to June (Edwards and Twomey, 1982). Adults congregate and deposit their adhesive eggs on aquatic or submerged terrestrial vegetation or any other object the eggs can adhere to. A self-sustaining population of carp spawns within the dense tule stands in Lake Merced in the spring (Maristics, 2004). Adult carp are opportunistic feeders which are able to utilize any available food source. Fry initially feed on zooplankton, but feed on phytoplankton when zooplankton density is low. As the young fish grow, they feed on littoral fauna and later on bottom fauna, taking in worms and larvae of aquatic insects as well as vegetable food, such as seeds, algae, and detritus.

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[4] The littoral zone is the near-shore area where sunlight penetrates all the way to the sediment and allows aquatic plants to grow.

Channel Catfish

Channel catfish are native to the Mississippi River basin. They have been widely introduced in other areas in the United States and have established populations in most Pacific coast drainages. Optimum lake habitat is characterized by large surface area, warm temperatures, high productivity, low to moderate turbidity, and abundant cover. Littoral areas (less than 15 feet deep) composing at least 20 percent of the Lake surface, and with at least 40 percent suitable cover, are considered to provide adequate area for spawning, fry and juvenile rearing, and feeding habitat for channel catfish. Spawning occurs in late spring and early summer when temperature reaches about 21 °C (70 °F). Adult channel catfish are opportunistic feeders on terrestrial and aquatic insects, detritus and plants, crayfish, mollusks, and fish.

Lake Merced Existing Aquatic Habitat Conditions

When comparing the habitat requirements and tolerance ranges of the present fishery to existing physical and water quality conditions within the Lake, it is evident that the Lake provides suitable conditions that are within the water quality tolerance range for many species, but does not provide optimal conditions for any of the primary recreational target species (described above). Existing water quality conditions are described in detail in Section 3.9, Hydrology and Water Quality and form the basis for the following description of existing fishery habitat suitability within the context of the differing requirements of the primary recreational target species with regard to water temperature, DO, and pH.

Temperature. Temperature data collected from August 2011 to January 2013 (ESA, 2015) indicate that minimum winter water temperatures are approximately 8.5 °C (47 °F) (measured in bottom waters) while peak summer temperatures may reach up to about 22 °C (72 °F) in waters near the surface. From approximately mid-October through mid-April, the Lake is well mixed with a relatively uniform temperature profile throughout the water column that ranges from about 9 °C to 18 °C. From late spring through early fall, however, rising air temperatures and solar radiation initiate stratification (see Section 3.9, Hydrology and Water Quality) when the surface layers of the Lake are warmed by the sun. Seasonal average surface temperatures in the summer are 19.4 °C (67 °F). In June and July, surface water temperatures regularly exceed 20 °C. Temperatures less than 20 °C generally persist within the mid and lower depth water column below 10- to 15-foot depths. Wind-driven mixing of the water column periodically disturbs this stratification. Data collected from August to November in 2011 show that complete mixing of the epilimnion and hypolimnion occurred on average every 9 to 11 days during the fall.

Water temperatures between October and April are well within the temperature preference range of coldwater species such as rainbow trout. The conditions during summer months are within the tolerance range for rainbow trout, especially when considering the differences in temperature at different water depths. Thus, Lake Merced water temperatures are generally suitable for rainbow trout juvenile and adult rearing during most of the year throughout the water column, but summer maximum temperatures may at times create temporarily reduced growth conditions for the species in surface waters. Average water temperatures in Lake Merced are at the lower end of the preference range of warmwater species such as largemouth bass and channel catfish. Although these species are able to maintain self-sustaining populations under existing conditions, reproductive success and growth are likely limited by cool water temperatures in Lake Merced.

Dissolved Oxygen. Continuous (hourly) DO monitoring data collected from August 2011 to January 2013 indicate that from November through March, when cooler air temperatures prevail and the Lake is continually well mixed from top to bottom, DO levels average well above 7 mg/L. These levels are adequate for the range of cold and warmwater fish species present in Lake Merced, including rainbow trout. However, starting in April and continuing through October when stratification occurs, DO levels in the hypolimnion (the lower, colder layer of water in the lake) periodically fall below 5 mg/L. During this period, rainbow trout and largemouth bass likely avoid the hypolimnion, unless utilizing the lower waters as temporary foraging habitat or as a coldwater temperature refugia. Channel catfish and common carp, on the other hand, may continue to utilize the hypolimnion during these periods due to their tolerance for lower DO levels, but growth and productivity of these species are likely periodically reduced at DO levels below 5 mg/L.

pH. Under baseline conditions, Lake Merced has an elevated pH range, particularly in surface waters where sunlight fuels algal growth. The pH level frequently peaks above 8.5 during sunny afternoons as a result of algal photosynthesis; however, the actual pH value reached is significantly influenced by the background pH level, which is dependent upon the alkalinity or abundance of alkaline minerals in the water. As described above, a pH range of 6.5 to 8.5 is considered optimal for most freshwater fish species and aquatic wildlife, and levels above 9.0 are considered stressful. However, the majority of elevated pH (i.e., greater than 8.5) levels occur in the upper layer of the water column, and fish are able to move into more favorable pH levels in the mid- to lower depths, depending on DO and temperature conditions and species-specific tolerance ranges. More importantly, fish are able to acclimate to many environmental variables, including pH, that may be considered at the upper or lower tolerance range limits. A review of the hourly pH data collected at Lake Merced from August 2011 to January 2013 indicates (a) that pH increases to levels above 9.0 are infrequent and gradual, and (b) that pH levels do not generally increase above the 9.3 level to which rainbow trout can acclimate fairly rapidly. Although similar analyses are not available for the other three primary angler-target species in the Lake (largemouth bass, common carp, channel catfish), these species are generally more tolerant of water quality perturbations than rainbow trout, and it is likely that these species can similarly acclimate to occasional gradual pH increases in Lake Merced, as evidenced by their ability to maintain self-sustaining populations in the Lake.

3.4.1.4 Sensitive Natural Communities

A sensitive natural community is a biological community that is regionally rare, provides important habitat opportunities for wildlife, is structurally complex, or is in other ways of special concern to local, state, or federal agencies. Most sensitive natural communities are given special consideration because they perform important ecological functions, such as maintaining water quality and providing essential habitat for plants and wildlife. Some plant communities support a unique or diverse assemblage of plant species and therefore are considered sensitive from a botanical standpoint. The most current version of the CDFW's *List of California Terrestrial Natural Communities* (CDFG, 2010) indicates which natural communities are of special status given the current state of the California classification. The CDFW formerly tracked sensitive natural communities in the CNDDB. Due to funding cuts no new occurrences of sensitive natural communities have been added to the CNDDB since the mid-1990s, although the database continues to include those occurrences recorded prior to the program getting defunded. The CNDDB reports no sensitive natural community occurrences for the two-quadrangle area containing and surrounding the study area (CNDDB, 2016). However, central dune scrub, found at several locations within the Project study area at Lake Merced, Fort Funston, and Avalon Canyon access road, is considered to be a sensitive natural community due to its limited distribution in the state and the diversity of special-status plant species that often occur there. The state rarity ranking for central dune scrub is S2.2: threatened natural community covering a total area of 2,000 to 10,000 acres in California.

The SFRPD has identified Significant Natural Resource Areas, which are fragments of unique plant and animal habitats within San Francisco and Pacifica that have been preserved within SFRPD-managed parks. The SFRPD identified approximately 395 of Lake Merced's 614 acres as a Significant Natural Resource Area. This acreage generally encompasses the lake waters, the bordering freshwater marsh wetland, and upland vegetation. This area includes double-crested cormorant rookeries; several areas that support sensitive plant species; Impound Lake and its associated wetlands; tule marsh around East, North, and South Lakes; the water of East Lake, which supports western pond turtles; the habitat between the marshes and the Significant Natural Resource Area boundary; urban forests; and North and South Lakes (SFPD, 2011). The Significant Natural Areas Management Plan has not yet been approved. However, most of the resources designated as such are also considered sensitive by regulatory agencies, such as CDFW, the California Coastal Commission (CCC), and the U.S. Army Corps of Engineers (Corps) and are afforded protections under federal and state regulations and policies (see Section 3.4.2, below).

3.4.1.5 Wetlands and Other Jurisdictional Waters

Wetlands are ecologically complex habitats that support a variety of both plant and animal life. Section 404 of the Clean Water Act defines wetlands for purposes of federal jurisdiction as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support (and do support, under normal circumstances) a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3[b] and 40 CFR 230.3). Under normal circumstances, the federal definition of wetlands requires three wetland identification parameters be present: wetland hydrology, hydric soils, and hydrophytic vegetation. Examples of federally jurisdictional wetlands include freshwater marsh, seasonal wetlands, and vernal pool complexes that have a hydrologic link to other waters of the U.S. (see definition below for "other waters of the U.S."). The Corps is the responsible agency for regulating wetlands under Section 404 of the Clean Water Act, while the U.S. Environmental Protection Agency (USEPA) has overall responsibility for the Act. The Regional Water Quality Control Board (RWQCB) regulates federally jurisdictional wetlands under Section 401 of the Clean Water Act. The RWQCB also has regulatory authority over wetlands, including those that are "isolated" and therefore not considered federally jurisdictional, under California's Porter-Cologne Water Quality Control Act. The CDFW does not normally have direct jurisdiction over wetlands unless they are subject to jurisdiction under Section 1600 of the California Fish and Game Code as regulated under Lake or

Streambed Alteration Agreements (LSAA), or they support state-listed endangered species; however, CDFW has trust responsibility for wildlife and habitats pursuant to California law. The CCC, or any local municipality with regulatory authority as delegated by the CCC, protects biological resources such as wetlands through a permitting process, to ensure compliance with the California Coastal Act for all projects in the coastal zone. It should be noted that most state laws protecting wetlands do not necessarily require all three identification parameters for wetlands, as cited for the federal Clean Water Act requirements above (see 3.4.2.2 for state definitions of wetlands); some state laws only require the presence of a single wetland identification parameter for a waterbody to be considered a wetland.[5]

In addition to wetlands, other waterbodies and features are regulated under federal and state law. "Other waters of the U.S." refers to those aquatic features that are regulated by the Clean Water Act but are not wetlands, and are defined under the Clean Water Act at 33 CFR 328.4. Examples of "other waters of the U.S." include rivers, creeks, intermittent and ephemeral channels, ponds, lakes, and the ocean. Waters of the State of California are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state" (California Water Code §13050(e)) and include all federally jurisdictional waters. Waters of the State are broadly construed to include both public and private waters in natural and artificial channels (SWRCB, 2008).

Daly City's environmental consultant (ESA) conducted a formal wetland delineation for federally jurisdictional wetlands and waters in November and December of 2012 (ESA, 2014). The field delineation identified and documented all potentially jurisdictional wetlands and other waters of the U.S. within the delineation study area. This wetland delineation found that within the study area, potential federally jurisdictional features include: Lake Merced, a freshwater lake used for recreational fishing and boating and thus, a Traditionally Navigable Water (TNW), and its adjacent wetlands; Vista Grande Canal, a man-made, brick-lined channel constructed in dry land to capture and divert perennial stormwater and authorized non-storm water flows to the Vista Grande Tunnel and out to the Pacific Ocean (a TNW); and the Pacific Ocean below the high tide line (HTL) at Fort Funston. The federal wetland delineation has not yet been verified by the Corps and should be considered preliminary until verification in writing is received from the Corps.

These potentially federally jurisdictional features may also be considered waters of the state and subject to regulations of the RWQCB, CDFW, and CCC, as described above. Because the state definition of wetlands requires only the presence of wetland vegetation (in contrast to federal jurisdictional wetlands which require indications of wetland vegetation, soils, and hydrology), the extent of state jurisdiction on the Lake Merced shoreline includes all of the federal jurisdictional wetlands, and extends further upslope. Thus, the area of state wetlands is substantially larger than federal wetlands, by as much as 40 to 50 percent.

[5] While no federal or state-regulated wetlands occur within the Fort Funston portion of the study area, it is noted that NPS is responsible for the protection of park wetland resources as required under Executive Order (E.O.) 11990 which established protection of wetlands and riparian systems as the official policy of the federal government.

3.4.1.6 Wildlife Movement Corridors

Wildlife movement corridors are considered an important ecological resource by CDFW and USFWS and under CEQA and NEPA. Movement corridors may provide favorable locations for wildlife to travel between different habitat areas such as foraging sites, breeding sites, cover areas, and preferred summer and winter range locations. They may also function as dispersal corridors allowing animals to move between various locations within their range. Topography and other natural factors, in combination with urbanization, can fragment or separate large open-space areas. Areas of human disturbance or urban development can fragment wildlife habitats and impede wildlife movement between areas of suitable habitat. This fragmentation creates isolated "islands" of vegetation that may not provide sufficient area to accommodate sustainable populations, and can adversely affect genetic and species diversity. Movement corridors mitigate the effects of this fragmentation by allowing animals to move between remaining habitats, which in turn allows depleted populations to be replenished and promotes genetic exchange between separate populations.

The San Francisco Peninsula is an important migratory stopover for birds along the Pacific Flyway, one of the four major migratory routes in North America. Raptors, songbirds, shorebirds and waterfowl stop to forage and rest during their fall and spring migrations in suitable habitat along this route such as Golden Gate Park, the Presidio, Mount Sutro, Lake Merced, and coastal beaches. While the San Francisco Peninsula's location on the Pacific Flyway allows open spaces to host transient individuals, it does not constitute a wildlife movement corridor as these areas are isolated within an otherwise densely developed urban environment. Contiguous beaches along the western fringe of the San Francisco peninsula could serve as a coastal corridor for wildlife movement between open space habitats connected to the coast, such as Lands End and the nearby western terminus of Golden Gate Park. Within the Project study area, the beach below Fort Funston could be considered a part of this coastal corridor; however, other open space areas connected to the coast within close proximity to Fort Funston provide marginal or limited habitat value for wildlife as urban (mainly residential) development generally abuts the narrow coastline. This may limit wildlife traffic within the study area to species using the intertidal and beach shoreline habitat, mainly a variety of shorebirds that forage in these environments.

3.4.1.7 Special-Status Species

A number of species known to occur in the study are protected pursuant to federal and/or state endangered species laws, or have been designated species of special concern by the CDFW. In addition, Section 15380(b) of the CEQA Guidelines provides a definition of rare, endangered, or threatened species that are not currently included in an agency listing, but whose "survival and reproduction in the wild are in immediate jeopardy" (endangered) or which are "in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens" or "is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and may be considered 'threatened' as that term is used in the federal Endangered Species Act."[6] Species recognized under these terms are collectively referred to as "special-status species." For the purpose of this EIR/EIS, special-status species include:

1. Species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.12 [listed plants], 17.11 [listed animals], and various notices in the Federal Register [FR] [proposed species]);

2. Species that are candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (61 FR 40, February 28, 1996);

3. Species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 Cal. Code Regs. 670.5);

4. Species formerly designated by the USFWS as species of concern or species designated by the CDFW as species of special concern;[7]

5. Species designated as "special animals" by the state;[8]

6. Species designated as "fully protected" by the state (there are about 35, most of which are also listed as either endangered or threatened);[9]

7. Raptors (birds of prey), which are specifically protected by California Fish and Game Code Section 3503.5, thus prohibiting the take, possession, or killing of raptors and owls, their nests, and their eggs;[10]

8. Plants listed as rare or endangered under the California Native Plant Protection Act (California Fish and Game Code, Section 1900 et seq.);

9. Species that meet the definitions of rare and endangered under CEQA. CEQA Section 15380 provides that a plant or animal species may be treated as "rare or endangered" even if not on one of the official lists (CEQA Guidelines, Section 15380); and

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6 For example, the CDFW interprets Ranks 1A, 1B, 2A, and 2B of the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California* to consist of plants that, in a majority of cases, would qualify for listing as rare, threatened, or endangered. However, the determination as to whether an impact is significant is made by the lead agency, absent the protection of other laws.

7 A California species of special concern is one that: has been extirpated from the state; meets the state definition of threatened or endangered but has not been formally listed; is undergoing or has experienced serious population declines or range restrictions that put it at risk of becoming threatened or endangered; and/or has naturally small populations susceptible to high risk from any factor that could lead to declines that would qualify it for threatened or endangered status.

8 Species listed on the current CDFW "special animals" list (October 2015), which includes 905 species. This list includes species that CDFW considers "those of greatest conservation need." (CDFW, 2015a)

9 The "fully protected" classification was California's initial effort in the 1960s to identify and provide additional protection to those animals that were rare or faced possible extinction. The designation can be found in the Fish and Game Code.

10 The inclusion of birds protected by Fish and Game Code Section 3503.5 is in recognition of the fact that these birds are substantially less common in California than most other birds, having lost much of their habitat to development, and that the populations of these species are therefore substantially more vulnerable to further loss of habitat and to interference with nesting and breeding than most other birds. It is noted that a number of raptors and owls are already specifically listed as threatened or endangered by State and federal wildlife authorities.

10. Plants considered by the CNPS to be “rare, threatened or endangered in California” under the California Rare Plant Ranking system (CNPR) which include Rank 1A, 1B, 2A, and 2B as well as Rank 3 and 4[11] plant species.

Lists of special-status plant and animal species that have the potential to occur within the study area for biological resources were compiled based on data contained in the CNDDB (CNDDB, 2016), the USFWS list of Federal Endangered and Threatened Species that Occur in or may be Affected by the proposed project (USFWS, 2016), and the CNPS Inventory of Rare and Endangered Plants (CNPS, 2015a) for the North San Francisco and South San Francisco U.S. Geological Survey 7.5 minute topographical quadrangles. Several species not included on these lists are also discussed based on documentation of their presence in the study area presented in prior reports or environmental literature. Locally significant plants are incorporated based on a list produced by the Yerba Buena Chapter of CNPS (CNPS, 2015b). **Table 1**, **Special-Status Plant Species**, and **Table 2**, **Special-Status Animal Species**, in **Appendix D**, present the special-status species, their status, their habitat requirements, and plant blooming periods, and considers the potential for each species to occur within the study area. **Figure 3.4-3** identifies the locations of regional special-status species occurrences as reported in CNDDB.

Based on review of the biological literature of the region, information presented in previous environmental documentation, and an evaluation of the habitat conditions of the study area, a species was designated as “absent” if: (1) the species’ specific habitat requirements (e.g., serpentine grasslands, as opposed to grasslands occurring on other soils) are not present, or (2) the species is presumed, based on the best scientific information available, to be extirpated from the project area or region. A species was designated as having a “low potential” for occurrence if: (1) its known current distribution or range is outside of the study area or (2) only limited or marginally suitable habitat is present within the study area. A species was designated as having a “moderate potential” for occurrence if: (1) there is low to moderate quality habitat present within the study area or immediately adjacent areas or (2) the study area is within the known range of the species, even though the species was not observed during biological surveys. A species was designated as having a “high potential” for occurrence if: (1) moderate to high quality habitat is present within the study area, and (2) the study area is within the known range of the species. Many of the species listed in Tables 1 and 2 in **Appendix D** have only a low potential for occurrence or are absent from the study area and were eliminated from further evaluation, primarily because the study area does not provide suitable habitat for them.

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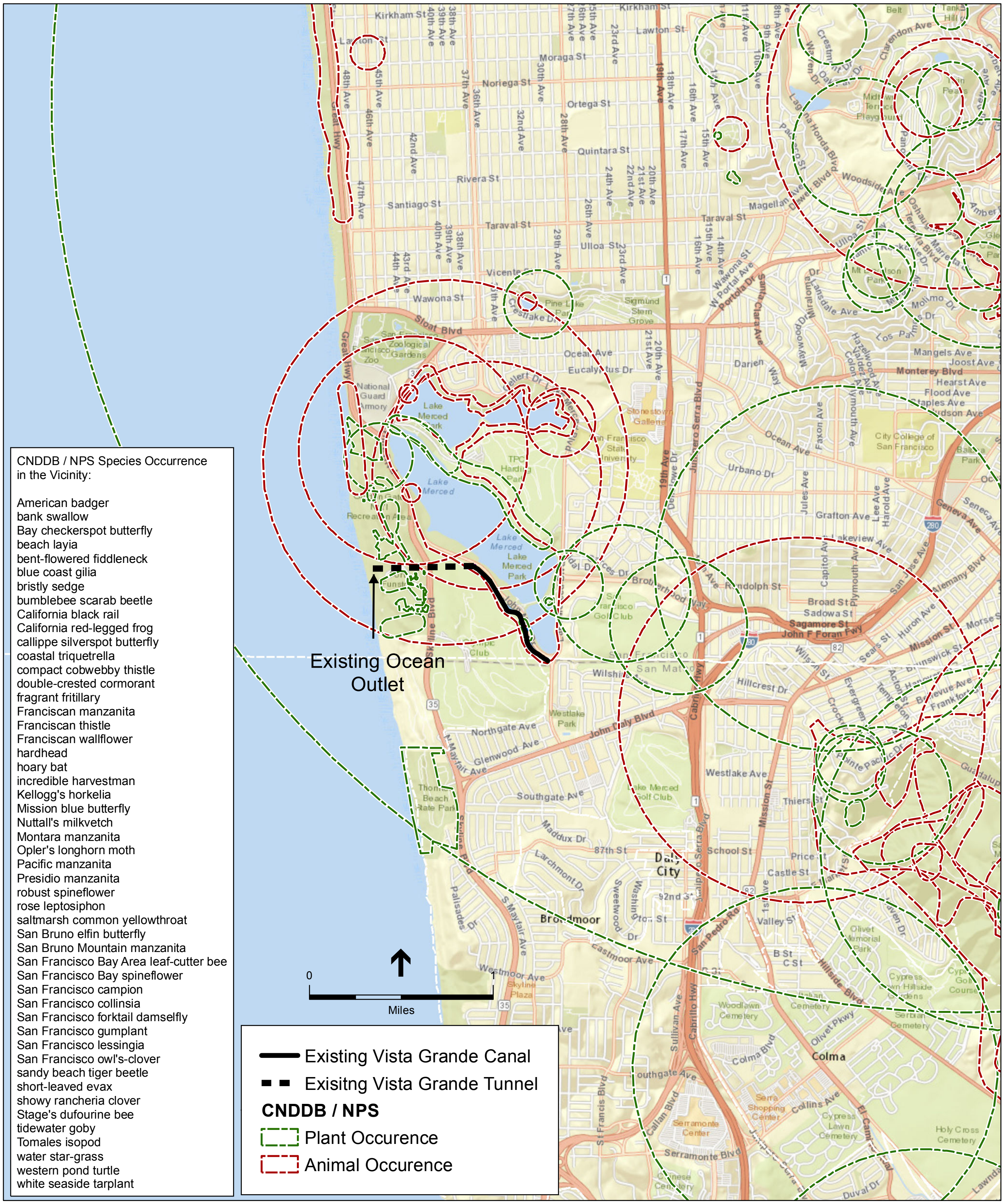
[11] Rank 3 plants may be analyzed under CEQA Guidelines Section 15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a Rank 4 plant are significant even if individual project impacts are not. CRPR Rank 3 and 4 may be considered regionally significant if, e.g., the occurrence is located at the periphery of the species’ range, or exhibits unusual morphology, or occurs in an unusual habitat/substrate. For these reasons, CRPR Rank 3 and 4 plants should be included in the special-status species analysis. Rank 3 and 4 plants are also included in the CNDDB Special Vascular Plants, Bryophytes, and Lichens List. The current online published list is available at: http://www.dfg.ca.gov/biogeodata (CDFW, 2015b).



SOURCE: CDFW, 2014; NPS, 2015

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.4-3
Special-Status Species in the Regional Project Study Area

Special-Status Plants

Most of the special-status plant species listed in Table 1 in Appendix D are considered to have a low potential to occur in the study area due to the absence of suitable habitat. Several special-status plant species were determined to have a moderate or high potential to occur in the study area due to the presence of suitable habitat, the presence of nearby populations, or existing or previously documented populations within the study area. Numerous populations of two special-status plants, San Francisco spineflower (*Chorizanthe cuspidata* var. *cuspidata*) and San Francisco wallflower (*Erysimum franciscanum*) were observed during the June 4, 2015 reconnaissance survey in areas adjacent to the proposed staging area at Fort Funston. No special-status plant species were observed during the previous February 5, 2014 biological resources reconnaissance survey of the Project study area, although this reconnaissance survey did not constitute a protocol-level[12] botanical survey of the study area. The following special-status plant species were determined to be present or have at least a moderate potential to occur in the study area:

- Franciscan onion
- Bent-flowered fiddleneck
- Coast rockcress
- Johnny-nip
- San Francisco spineflower
- Franciscan thistle
- Compact cobwebby thistle
- San Francisco wallflower
- Blue coast gilia
- San Francisco gumplant
- Short-leaved evax
- Kellogg's horkelia
- Rose leptosiphon
- Marsh microseris
- Oregon polemonium
- Coastal triquetrella
- Locally significant species

Each of these species was determined to have at least a moderate potential to occur in the coastal scrub or central dune scrub communities that occur along the Avalon Canyon access road. Extensive landslide activity has required the topography of the canyon to be completely graded and restored with native coastal scrub vegetation in 2000 and 2005. While this restoration effort is relatively recent, the community has matured into a prime example of coastal scrub habitat that could support special-status plants introduced as seeds through natural means (e.g., wind or animal transport).

Franciscan onion (*Allium peninsulare* var. *franciscanum*)

Franciscan onion is a CRPR rank 1B.2 perennial bulbiferous herb that occurs on clay, volcanic, or serpentine substrates on dry hillsides in grasslands and woodlands. This species is known sporadically from Mendocino County south to Santa Clara County. It is threatened by development, foot traffic, non-native plants, and trail maintenance. Franciscan onion has a moderate potential to occur in vegetation along Avalon Canyon access road. This species blooms from May to June.

[12] "Protocol-level" botanical surveys denote surveys conducted according to methodology described in the 2009 California Department of Fish and Game (CDFG) guidance document, *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities.*

Bent-flowered fiddleneck (*Amsinckia lunaris*)

Bent-flowered fiddleneck is a CRPR rank 1B.2 annual herb that occurs on gravelly slopes and in grassland, coastal bluff scrub, and woodland openings, often on serpentine substrates. The distribution of this species covers the north coast range, the southwest Sacramento Valley, the central coast, and the San Francisco Bay Area. This species has a moderate potential to occur in the coastal scrub community along Avalon Canyon access road. Bent flowered fiddleneck flowers from March to June.

Coast rockcress (*Arabis blepharophylla*)

Coast rockcress is a CRPR rank 4.3 perennial herb that occurs in rocky soils in upland broadleaved forests, coastal bluff scrub, coastal prairie, and coastal scrub. It is endemic to California, occurring mostly in the San Francisco Bay Area and nearby low-elevations of the California Coast Ranges. Suitable habitat for coast rockcress is present in areas of coastal scrub along Avalon Canyon access road where this species has a moderate potential to occur. Coast rockcress flowers between February and May.

Johnny-nip (*Castilleja ambigua* var. *ambigua*)

Johnny-nip is a CRPR rank 4.2 annual herb that occurs in moist soils in grasslands, coastal bluff scrub, and the margins of wetlands. The southern extent of the range of this species is Santa Cruz County and the range extends north along the west coast of the U.S. Johnny-nip has a moderate potential to occur in areas of coastal scrub along Avalon Canyon access road and at Lake Merced, though previous surveys of the lake have not documented this species. Johnny-nip flowers between March and August.

San Francisco spineflower (*Chorizanthe cuspidata* var. *cuspidata*)

San Francisco spineflower is a CRPR rank 1B.1 annual herb that occurs in northern coastal scrub communities and coastal dune habitats. It is known to occur in isolated locations around Impound Lake (Nomad, 2011) and robust populations are present within Fort Funston to the south of the proposed staging area as identified during ESA's June 2015 reconnaissance survey. Suitable coastal scrub and dune habitat that could support this species is present within the Project site at the proposed discharge structure at Impound Lake, along the Avalon Canyon access road, and south of the proposed Fort Funston staging area. San Francisco Bay spineflower flowers between April and June.

Franciscan thistle (*Cirsium andrewsii*)

Franciscan thistle is a CRPR rank 1B.2 perennial thistle that grows on bluffs, ravines, and seeps within coastal scrub and coastal prairie, sometimes on serpentine substrates. The distribution of this species covers the central coast and north coast of California with the majority of populations occurring in Marin and Sonoma Counties. Several occurrences from San Francisco County exist including Montara Mountain and Lake Merced. Suitable habitat for this species is present in the coastal scrub and seeps along Avalon Canyon access road and around Lake Merced where this species has a moderate potential to occur. Records from Lake Merced are dated 1933 and precise location data is not given. Franciscan thistle flowers between March and July.

Compact cobwebby thistle (*Cirsium occidentale* var. *compactum*)

Compact cobwebby thistle is a CRPR rank 1B.2 perennial thistle that grows on bluffs in chaparral, coastal dunes, coastal scrub, or coastal prairie. Its distribution covers the central coast from San Luis Obispo to Monterey. Compact cobwebby thistle has a moderate potential to occur in the study area. One record from Ocean View in San Francisco County exists, but this population is not presumed extant. This species is formerly known to Lake Merced where suitable habitat persists; suitable habitat is also found in coastal scrub and central due scrub communities of Avalon Canyon access road and Fort Funston. Compact cobwebby thistle flowers from April to June.

San Francisco wallflower (*Erysimum franciscanum*)

San Francisco wallflower is a CRPR rank 4.2 perennial herb and a locally rare species (discussed further below) that occurs in coastal strand, valley grassland, northern coastal scrub and coastal dunes. It is endemic to California, occurring mostly in the San Francisco Bay Area, and has an affinity for serpentine soils. A known population of San Francisco wallflower is present on the northeastern slope of Impound Lake (Nomad, 2011) and suitable habitat for this species is occurs at the Impound Lake discharge structure worksite. Populations were identified to the south of the proposed Fort Funston staging area during ESA's June 4, 2015 reconnaissance survey and suitable habitat for this species is present along the Avalon Canyon access road. San Francisco wallflower flowers between March and June.

Blue coast gilia (*Gilia capitata* ssp. *chamissonis*)

Blue coast gilia is a CRPR rank 1B.1 annual herb that occurs in northern coastal scrub communities and coastal dune habitats. A single population is documented at Impound Lake (Nomad, 2011) and multiple populations have been identified within the northern extent of Fort Funston and near the nursery (GGNRA, 2013). Suitable coastal scrub and dune habitat that could support this species is present within the Project site at the proposed discharge structure at Impound Lake, along the Avalon Canyon access road, and to the south of the proposed Fort Funston staging area; this species has a moderate potential to occur in such habitat at these locations. Blue coast gilia flowers between April and July.

San Francisco gumplant (*Grindelia hirsutula* var. *maritima*)

San Francisco gumplant is a CRPR rank 3.2 plant that occurs on sandy, clay, or serpentine slopes in coastal bluff scrub, coastal scrub, and grasslands. The distribution of San Francisco gumplant extends from San Luis Obispo in the south to coastal Sonoma County in the north. Historic collections were made at Lake Merced in 1895 (GH417653[13]) and near the Olympic Club Golf Course in 1927 (RSA17974[14]) in the Project vicinity. San Francisco gumplant was documented at Fort Funston in the Project vicinity in 2011 where suitable habitat persists (GGNRA, 2013). Suitable habitat is also present along the Avalon Canyon access road. This species has a moderate potential to occur at these locations within the Project study area. San Francisco gumplant flowers June to September.

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[13] Herbarium collection Specimen ID as reported in the Consortium of California Herbaria database (CCH, 2014a).
[14] Herbarium collection Specimen ID as reported in the Consortium of California Herbaria database (CCH, 2014b).

Short-leaved evax (*Hesperevax sparsiflora* var. *brevifolia*)

Short-leaved evax is a CRPR rank 1B.2 annual herb that occurs on sandy coastal bluffs, terraces, or dunes in coastal bluff scrub, dunes, or coastal prairie. Short-leaved evax is found mainly along the north coast of California in the vicinity of Fort Bragg, although a couple of records are present for the Santa Cruz area. This plant is not recorded in the Project vicinity; however, suitable habitat may be present in the central dune scrub at Fort Funston and along Avalon Canyon access road. Suitable habitat for this species is present at Lake Merced however it is not historically known to the area. This species has a moderate potential to occur at these locations within the Project study area. Short-leaved evax flowers between March and June.

Kellogg's horkelia *(Horkelia cuneata* ssp. *sericea)*

Kellogg's horkelia is a CRPR rank 1B.1 perennial herb that occurs on old dunes and coastal sandhills in chaparral, coastal dunes, and coastal scrub communities. Only one population is known to occur in the San Francisco Bay Area in the Crocker Hills area; however, the distribution of Kellogg's horkelia extends along the coast from Santa Barbara in the south to Point Reyes in the north. Historic records are present from 1895 (GH345633) and 1912 (UC185376) in the Lake Merced area. Suitable habitat for this species persists at Lake Merced and also is present at Fort Funston and along Avalon Canyon access road. This species has a moderate potential to occur at these locations within the Project study area. Kellogg's horkelia flowers between April and September.

Rose leptosiphon (*Leptosiphon rosaceus*)

Rose leptosiphon is a CRPR rank 1B.1 annual herb that occurs on open, grassy slopes and coastal bluffs in coastal bluff scrub. It is known from very few populations along the coast from Santa Clara County in the south to Sonoma County in the north. This species is possibly threatened by competition and non-native plants. Suitable habitat for rose leptosiphon is present along the Avalon Canyon access road where this species has a moderate potential to occur. Rose leptosiphon flowers between April and July.

Marsh microseris (*Microseris paludosa*)

Marsh microseris is a CRPR rank 1B.2 perennial herb that occurs in moist grassland and open woodland communities. The distribution of this species extends along the coast and just inland of the coast from San Luis Obispo in the south to Fort Bragg in the north. There are several historic records of marsh microseris from the San Francisco Presidio. Open wetland and grassland areas along the margin of Lake Merced potentially support suitable habitat for this species. Avalon Canyon access road also provides potentially suitable habitat. This species has a moderate potential to occur at these locations within the Project study area. Marsh microseris flowers between April and July.

Oregon polemonium (*Polemonium carneum*)

Oregon polemonium is a CRPR rank 2B.2 perennial herb that occurs in moist to dry open areas in coastal scrub or coastal prairie. The southern extent of the range of this species is San Mateo County and the range extends north along the coast and further inland at the north end of the state. Suitable habitat for Oregon polemonium occurs in areas coastal scrub at Fort Funston and along Avalon Canyon access road; suitable habitat also occurs at Lake Merced however it is not historically known to the area. This species has a moderate potential to occur at these locations within the Project study area. Oregon polemonium flowers between April and September.

San Francisco campion (*Silene verecunda*)

San Francisco campion is a CRPR rank 1B.2 perennial herb that occurs in coastal prairie, chaparral, northern coastal scrub, and valley grasslands of the San Francisco peninsula and the coast north of Santa Cruz. San Francisco campion was previously identified at Fort Funston in 2009 though not near the proposed Project staging area. Suitable habitat for this species is present along Avalon Canyon access road where this species has a moderate potential to occur. San Francisco campion flowers between March and June.

Coastal triquetrella (*Triquetrella californica*)

Coastal triquetrella is a CRPR rank 1B.2 moss that occurs in coastal scrub or coastal bluff scrub. In California this moss is known from fewer than 10 small coastal occurrences, most of which are located in the San Francisco Bay Area. Potentially suitable habitat for this species is present along Avalon Canyon access road where this species has a moderate potential to occur.

Locally rare species

Several species designated as locally rare by the Yerba Buena Chapter of the CNPS are also found within the Project study area. The following species have been documented in areas of dune scrub or coastal dune scrub in the Lake Merced Watershed: dune tansy (*Tanacetum bipinnatum*), San Francisco wallflower (described above), California pipevine (*Aristolochia californica*), Wight's paintbrush (*Castilleja wightii*), Vancouver rye (*Elymus* x *vancouverensis*), wild cucumber (*Marah oreganus*), canyon live oak (*Quercus chrysolepis*), coastal black gooseberry (*Ribes divaricatum*), and thimbleberry (*Rubus parviflorus*). Some of these species, such as San Francisco wallflower and dune tansy, have been documented at Fort Funston (Forrestel, 2015; GGNRA, 2013) and could also occur along the Avalon Canyon access road where suitable habitat is present.

Of these locally rare species known or likely to occur in the Project study area, only two have been documented in the vicinity of proposed Project facilities, specifically the discharge structure at Impound Lake. These include a dune tansy population on the southwestern shore of South Lake and dune tansy and San Francisco wallflower populations on the northeastern slope of Impound Lake (Nomad, 2011).

Special-Status Animals

Of the special-status animals listed in Table 2 in **Appendix D**, only species known to be present within the study area or classified as having at least a moderate potential for occurrence in the study area were considered in the impact analysis and described in further detail, below. Special-status marine fish, including central California coast steelhead (*Oncorhynchus mykiss*) or central California coast coho salmon (*O. kisutch*), could occur in marine waters offshore of the beach portions of the study area. While no special-status animal species were observed during the biological resources reconnaissance survey conducted February 5, 2014, several have the potential to occur in the study area.

The following special-status animals were determined to have at least a moderate potential to occur in the study area:

- Western pond turtle
- Special-status birds
- Migratory birds
- Special-status bats

Western pond turtle (*Emys marmorata)*

Western pond turtle is a California species of special concern. It inhabits rivers, streams, natural and artificial ponds, and lakes. Adjacent terrestrial habitat is also critical for egg laying, winter refuge, and dispersal. This species is known to occur in East Lake, and suitable habitat is present in greater Lake Merced and the Project study area (SFPUC, 2011). Breeding status of the population is unknown however upland habitat in proximity to the lake system appears to be sufficient to support a viable local population (SFRPD, 2006).

Special-status birds

Bank swallow (*Riparia riparia*) is a California threatened species. Bank swallows nest in colonies and create burrows in vertical banks or cliffs with sandy substrate. Nesting colonies have been documented at several locations in the bluffs within the study area since 1905 (NPS, 2007). In recent years the colony has been located in the bluffs north of Fort Funston, approximately 1 mile from the existing beach outfall structure. Avian surveys performed in support of the Project in 2013 documented a single, active, nesting colony located more than one mile north of the existing beach outlet structure (ESA, 2013). NPS has confirmed nesting activity at this same location in 2014 (Merkle, 2014). The bluffs surrounding Ocean Outlet are highly eroded and lack the vertical face this species prefers when establishing a nesting colony, thus it is unlikely that nesting bank swallows will occur on the Project. However, this species is an aerial forager of primarily flying or jumping insects that occur over grasslands, wetlands, and open waters of rivers, streams, ponds, and lakes. During breeding when young are being fed, feeding sites are usually within 50-200 meters of the colony and are therefore expected to forage over Lake Merced within the Project study area and could enter the Fort Funston study area during foraging or dispersal (Bank Swallow Technical Advisory Committee, 2013).

San Francisco common yellowthroat is a former federal species of concern and is a current California species of special concern. It is known to nest in the riparian wetlands along the periphery of Lake Merced (CNDDB, 2016). Double-crested cormorant, a species on the CDFW Watch List, has several established rookeries at Lake Merced (SFRPD, 2006) that are also used by nesting herons. The rookery located in the eucalyptus trees on the north side of the San Francisco Police Department firing range, on the southwest shore of South Lake is closest to proposed Project facilities (CNDDB, 2016). This species breeds and forages in Lake Merced and the Project study area.

American peregrine falcon (*Falco peregrines anatum*), a California fully protected species, is regularly observed in the study area (eBird, 2015a). This species is not known to nest in the cliffs at Fort Funston above Ocean Beach or in suitable substrate within the study area; however, suitable habitat does exist for this purpose (Stewart, 2012; ESA, 2013).

Migratory western snowy plover (*Charadrius alexandrius nivosus*), a federally threatened species and California species of special concern, has the potential to occur on study area beaches between July and May, annually, but do not nest in the study area. Snowy plovers will rest in shallow depressions of the beach where they are protected from the wind and forage on invertebrates in the rack of the tide line to build up fat reserves for breeding. Most observations of this species have occurred on Ocean Beach between Lawton Street and Judah Street, more than 3 miles north of the existing outfall (Merkle, 2012; NPS, 2012).

Migratory birds

Several migratory birds that do not have special-species status could nest in trees and shrubs and on buildings within the study area. Several raptors are known to nest in San Francisco in suitable habitat, which is present in the study area consisting of the mature trees lining John Muir Drive, the Olympic Club, and surrounding Lake Merced, as well as in the dense riparian vegetation which borders the lake. These species may include red-tailed hawk, red-shouldered hawk, American kestrel (*Falco sparverius*), Cooper's hawk (*Accipiter cooperi*), and great horned owl (*Bubo virginianus*). The study area also hosts many native passerine and aquatic birds during the breeding season, such as black phoebe, pygmy nuthatch, house finch, Anna's hummingbird, marsh wren, pied-billed grebe, and great blue heron (Murphy, 1999) (SFFO, 2003). While whimbrel, long-billed curlew, sanderling, willet and marbled godwit do not nest on Bay Area beaches and intertidal areas, these shorebirds frequent such environments for foraging during migration or overwinter within these environments of the study area. The MBTA and California Fish and Game Code protect raptors, most native migratory birds, and resident breeding birds that would occur and/or nest in the Project study area.

Special-status bats

Two bat species listed as a California species of special concern or a California special animal either are known to occur or have at least a moderate potential to occur around Lake Merced or at Fort Funston and thus the Project study area: western red bat (*Lasiurus blossevillii*) and Yuma myotis (*Myotis yumanensis*). Suitable roosting habitat for these bats is open spaces within buildings and man-made structures including bridges and culverts, in tree foliage, underneath the exfoliating bark of trees, and in tree cavities. Bat surveys conducted in 2009 of San Francisco's parks and natural areas found that the three most commonly encountered species in the area are Mexican free-tailed bat (*Tadarida brasiliensis*), Yuma myotis, and western red bat. While Mexican free-tailed bats, which have no special status, were widespread and abundant throughout the sampled natural areas, Yuma myotis and western red bat were much less abundant and generally were restricted to parks with lakes. Yuma myotis and Mexican free-tailed bats were the only species recorded in a 2009 survey at Lake Merced, and the documented population was very low. (Krauel, 2009) Acoustic monitoring of National Parks in San Francisco in 2004 and 2005 recorded both western red bat and Yuma myotis calls and several other common bat species at

Fort Funston (Fellers, 2005). Suitable roosting habitat for these two species is present in the Project area and individuals are likely to forage over open dunes at Fort Funston and over Lake Merced.

3.4.1.8 Critical Habitat

Critical habitats are areas considered essential for the conservation of a species listed as endangered or threatened under the federal Endangered Species Act. Critical habitats are specific geographic areas that contain features essential for conservation of listed species and may require special management and protection. Critical habitat may include an area not currently used by an endangered or threatened species, but that will be needed for species recovery. Projects involving a federal agency or federal funding are required to consult with the USFWS to ensure that project actions will not destroy or adversely modify critical habitat.

A review of GIS-based habitat data for *USFWS Critical Habitat for Threatened and Endangered Species* shows that the Project site is not located within designated critical habitat for any listed species.[15]

3.4.1.9 Target Invasive Plants

Invasive plants are plants of exotic origin that successfully reproduce and spread in an introduced range without the help of people (though many invasive plants disperse quite successfully on vehicles, clothing, and equipment with the unknowing help of people). This definition is based on the discussion of "what makes a plant 'invasive'" from the California Invasive Plant Council (Cal-IPC, 2014) and Richardson et al (2000). A wide range of plants encompassed by this definition have varying impacts on the ecosystems in which they occur. Some invasive plants have no impact and some (e.g., iceplant and Cape ivy) can have a substantial impact on the local ecosystem by altering environmental conditions such as light availability and substrate chemistry and composition, or by changing the fire regime. These changes in local environment can lead to changes in native or rare plant species abundance, and community composition and structure, which in turn can alter the suitability of the area to wildlife and recreation uses.

Invasive plants that are believed to have a negative impact on local ecosystems and are considered to be management priorities within the scope of the Project are listed and described below and are termed "target invasive plants." With the exception of acacia (*Acacia* spp.) trees which can rapidly colonize disturbed areas, invasive trees such as blue gum eucalyptus or Australian tea tree (*Leptospermum laevigatum*) are not considered as likely to spread as a result of Project construction as invasive forbs or grasses through seed dispersal. Stands of invasive trees are not located adjacent to Project elements that require ground disturbance and colonization by such species in newly disturbed areas during or shortly after Project construction is remote. The following list of target invasive species was generated based on observations during site reconnaissance surveys, on the Lake Merced botanical surveys identified in Section 3.4.1, and input from the NPS Fort Funston staff. Target invasive plant descriptions are based on *Weeds of California and Other Western States* (DiTomaso and Healy, 2007). Several of these plants are

[15] U.S. Fish and Wildlife Service Critical Habitat Portal available at: http://ecos.fws.gov/crithab/.

already widespread in the Project study area and regionally along the California coast. However, further spread of these species as a result of Project activities is undesirable.

Black acacia *(Acacia melanoxylon)*

Black (blackwood) acacia is a tree which grows to 15 meters tall, is typically single-trunked with straight to sickle-shaped smooth leaves, pale yellow to cream-colored spherical flower heads, and clustered seed pods. Young branches or sprouts often have 2-times pinnate compound leaves. Black acacia reproduces 1) by seed dispersed near the parent plant, through human interference, or water transport; 2) vegetatively through root suckers. Black acacia is prolific in the San Francisco Bay region (occurs around Lake Merced), throughout the North Coast, and on Santa Crus Island. Cut trees are resistant to most chemical treatments and mechanical control must be frequent to manage seedlings and sprouts from the remaining root network. At least 11 other *Acacia* species have naturalized in California.

Iceplant *(Carpobrotus edulis)*

Iceplant is a perennial plant that forms mats close to the ground and traps sand thereby stabilizing sand dunes. Iceplant reproduces by seed and by stem fragments that produce adventitious[16] roots at the nodes. Fruits are consumed by animals that then disperse the seeds through their droppings; stem fragments can adhere to vehicles or tools and disperse to new locations. Plants were also actively planted in dune systems along the California coast and along highways to prevent soil erosion. Extensive stands of iceplant can alter the natural shifting of sand dunes which facilitates the invasion of other invasive plants and displaces native sand dune species.

Jubata grass *(Cortaderia jubata)*

Jubata grass is a large perennial grass with showy plume-like inflorescences that was introduced as an ornamental plant and has spread extensively along the California coast. This plant reproduces by abundant seed and is difficult to eradicate once established due to a dense, fibrous root system with spreading rhizome network that readily sprouts back after mechanical disturbance. Jubata grass establishes well on disturbed soil along roadsides and in coastal bluffs, dunes, and grasslands.

Cotoneaster *(Cotoneaster spp.)*

Cotoneaster is a perennial shrub with showy red fruits that was introduced as an ornamental and can be seen growing in landscaped areas and gardens throughout the San Francisco Bay Area. Invaded habitats include coastal scrub, grasslands, and mixed evergreen forest, often near human inhabited areas. Cotoneaster spreads by seed; animals (primarily birds) readily consume the red fruits and disperse the seeds through their droppings.

Cape ivy *(Delairea odorata)*

Cape ivy is an herbaceous perennial vine that establishes particularly well in coastal riparian and scrub communities within moderate to dense tree or shrub cover. Cape ivy grows up through tree and shrub canopies and also forms a dense mat along the ground; this dense cover can smother

[16] Not arising from or growing in the typical location on a plant, such as roots growing on stem nodes or leaf tissue.

other vegetation, reducing recruitment of native plants and overall species richness. Plants spread by vegetative propagation via fragments of stolon, rhizomes, or stems. Seed production is not widespread but does occur in some locations.

Upright veldtgrass *(Ehrharta erecta)*

Upright veldtgrass is a perennial grass native to South Africa that was cultivated as an experimental grass in Berkeley and Davis in the mid-1900s. It easily establishes in disturbed, moist places, urban areas, turf, wetlands, and other moist natural communities within the San Francisco Bay region, southern Sacramento Valley and along the California coast up to 200 meters in elevation. Erect veldtgrass thrives in shade, grows in many soil types, and can seed year round. Regular hand weeding of the entire plant (including fine roots) is recommended for eradication.

French broom *(Genista monspessulana)*

French broom is a perennial shrub introduced as an ornamental plant that has spread throughout coastal areas and low-elevation forests in California. It is an extremely aggressive invader that can convert grasslands to shrub dominated communities and is very difficult to eradicate due to a long-lived seed bank along with the ability to resprout from the root crown following mechanical damage. French broom establishes well in disturbed areas such as road cuts and fuel breaks.

Bermuda buttercup *(Oxalis pes-caprae)*

Bermuda buttercup is a perennial herb that was introduced from South Africa as a garden ornamental that is difficult to control and has spread throughout the west coast, Sacramento Valley, Arizona and Florida. Bermuda buttercup reproduces vegetatively form bulbs that are easily dispersed with soil movement, intentional planting, disposal of garden refuse or nursery soil, and through the California vole favors the plant as a food source. Physical removal of bulbs as a means to control the plant is only effective when parent bulb energy reserves are exhausted, usually just as plants begin to flower. Planting a fast-growing cover crop after bulb removal can increase control.

3.4.2 Regulatory Setting

3.4.2.1 Federal

Federal Endangered Species Act

The federal Endangered Species Act (ESA; 7 USC §136, 16 USC §1531 et seq.) protects the fish and wildlife species and their habitats that the USFWS or National Marine Fisheries Service (NMFS) has identified as threatened or endangered. The term endangered refers to species, subspecies, or distinct population segments that are in danger of extinction through all or a significant portion of their range. The term threatened refers to species, subspecies, or distinct population segments that are likely to become endangered in the near future.

The USFWS and NMFS administer the ESA. In general, the NMFS is responsible for protecting ESA-listed marine species and anadromous fishes (those that live in the sea but migrate upstream to spawn), which are not applicable to Lake Merced; listed, proposed, and candidate wildlife, plant species, and fish species are under USFWS jurisdiction. “Take”[17] of listed species can be authorized through either the Section 7 consultation process (for actions by federal agencies) or the Section 10 permit process (for actions by non-federal agencies). Federal agency actions include activities on federal land or that are conducted by, funded by, or authorized by a federal agency (including issuance of federal permits and licenses).

Under Section 7 of the ESA, the federal agency conducting, funding, or permitting an action (known as the federal lead agency) must consult with the USFWS, as appropriate. This consultation is to ensure that the proposed action would not jeopardize endangered or threatened species or destroy or adversely modify designated critical habitat. If a project “may affect” a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment evaluating the nature and severity of the expected effect. In response, the USFWS issues a biological opinion determining whether (1) the proposed action may either jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding); or (2) that the proposed action would not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

Critical habitat. Under the ESA, the Secretary of the Interior (or the Secretary of Commerce, as appropriate) formally designates critical habitat for certain federally listed species and publishes these designations in the *Federal Register*. Critical habitat is not automatically designated for all federally listed species, so many listed species have no formally designated critical habitat. Critical habitat is defined as the specific areas that are essential to the conservation of a federally listed species and that may require special management consideration or protection. Critical habitat is determined using the best available scientific information about the physical and biological needs of the species. These needs, or primary constituent elements, are as follows: space for individual and population growth and for normal behavior; food, water, light, air, minerals, or other nutritional or physiological needs; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitat that is protected from disturbance or is representative of the historical geographic and ecological distribution of a species. As described above in Section 3.4.1.8, there is no federally designated critical habitat within the Project site. Additionally, Fort Funston is listed as a recovery unit for San Francisco lessingia *(Lessingia germanorum)* as discussed below.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA; 16 USC §703) prohibits taking, killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs. The ESA

[17] The ESA defines the term “take” as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 USC §1532(19).

defines take as "…harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any threatened or endangered species." Harm may include significant habitat modification where it actually kills or injures a listed species through impairment of essential behavior (e.g., nesting or reproduction). Therefore, for projects that would not result in the direct mortality of birds, the MBTA is generally also interpreted in CEQA and NEPA analyses as protecting active nests of all species of birds that are on the List of Migratory Birds, published in the *Federal Register* in 1995. With respect to nesting birds, while the MBTA itself does not provide specific take avoidance measures, the USFWS and CDFW over time have developed a set of measures sufficient to demonstrate take avoidance. Since these measures are typically required as permitting conditions by these agencies, they are often incorporated as mitigation measures for projects during the environmental review process. These requirements include avoiding tree removal during nesting season, preconstruction nesting bird surveys, and establishment of appropriate buffers from construction if active nests are found.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA; 16 USC §1361 et seq.) is the principal federal legislation that guides marine mammal species protection and conservation policy. It delegates authority for oceanic marine mammals to the Secretary of Commerce, the parent agency of the NOAA. Species of the order Cetacea (whales and dolphins) and species, other than walrus, of the order Carnivora, suborder Pinnipedia (seals and sea lions), are the responsibility of NOAA Fisheries (or NMFS). The USFWS is responsible for the sea otter. Marine mammals that are already managed under international agreements are exempt as long as the agreements further the purposes of the MMPA.

The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA), Section 307 (16 USC §1456(c)) mandates that federal agency activities be "consistent to the maximum extent practicable with the enforceable policies of approved state management programs," and that this consistency be documented and coordinated with the state. A federal agency ensures consistency of its proposed actions with state management programs by submitting a consistency determination to the relevant state agency. After receipt of the consistency determination, the state agency informs the federal agency of its concurrence with, or objection to, the federal agency's consistency determination.

The California Coastal Commission (CCC) is the state agency charged with administering the federal CZMA within the California coastal zone. Within the CCC's areas of concern, the coastal zone consists of all areas located within the CCC's jurisdiction which extends 3 miles seaward and inland 1,000 yards from the mean high tide line. Any federal activity that affects any natural resources (including wetlands and other waterbodies), land uses, or water uses within CCC's area of concern will be subject to the consistency requirement. Obligations under the CZMA must be met through the federal consistency determination process that is outlined in the CZMA Federal Consistency Regulations, 71 Federal Regulation 787-831 at 15 CFR 930. The CCC and the California Coastal Act are discussed under state law (see Section 3.4.2.2).

Clean Water Act

Two definitions of "wetland" are considered for this Project: the federal definition, as utilized by the Corps and the RWQCB under the Clean Water Act (described below), and the state definition, as utilized by the RWQCB and the CCC, under the Porter-Cologne Water Quality Control Act and the California Coastal Act, respectively (see Section 3.4.2.2).

Federal Wetland Definition

Wetlands are a subset of waters of the United States and receive protection under Section 404 of the Clean Water Act. The term "waters of the United States,"[18, 19] as defined in the Code of Federal Regulations (33 CFR 328.3[a]; 40 CFR 230.3[s]), includes:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters including interstate wetlands; (Wetlands are defined by the federal government [33 CFR 328.3(b)] as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions)
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters which are or could be used by interstate or foreign travelers for recreational or other purposes; or from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or which are used or could be used for industrial purposes by industries in interstate commerce;
4. All impoundments of waters otherwise defined as waters of the United States under the definition;
5. Tributaries of waters identified in paragraphs (1) through (4);

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[18] Based on the Supreme Court ruling in *Solid Waste Agency for Northern Cook County v. U.S. Army Corps of Engineers* related to federal jurisdiction over isolated waters (January 9, 2001), non-navigable, isolated, intrastate waters are no longer defined as waters of the United States based solely on their use by migratory birds. Jurisdiction over non-navigable, isolated, intrastate waters may be exercised if their use, degradation, or destruction could affect other waters of the Unites States or interstate or foreign commerce. According to this ruling, jurisdiction over such other waters must be analyzed on a case-by-case basis, as should impoundments of waters, tributaries of waters, and wetlands adjacent to waters.

[19] On June 29, 2015, the Corps and EPA issued a Final Rule on the Definition of "Waters of the United States," which took effect on August 28, 2015 (80 FR 37054 – 37127). On October 9, 2015, the new rule was stayed by a Circuit Court of Appeals pending resolution of multiple legal challenges. This new rule is intended to resolve jurisdictional uncertainty following the *SWANCC, Rapanos* and *Carabell* decisions and provide a clear definition of waters and wetlands that are protected under the CWA. This new rule specifies several features that are jurisdictional by rule (TNWs, interstate waters and wetlands, territorial seas, impoundments of water, tributaries, and all waters adjacent to these features), and provides exemptions previously recognized, but not necessarily codified (*e.g.*, storm water control features created in dry land).

6. The territorial seas;

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6).

8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with the U.S. Environmental Protection Agency.

Federal Regulation of Activities in Wetlands

The regulations and policies of various federal agencies, such as the Corps, USEPA, USFWS, and NMFS, mandate that filling wetlands be avoided unless it can be demonstrated that no practicable alternatives exist. The Corps has primary federal responsibility for administering regulations that concern waters and wetlands. In this regard, the Corps acts under two statutory authorities: the Rivers and Harbors Act (Sections 9 and 10), which governs specified activities in "navigable waters," and the Clean Water Act (Section 404), which governs the fill of waters of the United States, including wetlands. The Corps requires that a permit be obtained if a project proposes to place fill in navigable waters and/or to alter waters of the United States below the ordinary high-water mark in non-tidal waters. The USEPA, USFWS, NMFS, and several other agencies may comment on Corps permit applications. The USEPA provides the primary criteria for evaluating the biological impacts of Corps permit actions in wetlands.

National Park Service Regulations and Policies

NPS regulations and policies, including the NPS Organic Act of 1916, NPS *Management Policies 2006* (NPS, 2006), and the NPS Natural Resource Management Reference Manual 77, direct the NPS to provide for the protection of park resources. The Organic Act directs the NPS to conserve "wild life" unimpaired for future generations and is interpreted to mean that native animal and plant life is to be protected and perpetuated as part of a park unit's natural ecosystem.

The NPS *Management Policies 2006* states that the NPS "will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems." The term "plants and animals" refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals (NPS, 2006). The NPS will achieve this by:

- preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them. (NPS, 2006)

Section 4.1 of NPS *Management Policies 2006* states, “natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.” Section 8.2.2.1 states, “Superintendents will develop and implement visitor use management plans and take action, as appropriate, to ensure that recreational uses and activities in the park are consistent with its authorizing legislation or proclamation and do not cause unacceptable impacts on park resources or values.” (NPS, 2006)

Overall, the goal of the NPS is to minimize impacts caused by humans (including impacts on individual wildlife) and avoid significant effects from disturbance to the abundance, diversity, dynamics, distributions, habitats, and behaviors of wildlife populations and communities and ecosystems in which they occur, pursuant to 36 CFR 2.2 and NPS *Management Policies 2006*, Section 4.4.1. Although the focus of the impact analysis is predominantly the impacts on wildlife populations, the NPS acknowledges that adverse impacts on individual animals would likely occur and seeks to minimize them. In addition to NPS management policies, federally listed species in national parks are protected by the ESA, which mandates all federal agencies consider the potential effects of their actions on species listed as threatened or endangered (16 USC §1531 et seq.). If the NPS determines that an action may affect a federally listed species, consultation with the USFWS is required to ensure that the action would not jeopardize the species’ continued existence or result in the destruction or adverse modification of critical habitat. NPS *Management Policies 2006* state that the NPS will survey for, protect, and strive to recover all species native to NPS units that are listed under the ESA, and proactively conserve listed species and prevent detrimental effects on these species (NPS, 2006, section 4.4.2.3). NPS *Management Policies 2006* Section 4.4.2.3 also states, “[the NPS will] manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible” (NPS, 2006).

Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan

The Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan, published in 2014 and adopted in 2015, identifies three management zones within Fort Funston and establishes management objectives for these zones. The Natural Resources Zone includes guidance relevant to Biological Resources. In the Natural Resource Zone (consisting of the corridors along the perimeter and northern beach), the management objective is to protect and support recovery of native habitats while providing for a variety of compatible recreational activities. “Fort Funston’s islands of native habitat would be expanded to form a continuous habitat corridor that supports the recovery of native dune habitat including San Francisco *Lessingia* plants. The northern stretch of beach would be managed to protect shorebirds, coastal bluffs, and bank swallows and to allow natural coastal and marine processes to occur…” (NPS, 2014).

Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula

The Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula (Recovery Plan) was developed by the USFWS Sacramento field office with input from GGNRA staff, among others, familiar with past and prospective vegetation management of the Presidio and Fort Funston. The Recovery Plan features two plant species, San Francisco lessingia and Presidio (=Raven's) manzanita, both of which are federally listed as endangered, are endemic to the northern San Francisco peninsula, and limited to habitat of specific substrates including old coastal sand deposits and serpentine outcrops, respectively. Both species grow only in sparse, relatively open native dune scrub, coastal scrub, and grassland vegetation. As presented in Table 1 in Appendix D, both of these species were determined to have a low potential to occur within the study area following review of documented regional occurrences. The objectives of the Recovery Plan are to conserve and restore sufficient habitat and populations of San Francisco lessingia and Presidio manzanita to reduce their federal listing from "endangered" to "threatened" by 2020 and 2030, respectively, and ultimately delist San Francisco lessingia by 2030. Actions emphasize reestablishment of dynamic, persistent populations of each species within restored supportive habitats that can become self-sustaining communities in perpetuity. Specific recovery units are identified within the Recovery Plan for each species and Fort Funston is listed as a recovery unit for San Francisco lessingia. Specific areas of Fort Funston are designated for protecting and enhancing existing habitat, restoration of dune habitat, or rehabilitation of degraded coastal bluffs. The proposed Project staging area at Fort Funston and concrete pump staging area and hose alignment occur within a unit designated for managing existing habitats compatible with sustainable reestablished populations of San Francisco lessingia. San Francisco lessingia is not present at locations within Fort Funston proposed for use under the Project.

Executive Order 13112: Prevention and Control of Invasive Species

Enacted in February 1999, Executive Order (EO) 13112 calls for federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. This includes consideration of the potential effects of invasive species in NEPA analyses. The EO established an Invasive Species Council comprised of federal agencies and headed by the Secretary of the Interior with the responsibility to oversee the executive order and prepare a national Invasive Species Management Plan that provides guidelines for preventing the introduction and spread of invasive species.

3.4.2.2 State

California Endangered Species Act

Under the California Endangered Species Act (CESA), the CDFW has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code §2070). The CDFW also maintains a list of candidate species, which are those formally under review for addition to either the list of endangered species or the list of threatened species. In addition, the CDFW maintains a list of "species of special concern," which serves as a watch list.

The CESA prohibits the take of plant and animal species that the California Fish and Game Commission has designated as either threatened or endangered in California. "Take" in the context of the CESA means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill a listed species (California Fish and Game Code §86). The take prohibitions also apply to candidates for listing under the CESA. However, Section 2081 of the CESA allows the CDFW to authorize exceptions to the state's take prohibition for educational, scientific, or management purposes.

In accordance with the requirements of the CESA, an agency reviewing a project within its jurisdiction must determine if any state-listed endangered or threatened species could be present in the project area. The agency also must determine if the project could have a potentially significant impact on such species. In addition, the CDFW encourages informal consultation on any project that could affect a candidate species.

California Native Plant Protection Act

State listing of plant species began in 1977 with the passage of the California Native Plant Protection Act (CNPPA, California Fish and Game Code §§1900-1913), which directed the CDFW to carry out the legislature's intent to "preserve, protect, and enhance endangered plants in this state." The CNPPA gave the California Fish and Game Commission the power to designate native plants as endangered or rare and to require permits for collecting, transporting, or selling such plants. The CESA expanded on the original CNPPA and enhanced legal protection for plants. The CESA established threatened and endangered species categories and grandfathered all rare animals—but not rare plants—into the act as threatened species. Thus, three listing categories for plants are employed in California: rare, threatened, and endangered.

Special-Status Natural Communities

The CDFW's Natural Heritage Division identifies special-status natural communities, which are those that are naturally rare and those whose extent has been greatly diminished through changes in land use. The CNDDB tracks 135 such natural communities in the same way that it tracks occurrences of special-status species: Information is maintained on each site for the natural community's location, extent, habitat quality, level of disturbance, and current protection measures. The CDFW is mandated to seek the long-term perpetuation of the areas in which these communities occur. While there is no statewide law that requires protection of all special-status natural communities, CEQA requires consideration of the potential impacts of a project on biological resources of statewide or regional significance. No special-status natural communities occur within the Project study area.

California Fish and Game Code

Fully Protected Species

Certain species are considered *fully protected*, meaning that the code explicitly prohibits all take of individuals of these species except for take permitted for scientific research. Section 5050 lists fully protected amphibians and reptiles, Section 5515 lists fully protected fish, Section 3511 lists fully protected birds, and Section 4700 lists fully protected mammals.

It is possible for a species to be protected under the California Fish and Game Code, but not fully protected. For instance, mountain lion (*Puma concolor*) is protected under Section 4800 et seq., but is not a fully protected species.

Protection of Birds and Their Nests

Under Section 3503 of the California Fish and Game Code, it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto. Section 3503.5 of the code prohibits take, possession, or destruction of any birds in the orders Falconiformes (hawks) or Strigiformes (owls), or of their nests and eggs. Migratory non-game birds are protected under Section 3800, while other specified birds are protected under Section 3505.

Stream and Lake Protection

CDFW has jurisdictional authority over streams and lakes and the wetland resources associated with these aquatic systems under California Fish and Game Code Sections 1600 et seq. through administration of Lake or Streambed Alteration Agreements. Such agreements are not a permit, but rather a mutual accord between CDFW and the project proponent. California Fish and Game Code Sections 1600-1616 authorize CDFW to regulate work that will "substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river lake or stream." Because CDFW includes under its jurisdiction streamside habitats that may not qualify as waters or wetlands under the federal Clean Water Act definition (see Section 3.4.2.1), CDFW jurisdiction may be broader than Corps jurisdiction.

CDFW enters into a Streambed Alteration Agreement with the project proponent and can impose conditions in the agreement to minimize and mitigate impacts to fish and wildlife resources. A project proponent must submit a notification of streambed alteration to CDFW before construction. The notification requires an application fee for Streambed Alteration Agreements, with a specific fee schedule to be determined by CDFW. CDFW can also enter into programmatic agreements that cover recurring operation and maintenance activities and regional plans. These agreements are sometimes referred to as Master Streambed Alteration Agreements (MSAAs).

Under Fish and Game Code Section 1602 (Streambed Alteration Agreements), the CDFW takes jurisdiction over the stream zone which is defined top of bank or outside extent of riparian vegetation, whichever is the greatest. Within the stream zone, waters of the State of California are typically delineated to include the streambed to the top of the bank and adjacent areas that would meet any one of the three wetland parameters in the Corps definition (vegetation, hydrology, and/or soils). Whereas federal jurisdiction requires meeting all three parameters, in practice meeting one parameter, or even the presence (rather than dominance) of wetland plants in an area associated with a jurisdictional streambed would qualify an area as waters of the State of California. CDFW jurisdiction is not limited to navigable waters or tributaries to navigable waters; however, isolated wetlands and wetlands not associated with a lake shoreline or streambed are not typically subject to CDFW jurisdiction.

Regional Water Quality Control Board

The SWRCB and the Regional Water Quality Control Boards (RWQCBs) (together "Boards") are the principal state agencies with primary responsibility for the coordination and control of water quality. In the Porter-Cologne Water Quality Control Act (Porter-Cologne), the California Legislature declared that the "state must be prepared to exercise its full power and jurisdiction to protect the quality of the waters in the state from degradation..." (California Water Code §13000). Porter-Cologne grants the Boards the authority to implement and enforce the water quality laws, regulations, policies, and plans to protect the groundwater and surface waters of the state. Discharges to waters of the state determined to be jurisdictional may require a project proponent to obtain waste discharge permits (for non-federally-jurisdictional waters) and/or a Clean Water Act Section 401 certification to support non-NPDES federal project permitting (for federally jurisdictional waters, as in the case of the required Corps permit). The enforcement of the state's water quality requirements is not solely the purview of the Boards and their staff. Other agencies (e.g., the CDFW) have the ability to enforce certain water quality provisions in state law.

Policy on the Use of Constructed Wetlands for Urban Runoff (Resolution No. 94-102)

Regional Board Resolution 94-102 provides a policy framework for the establishment of constructed wetlands to control urban stormwater runoff and other discharges. Pursuant to 40 CFR Part 122.2, wetlands constructed and operated under the policies set forth in Resolution 94-102 are waste treatment systems and, as such, are not waters of the U.S. Prior to authorizing the construction of an urban runoff treatment wetland, the Regional Board will require reasonable monitoring to demonstrate that substances transferred to the constructed wetland do not harm wildlife. More information about this policy is provided in Section 3.9, Hydrology and Water Quality.

California Coastal Act

Within the California Coastal Zone, the CCC also has authority to regulate development that would conflict with the provisions of the California Coastal Act. The coastal zone generally extends three miles seaward and about 1,000 yards inland from the mean high tide line of the sea. In significant coastal estuarine, habitat, and recreational areas it extends inland to the first major ridgeline paralleling the sea or five miles from the mean high tide line of the sea, whichever is less, and in developed urban areas the zone generally extends inland less than 1,000 yards. In order to carry out the policies of the Coastal Act, each of the 73 cities and counties in the coastal zone is required to prepare a local coastal program (LCP) for the portion of its jurisdiction within the coastal zone and to submit the program to the Commission for certification. The CCC manages protection of biological resources through a permitting process for all projects in the coastal zone. Once the CCC certifies a LCP, the local government gains authority to issue most coastal development permits (CDP). The CCC generally retains permit authority over certain specified lands (such as public trust lands or tidelands). Only the CCC can grant a coastal development permit for development in areas of its retained jurisdiction. The CCC has unusually broad authority to regulate development in the coastal zone, and a permit is required for any project that might change the intensity of land use in the coastal zone. For example, a project that would require a building or grading permit from a city or county would also require a CDP. Other projects, such as major vegetation clearing or subdividing, may also require a CDP. The local government or the CCC reviews applications before it to determine whether the proposed development would substantially change any existing biological resources, including wetlands, and to consider the net effects of the project on rare and endangered species. Daly City's and San Francisco's LCPs are discussed further below in the Regional and Local subsection.

California Wetland Definition

As legal protection of and scientific attention to wetlands have increased, so have the number of wetland definitions contained in State and federal law. Most of these definitions vary slightly but share common terms and concepts. In general, California agencies have adopted the Cowardin et al. (1979) classification system to define wetlands. The Cowardin classification broadly describes wetlands as lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. According to this classification system, wetlands must have one or more of the following three attributes: (1) at least periodically, the land predominantly supports hydrophytes;[20] (2) the substrate is predominantly undrained hydric soil; or (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al., 1979).

Under normal circumstances, the federal definition of wetlands requires all three wetland identification parameters to be met, whereas the Cowardin definition requires the presence of at least one of these parameters.

The CDFW, in their review of Lake and Streambed Alteration Agreements under Section 1600 of the California Fish and Game Code, generally relies upon the Cowardin system and the presence of at least one parameter in considering an area a wetland and therefore subject to Fish and Game Code regulation.

The CCC broadly defines wetlands under the Coastal Act (Cal. Pub. Res. Code §30121) as follows:

> Wetland means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, or fens.

The CCC Administrative Regulations (Cal. Code Regs. §13577(b)) provide a more explicit definition:

> Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such

[20] The USFWS has developed the following definition for hydrophytic vegetation: "plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content" (Cowardin et al., 1979).

wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats.

Although the exact procedures for delineating wetlands subject to CCC jurisdiction have varied somewhat in the past, the CDFW wetland definition and classification system is the delineation methodology generally followed by the CCC. For projects requiring federal (Corps) review, a CCC permit applicant may, in some cases, need to obtain two delineations, one for the coastal development permit, and another for the Corps Section 404 permit.

California Regulation of Activities in Wetlands

The State's authority to regulate activities in wetlands and waters at the project sites resides primarily with the RWQCB, which regulates discharges to wetlands/waters of the U.S. and waters of the State under the federal Clean Water Act and the California Porter-Cologne Water Quality Control Act, and provides Clean Water Act Section 401 certifications for placement of fill within those waters. The CDFW provides comment on Corps permit actions under the Fish and Wildlife Coordination Act. Moreover, under Sections 1600 through 1616 of the California Fish and Game Code, the CDFW regulates activities that would substantially divert, obstruct the natural flow of, or change, rivers, streams, and lakes. The jurisdictional limits of the CDFW are defined in Section 1602 of the California Fish and Game Code as the bed, channel, or bank of any river, stream, or lake. CDFW jurisdiction generally extends beyond the bed or bank of these features to include adjacent riparian habitat, including adjacent wetlands. The CDFW regulates activities that would substantially alter or result in the deposit or disposal of debris, waste, or other materials into any river, stream, or lake, and requires preparation of a streambed alteration agreement for activities that are proposed within or near a river, stream, or lake. Lastly, the CCC (or designated local government), in their review of a Coastal Development Permit (CDP) application and a project's consistency with the CZMA, makes a determination as to whether the proposed project would substantially change any existing biological resources, including wetlands.

California Rare Plant Rank

CDFW works in collaboration with the California Native Plant Society (CNPS) and botanical experts to maintain an Inventory of Rare and Endangered Plants, and the similar Special Vascular Plants, Bryophytes, and Lichens List. The plant species on these lists may meet the CEQA definition of rare or endangered. As a trustee agency for the plants and wildlife of California, ecological communities, and the habitat upon which they depend, CDFW advises public agencies during the CEQA process to help ensure that the actions they approve do not significantly impact such resources. CDFW often advises that plant species with an appropriate California Rare Plant Rank in the Inventory be properly analyzed by the lead agency during project review to ensure compliance with CEQA. The following identifies the definitions of the California Rare Plant Rankings (CRPR):

Rank 1A: Plants presumed extirpated in California and either rare or extinct elsewhere.

Rank 1B: Plants Rare, Threatened, or Endangered in California and elsewhere.

Rank 2A: Plants presumed extirpated in California, but more common elsewhere.

Rank 2B: Plants Rare, Threatened, or Endangered in California, but more common elsewhere.

Rank 3: Plants about which more information is needed - A Review List.

Rank 4: Plants of limited distribution - A Watch List.

3.4.2.3 Regional and Local

Daly City Local Coastal Program

The Coastal Element of the Daly City 2030 General Plan, which updates the land use plan component of the Coastal Element/LCP adopted by the City Council in 1984, identifies Avalon Canyon as an Environmentally Sensitive Habitat Area (ESHA), which Section 30107.5 of the Coastal Act defines as: "Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments." Section 30240 of the California Public Resources Code states: (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas [and] (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

Western Shoreline Area Plan

The Western Shoreline Area Plan is a subsection of the San Francisco General Plan, and also serves as San Francisco's certified Local Coastal Program. As such, the Western Shoreline Area Plan carries forward the requirements of the California Coastal Act (Public Resource Code §30000 et seq.) and sets forth several policies governing development in San Francisco's coastal zone. A key objective of the Western Shoreline Area Plan for the Lake Merced Subarea is to preserve the recreational and natural habitat of the lake. Policies established to meet this objective include those designed to preserve recreational facilities, passive activities, playgrounds, and vistas of the Lake Merced area; maintain a recreational pathway around the lake for multiple use; and limit activities in Lake Merced to those that would not adversely affect the lake's water quality as a standby reservoir for emergency use.

With certification of the Local Coastal Program in 1984, San Francisco obtained authority for issuance of CDPs for development activities within its coastal zone boundary. Today, most CDPs are issued by the San Francisco Planning Commission pursuant to San Francisco Planning Code Section 330 et seq. However, within the project area the CCC has retained jurisdiction over the waters of Lake Merced and its associated wetlands. In addition, San Francisco City Planning Commission decisions regarding the issuance of CDPs for projects located within a 100-foot buffer of Lake Merced and associated wetlands are appealable to the CCC. The Western Shoreline Plan does not map any ESHA or establish objectives or policies specific to biological resources within San Francisco's coastal zone. However, the Coastal Commission generally considers wetlands, lakes, and riparian habitats to be ESHAs because of the valuable role these areas play in maintaining the natural ecological functioning of many coastal habitat areas and because these areas are easily degraded by human developments. Therefore, because the Coastal Commission has both retained and appeals jurisdiction over portions of the proposed project area, this analysis conservatively assumes that open waters, wetlands, and associated riparian vegetation within the project area are considered ESHAs.

San Francisco Recreation and Park Department Significant Natural Resources Areas Management Plan

The San Francisco Recreation and Park Department is currently completing an update to the Significant Natural Resource Areas Management Plan (SNRAMP) for designated significant natural areas in San Francisco. The purpose of the proposed update to the SNRAMP is to establish a maintenance and preservation program to protect and enhance natural resource values. The SNRAMP itself has not been adopted, but the process began in 1995, with the preparation of a staff report on the proposed SNRAMP (SFRPD, 1995). The report set forth general objectives, policies, and management actions to guide development of the SNRAMP and to protect and enhance natural areas under San Francisco's jurisdiction. General policies and management actions presented in the approved 1995 plan relevant to biological resources at Lake Merced include the following:

III. General Policies and Management Actions

A. Vegetation

  a. Maintain and promote indigenous plant species; propagate native plants using seed collected from the specific site to avoid alteration of unique genetic strains of native plant species

  b. Control or remove invasive species; remove exotic plants that adversely affect indigenous plant growth

  c. Enhance riparian areas

  d. Reforest or replant areas where appropriate to maintain diversity of indigenous plant communities

  e. Preserve habitat that supports wildlife

B. Water Resources

  a. Maintain or improve water quality of streams and ponds

  b. Protect riparian zones from erosion and sedimentation

  c. Maintain drainage and erosion prevention devices along roads and service trails

  d. Control drainage and runoff from roads

  e. Establish and maintain tule encroachment zone around lakes

  f. Use proper controls when using aquatic herbicide

San Francisco Public Works Code

The San Francisco's Urban Forestry Ordinance (Article 16 of the Public Works Code) protects street trees, significant trees, and landmark trees under SFDPW jurisdiction, regardless of species. The ordinance protects the following three categories of trees:

A **street tree** is "any tree growing within the public right-of-way, including unimproved public streets and sidewalks, and any tree growing on land under the jurisdiction of the Department [of Public Works]," as defined in Section 802 of the ordinance. Section 806b requires entities (other than the SFDPW) to obtain a permit from the department before removing any street trees.

A **significant tree** is defined in Section 810A of the ordinance as any tree (1) located on property under the jurisdiction of the SFDPW or on privately owned property with any portion of its trunk within 10 feet of the public right-of-way, and (2) any tree that satisfies at least one of the following criteria: a diameter at breast height in excess of 12 inches, a height in excess of 20 feet, or a canopy in excess of 15 feet. Any entity other than the SFDPW must obtain a permit to remove significant trees according to the process described in Section 806b.

A **landmark tree** is any tree that (1) has been nominated as such by a member of the public, a landowner, the San Francisco Planning Commission, the Board of Supervisors, or the Historic Preservation Commission, (2) the Urban Forestry Council (within the San Francisco Department of the Environment) has subsequently recommended as a landmark tree, and (3) is designated a landmark tree by ordinance approved by the Board of Supervisors. According to Section 810 of the ordinance, nominated trees undergoing review are protected according to the same standards as designated landmark trees until the review process is completed.

Permits are required for planting or removing street trees and significant trees, and protection measures are required for these trees if construction work would occur within the trees' drip lines. Trees located along the Vista Grande Canal and in the footprint of the treatment wetlands would qualify as street trees and significant trees; however there are no landmark trees in the Project area. Protections for street and significant trees described in the ordinance are included below.

(a) Injury to or Destruction of Trees Prohibited. It shall be unlawful for any person to intentionally, maliciously or through gross negligence injure or destroy a street tree, any tree on City property, a significant tree, or a landmark tree. Removal of a tree under City order or removal in accordance with a permit issued pursuant to Section 806, 810, or 810A of this Article is exempt from this prohibition.

(b) Injury to or Destruction of Landscape Materials Prohibited. It shall be unlawful for any person to intentionally, maliciously or through gross negligence injure or destroy any landscape material in any street median, center strip, or other landscaped portion of a public right-of-way under the City's jurisdiction, except as authorized by the Department.

(c) Construction Work: Protection of Trees Required. It shall be unlawful for any person to engage in any construction work on private or public property without first taking steps to protect street trees, significant trees, and landmark trees from damage, including damage caused by soil compaction or contamination, excavation, or placement of concrete or other pavement or foundation material. If excavation, construction, or street work is planned within the dripline of a significant tree, a landmark tree or a tree on any street or other publicly owned property said tree(s) shall be adequately protected. If any construction work results in the injury or damage to such trees, the responsible party(ies) may be subject to the penalties set forth in Section 811 of this Article.

3.4.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.4.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G, Section IV, a project would have a significant impact on biological resources if it would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS;

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS;

c) Have a substantial adverse effect on federally protected wetlands or other jurisdictional waters as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.4.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook Environmental Screening Form (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have measurable impacts on biological resources (including wetlands and other waterbodies) with impact intensity based on the impact descriptions in the following tables.

Vegetation

Impact Intensity	Impact Description
Negligible:	No effects would occur, or effects would result in no measurable or perceptible changes in plant community size, continuity, or integrity.
Minor:	Effects would be measurable or perceptible, but they would be localized and within a relatively small area, and the overall viability of the plant community would not be affected. Adverse effects could be mitigated through avoidance/minimization measures.
Moderate:	Effects would be measurable and perceptible over a larger area and could affect the overall viability or integrity of the vegetation community within the study area. Adverse effects could be mitigated by implementation of impact avoidance/minimization measures, restoration of the vegetation community, or restoration of a previously lost or degraded vegetation community.
Major:	Effects would permanently, drastically alter the size or integrity of a vegetation community. Impacts to the vegetation community would not be fully mitigable.

Wetlands/Other Waters

Impact Intensity	Impact Description
Negligible:	No effects would occur or effects would be below or at the lower levels of detection.
Minor:	Effects would be detectable, but small in terms of area and the nature of the change and without the potential to expand if left alone.
Moderate:	Effects would be readily apparent over a small area and would have the potential to expand in area. Adverse impacts could be mitigated by restoration or enhancement of previously lost or degraded wetland habitats.
Major:	Effects would be readily apparent over a large area. Adverse impacts would have measurable consequences that could not be mitigated.

Terrestrial Wildlife and Aquatic Wildlife

Impact Intensity	Impact Description
Negligible:	No measurable or perceptible changes would occur to the amount, distribution, connectivity, or integrity of wildlife habitat or populations.
Minor:	Impacts to wildlife such as temporary disturbance of habitat or the loss of an individual of a common species would be detectable, but these disturbances would not be expected to be outside the natural range of variability of species’ populations, their habitats, or the natural processes sustaining them. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate:	Effects to wildlife habitat would be measurable and perceptible over a larger area and could affect its overall amount, integrity, and connectivity in the study area. Habitat changes and disturbance and loss of individuals could affect the overall size of wildlife populations, but reductions in population size would not threaten the continued existence of a species’ local population. Impacts could be mitigated by implementation of impact avoidance/minimization measures, restoration of the vegetation community or habitat, restoration of previously lost or degraded wildlife habitat, or creation of new wildlife habitat.
Major:	Effects would permanently, drastically alter the amount, integrity, or connectivity of wildlife habitat. Changes in the size and integrity of a wildlife population could threaten the continued existence of a species’ local population. Impacts to the wildlife habitat and associated populations could not be mitigated.

Special-Status Species

Impact Intensity	Impact Description
Negligible:	No measureable or perceptible changes would occur to the amount, distribution, connectivity, or integrity of special-status plants or vegetation communities, or special-status wildlife populations or habitats.
Minor:	Impacts may affect some individual plants and a portion of the special-status vegetation community as a whole. Impacts to special-status species would be detectable, but they would not be expected to be outside the natural range of variability of species’ populations, their habitats, or the natural processes sustaining them. No loss of special-status species individuals would be expected to occur. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate:	Effects to habitat for special-status species would be measurable and perceptible over a larger area and could affect its overall amount, integrity, and connectivity in the study area. Habitat changes and disturbance and loss of individuals could affect the overall size of populations, but reductions in population size would not threaten the continued existence of a species’ local population. Impacts could be mitigated by implementation of impact avoidance/minimization measures, restoration of the habitat, restoration of previously lost or degraded habitat, or creation of new habitat.
Major:	Effects would permanently, drastically alter the amount, integrity, or connectivity of habitat for special-status species. Changes in the size and integrity of a special-status population could threaten the continued existence of a species’ local population. Impacts to the habitat and associated populations could not be mitigated.

3.4.3.3 Criteria and Thresholds with No Impact or Not Applicable

Because of the nature of the Project and its physical setting, the Project would not result in impacts related to the following significance criteria and thresholds; these criteria and thresholds are not discussed in the impact analysis for the following reasons:

f) ***Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.*** No adopted habitat conservation plan or natural community conservation plan covers the Project site(s) and therefore the Project could not conflict with these plans. The San Francisco Recreation and Park Department's 1995 *Significant Natural Resources Areas Management Plan* (SNRAMP) consists of a staff report. General policies and management actions in the staff report relevant to biological resources at Lake Merced include general policies to maintain/promote indigenous plant species and control/remove invasive species, protect special-status species, enhance riparian areas, and maintain/improve water quality of streams and ponds (SFRPD, 1995). The Project would contribute to Lake Merced water levels and maintain or improve the water quality of the lake, thereby improving the aquatic habitat. While the Project would include short-term construction disturbance to riparian and wetland areas and potential disturbance to special-status plant and animal species at Lake Merced, the duration and extent of affected areas would be limited and would not conflict with the overall goal related to maintenance and promotion of native plant communities and wildlife habitats, control/removal of invasive species, or protection of special-status species.

3.4.4 Methodology and Assumptions

Impacts on biological resources are identified and evaluated based on relevant CEQA, NEPA, NPS, and local standards, policies, and guidelines; on the likelihood that special-status species, sensitive habitats, wetlands and waters, and wildlife corridors are present within the Project area (as described in Section 3.4.1); and on the likely effects that Project construction, operation, and maintenance might have on these resources. Special-status resources that have no or low potential to occur in the study area (as presented in Appendix D) are not considered in the impact analysis.

As described in Section 3.4.1.3, no special-status fish occur in Lake Merced and therefore are not considered under the following impact analysis. Special-status marine fish, including central California coast steelhead (*Oncorhynchus mykiss*) or central California coast coho salmon (*O. kisutch*), could occur in marine waters offshore of the Ocean Outlet work area were considered but dismissed from the following discussion. Construction associated with the Ocean Outlet would occur on the beach and intertidal zone and not in the deep, offshore waters where these species may be present and or have the potential to be affected by proposed Project construction activities. Further, the Ocean Outlet work area would be isolated through use of a cofferdam to contain Project components and avoid interference with wildlife using the beach or fish using nearshore waters. Similarly, local pinnipeds (seals and sea lions), including the delisted Steller sea lion, that could occur in waters offshore of the Project study area were considered but dismissed from further discussion due to the isolation of the work area from marine waters within a cofferdam on the beach around the Ocean Outlet structure. Protected nursery or haul-out sites do not occur within the study area and any marine mammal occurrence on study area beaches would be the result of rare strandings.

This section analyzes potential Project impacts to biological resources from the construction phase (short-term) and the operations and maintenance phase (long-term). This analysis addresses potential direct, indirect, and cumulative impacts of the Project to special-status species, sensitive natural communities, wetlands and waters of the U.S., and other biological resources. Direct impacts are those resulting from the Project and that occur at the same time and place. Indirect impacts are caused by the Project, but can occur later in time or farther removed in distance while still reasonably foreseeable and related to the Project. Impact analyses typically characterize effects to biological resources as temporary or permanent, with a permanent impact referring to areas that are developed or otherwise precluded from restoration to a pre-project state.

For the purposes of this EIR/EIS, the word "substantial" as used in the significance criteria above is defined by the following three principal components:

i. Magnitude and duration of the impact (e.g., substantial/not substantial)
ii. Uniqueness of the affected resource (rarity)
iii. Susceptibility of the affected resource to disturbance

The approach to analysis of impacts related to operation of the Project are described below under the heading Operational Impacts.

3.4.5 Impact Analysis

3.4.5.1 Proposed Project

CEQA Analysis

Construction Impacts

Special-Status Plants

a) Impact BIO-1: Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on plant species identified as sensitive or special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. (Less than Significant with Mitigation)

Northern coastal scrub communities and coastal dune communities within and adjacent to the Project footprint provide suitable habitat for, or have previously or currently support, several California Rare Plant Ranked species, including Franciscan onion, bent-flowered fiddleneck, coast rockcress, Johnny-nip, San Francisco spineflower, Franciscan thistle, compact cobwebby thistle, San Francisco wallflower, blue coast gilia, San Francisco gumplant, short-leaved evax, Kellogg's horkelia, rose leptosiphon, marsh microseris, Oregon polemonium, San Francisco campion, coast triquetrella, Wight's paintbrush, and dune tansy, and potentially other special-status plants. No federal- or State-listed plants have been observed or are expected to occur within the Project study area or proposed Project areas of disturbance.

Project construction activities, including materials and equipment staging within Fort Funston associated with the Vista Grande Tunnel and Ocean Outlet replacement, maintenance on and use of the Avalon Canyon access road beach access route, and construction of the Impound Lake discharge structure, could result in impacts to special-status plant populations and their supporting vegetation communities primarily through direct effects such as vegetation removal, ground disturbance, or trampling, though also indirectly though the potential spread of invasive species (discussed under Impact BIO-7, below). Special-status plant populations are not known to occur within the proposed Project site, and were not observed during reconnaissance surveys conducted in support of this analysis. However, there are known occurrences of special-status plants to the south of the proposed Fort Funston staging area and a moderate potential for special-status species to occur at the Avalon Canyon access road and other Project areas, based on the presence of supportive vegetation communities these species require (mainly coastal scrub and central dune scrub). While the Fort Funston staging area is within a disturbed area, it is possible for adjacent communities supporting special-status plants to migrate to the Project site prior to construction.

This is a potentially *significant* impact. Implementing **Mitigation Measure 3.4-1**, Avoidance, minimization, and compensation for impacts to special-status plants, would reduce potential impacts on special-status plants to a less-than-significant level by requiring preconstruction protocol-level surveys, implementing avoidance measures, relocating extant populations, and compensating for impacts to special-status plants that could not be avoided, if present.

Mitigation Measure 3.4-1: Avoidance, minimization, and compensation for impacts to special-status plants

A qualified botanist shall conduct appropriately timed floristic preconstruction surveys for special-status plant species with a moderate or high potential to occur in the study area, and for species known to be present in the study area, in all suitable habitat that would be potentially disturbed by the Project within the year of initiation of ground disturbance (e.g., spring/summer 2017 surveys prior to fall 2017 start of construction). Surveys on NPS-managed land shall be coordinated with NPS. Surveys shall be conducted following the current CDFW protocol (CDFG, 2009). If no special-status plants are found during focused surveys, the botanist shall document the findings in a letter to CDFW and the Project proponent, and no further mitigation will be required.

If special-status plants are found during focused surveys, the following measures shall be implemented:

a) Information regarding the special-status plant populations shall be reported to the CNDDB, mapped, and documented in a technical memorandum provided to Daly City.

b) No federal- or state-listed plants have been observed or are expected to occur within the Project areas of disturbance; however, if federal- or state-listed species are identified during floristic preconstruction surveys Daly City shall mark these plants for avoidance and comply with the federal and state Endangered Species Acts through consultation with USFWS and CDFW, respectively, as described in items c and d, below.

c) If other special-status plant population(s) (i.e., California Rare Plant Ranked or locally significant plants) are identified during floristic preconstruction surveys and can be avoided during Project implementation, it shall be clearly marked in the field by a qualified botanist and avoided during construction activities. Before ground clearing or ground disturbance, all on-site construction personnel shall be instructed as to the species' presence and the importance of avoiding impacts to this species and its habitat.

d) If special-status plant populations cannot be avoided, Daly City shall consult with CDFW and/or USFWS as appropriate (and NPS on populations within NPS-managed lands) to coordinate relocation of special-status plants or compensation if relocation is not determined to be a feasible or successful option by a qualified biologist:

    i. To the extent feasible, special-status plants that would be impacted by the Project shall be relocated within local suitable habitat. This can be done either through salvage and transplanting or by collection and propagation of seeds or other vegetative material. Any plant relocation shall be done under the supervision of a qualified biologist.

    ii. Compensation for temporary or permanent loss of special-status plant occurrences, in the form of land purchase or restoration, shall be provided to the level acceptable to the resource agencies. Compensatory measures shall be determined on a case-by-case basis in consultation with the resource agencies. Compensation for loss of special-status plant populations typically involves the purchase and permanent stewardship of known occupied habitat or the restoration and reintroduction of populations in degraded, unoccupied habitat. Restoration or reintroduction may be located on- or offsite.

    In either case the City of Daly City shall prepare a Mitigation and Monitoring Plan for relocated special-status plants or to compensate for the loss of special-status plant species. The plan shall detail relocation methods or appropriate replacement ratios and methods for implementation, success criteria, monitoring and reporting protocols, and contingency measures that shall be implemented if the initial mitigation fails. The plan shall be developed in consultation with the appropriate agencies prior to the start of local construction activities. For special-status plants displaced on NPS-managed lands, the Mitigation and Monitoring Plan shall be coordinated with and approved by NPS. At a minimum, success criteria shall require any mitigation to provide equal or better habitat and populations than the impacted area.

e) If more than 2 years elapses between the focused, floristic preconstruction surveys of the Project site and commencement of ground disturbance activities, a final set of appropriately timed focused, floristic preconstruction botanical surveys shall be conducted and populations mapped. The results of these final surveys shall be combined with previous survey results to produce habitat maps showing habitat where the special-status plants have been observed during either of the focused floristic surveys conducted for the Project. Copies of all surveys shall be submitted to NPS for NPS-managed lands and communications with the appropriate agencies shall be coordinated with NPS for NPS-managed lands.

f) If special-status plants are relocated from the Project or compensatory restoration or reintroduction of plants or seed is implemented, Daly City shall maintain and monitor the relocation sites and/or restored areas for 5 years following the completion of construction and restoration activities. Daly City shall submit monitoring reports to the resource agencies at the completion of restoration and for 5 years following restoration implementation. Monitoring reports shall include photo-documentation, planting specifications, a site layout map, descriptions of materials used, and justification for any deviations from the mitigation plan. Success criteria for restored areas after 5 years will be determined by the appropriate agencies that will approve the plans. For mitigation on NPS-managed lands, restoration plans shall be coordinated with and approved by NPS and all plants shall be propagated from material collected and grown according to NPS protocols.

Significance after Mitigation: Less than Significant.

Special-Status Reptiles

Impact BIO-2: Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on reptile species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. (Less than Significant with Mitigation)

There is suitable aquatic and upland habitat for western pond turtle, a California species of special concern, in Lake Merced. Construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could adversely affect this species by direct mortality, should it be present, which would be a *significant* impact. Similarly, construction activities associated with in-lake treatment measures that may be implemented under the LMP, potential facility improvements associated with lake level increases, or other future operations and maintenance improvements could result in direct impacts. Implementation of **Mitigation Measure 3.4-2a, Worker Environmental Awareness Program Training**, would reduce potential impacts on this species to a *less-than-significant* level by requiring all Project personnel to attend an environmental training prior to beginning work to educate workers on sensitive resources within and surrounding Project sites and regulatory environment protecting them, general protection measures and protocols to be implemented during construction, and consequences for non-compliance with Project-specific protection measures. Implementation of **Mitigation Measure 3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would reduce potential impacts on this species to a *less-than-significant* level by requiring the installation of terrestrial exclusion fencing around these lakeside construction areas, requiring the installation of a cofferdam around isolated in-water work areas, conducting preconstruction surveys, and requiring additional measures during site construction.

Mitigation Measure 3.4-2a: Worker Environmental Awareness Program Training

A Project-specific Worker Environmental Awareness Program (WEAP) training shall be developed and implemented by a qualified biologist and attended by all Project personnel prior to beginning work onsite. The WEAP training shall generally include but not be limited to education about the following:

a) Applicable State and federal laws, environmental regulations, Project permit conditions, and penalties for non-compliance;

b) Special-status plant and animal species with potential to occur at or in the vicinity of the Project site, avoidance measures, and a protocol for encountering such species including a communication chain;

c) Preconstruction surveys and biological monitoring requirements associated with each phase of work and at each Project site as biological resources and protection measures will vary depending on the land managers (see f, below);

d) Known sensitive resource areas in the Project vicinity that are to be avoided and/or protected as well as approved Project work areas, access roads, and staging areas;

e) Best management practices (BMPs) and their location at various Project sites for erosion control, species exclusion, in addition to general housekeeping requirements; and

f) Specific requirements sanctioned by NPS that the Project must comply with while working on NPS-managed lands, including but not limited to:

   i. Preconstruction surveys for and relocation of terrestrial wildlife prior to grading or vegetation removal at Fort Funston;

   ii. Biological monitoring during Project initiation at each NPS-managed Project location (e.g., Ocean Outlet work area) to identify nearby sensitive biological resources and implement avoidance or protection measures approved by NPS staff;

   iii. Seasonal work restrictions during wildlife breeding, nesting, or migration periods; and

   iv. Work area exclusion methods, communication and relocation protocols if wildlife enters a work area(s) while a biological monitor is not onsite.

Mitigation Measure 3.4-2b: Avoidance and Minimization Measures for Western Pond Turtle

During construction at the Lake Merced overflow structure in South Lake, construction at the outlet structure on the bank and within waters of Impound Lake, and during installation of the in-lake treatment infrastructure a qualified biological monitor shall be present during vegetation removal and the installation of exclusion fencing and cofferdam at Impound Lake. Also, the following measures shall be implemented:

a) Within one week before construction commences at these locations, a qualified biologist shall supervise the installation of exclusion fencing along the terrestrial boundaries of the work area, as the biologist deems necessary. This is to prevent western pond turtles and incidental common wildlife from entering the work area from the adjacent riparian and upland grassland habitats. The construction contractor shall install CDFW-approved species exclusion fencing, with a minimum height of 3 feet above ground surface and with an additional 4 to 6 inches of fence material buried such that species cannot crawl under the fence. Any vegetation removal in advance of exclusion fence installation shall be performed under the supervision of a qualified biologist.

b) A qualified biologist shall supervise the installation of a cofferdam around the in-water work area which shall be in place throughout the duration of construction on the Lake Merced overflow structure in South Lake and the Lake Merced outlet into Impound Lake (should lake water levels at the time of construction require in-water work to execute construction of either the overflow or the outlet structure). The following measures will be taken to prevent entrapment of western pond turtle and common, resident fish[21] within the cofferdam:

   i. The qualified biologist shall visually survey the area for wildlife where the cofferdam is to be installed and monitor affected waters during installation.

   ii. As the final cofferdam piece is installed, resulting in isolation of the work zone and potential trapping of turtles and fish, the qualified biologist shall oversee initial dewatering of the area and conduct rescue-relocation effort of potentially isolated turtles and fish. Once a zero catch is recorded for three successive passes of nets, the work area can be declared free of wildlife.

   iii. The biologist shall monitor final dewatering of the work area and rescue-relocate any final fish that are revealed by drawing water levels all the way down.

   iv. The isolated work area can now be considered a construction zone and can be managed as such. Memo of rescue-relocation results involving western pond turtles shall be submitted to CDFW, as required by CDFW, and kept on file at construction site (in case of inspections).

c) The biological monitor shall monitor the exclusion fencing and inspect the cofferdam weekly to confirm proper maintenance and inspect for turtles. If turtles are found, the contractor shall halt construction in the immediate area and contact the CDFW for instructions on how to proceed. Construction may resume after approval from the CDFW.

d) During construction and/or maintenance activities at work sites around Lake Merced, excavations deeper than 6 inches shall have an escape ramp of earth or a wooden plank installed at a 3:1 rise, be completely covered with plywood/metal plates at the end of each day to prevent entrapment, or be surrounded by species exclusion fencing to prevent species entry; openings, such as the ends of pipes, where western pond turtles might seek refuge shall be covered when not in use; and all trash that may attract predators or hide western pond turtles shall be properly contained each day, removed from the worksite, and disposed of regularly. Following site remediation, the construction contractor shall remove all trash and construction debris from the work areas.

Significance after Mitigation: Less than Significant.

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[21] No naturally occurring special-status fish species are currently found within the waters of Lake Merced (Lake Merced Task Force, 2007; see also the Water Quality Analysis [ESA, 2015]).

Special-Status and Migratory Birds

Impact BIO-3: Construction of the Project could have a substantial adverse effect either directly or through habitat modifications, on migratory birds and/or on bird species identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. (Less than Significant with Mitigation)

Construction activities, especially those that involve heavy machinery, may adversely affect nesting bird species within 0.25 mile of Project sites during the nesting season (January 1 – August 15). Migratory and native raptor and passerine bird species, including the San Francisco common yellow throat (a California species of special concern), are known to forage and/or nest in the coastal scrub, riparian vegetation, and manmade structures surrounding Lake Merced and Avalon Canyon access road; the mature non-native forest located between the existing canal and the Olympic Club; and the coastal dune scrub vegetation at Fort Funston. A nesting colony of bank swallows (California threatened species) is also documented on the bluffs approximately 1 mile north of the Ocean Outlet site though suitable substrate for this species to create a burrow colony in the bluffs surrounding the Ocean Outlet site is not available. Bank swallows do forage over open water within the Project study area, but are not anticipated to be adversely affected by construction while foraging over Lake Merced due to the relatively small in-water work areas associated with new Project facilities (at Impound Lake and South Lake) in comparison to foraging habitat found throughout the entire Lake Merced system. Due to the understood range that breeding bank swallows forage within while feeding young, individuals are most likely to forage over the western-most portions of North Lake and South Lake. Western snowy plover (federal threatened and a California species of special concern) is not known to nest within the Project study area but could rest and forage on study area beaches between July and May annually.

Project construction activities generate noise and visual disturbance that could affect nesting efforts at and around the Project sites. Construction activities that may alter the ambient noise environment or introduce short-term loud noise events include but are not limited to grading or ground disturbance at the Fort Funston staging area and wetland cells, soldier pile driving at the Lake Merced portal, and impact pile driving at the John Muir crossing near Impound Lake, on the Fort Funston Beach at the Ocean Outlet, at the temporary construction shaft at Fort Funston leading to the underground tunnel, and at sites where activities required for construction of potential LMP components, potential facility improvements associated with lake level increases, or other future operations and maintenance improvements could occur.

Noise pollution can be detrimental to wildlife, and bird populations are particularly susceptible because they rely on acoustic signals for mating, predator evasion, and communication between adults and offspring, among other behaviors. Reijnen and Foppen (1995) showed that male willow warblers (*Phylloscopus trochilus*) experience difficulties in mate attraction near highways, as a result of noise pollution. Ellis (1981) describes studies that show “noticeably alarmed” responses in raptors to sounds within the 82 to 114 dBA[22] range. More recent research has found certain types of

[22] dBA = A-weighted decibels

unnatural noise to be disruptive to bird life at a much lower level; Delaney et al. (1999) found that spotted owl flush rates in response to chain saws were apparent at levels above 46 dBA. Finally, West et al. (2007) found that chronic intense noise (e.g., oil field compressor station) of 92 dBA or more may induce physiological stress in some bird species, if they cannot avoid exposure. None of these studies were able to conclude that nest failure resulted from higher noise levels. Nevertheless, a single stimulus event clearly had an effect on bird behavior, and the studies suggest that short-term loud noises can affect foraging and roosting birds by temporarily disturbing these behaviors, and may deter bird use of an area (including nesting) if such noises persist over the long term.

Birds in the study area are accustomed to varying levels of ambient noise emanating from existing human activities in the area. For example, pedestrians are fairly constant throughout the day on the foot trail surrounding the lake as is vehicle traffic along John Muir Drive, Lake Merced Boulevard, and Highway 35. In Section 3.11.1.3 the existing noise environment of the immediate Project area is described to approximately range between 60 and 65 dBA L_{dn}.[23] Construction activities listed above would generate noise levels in exceedance of ambient noise levels in the study area. Table 3.11-8 in Section 3.11.5.1 depicts typical noise levels generated by construction equipment to be used during Project implementation. These levels range from 51 dBA, L_{eq}[24] at 50 feet for the operation of an excavator to 101 dBA, L_{eq} at 50 feet for an impact or vibratory pile driver.[25] Construction activities which would substantially alter the noise environment could disrupt birds attempting to nest in the vicinity of the Project site, disrupt parental foraging activity, or displace mated pairs with territories in the Project vicinity.

The loss of an active nest attributable to Project activities would be considered a *significant* impact under CEQA. Moreover, disruption of nesting migratory or native birds is not permitted under the federal MBTA or the California Fish and Game Code, as it could constitute unauthorized take. Thus, the loss of any active nest by, for example, removing a tree or shrub containing an active nest or causing visual or noise disturbance which leads to nest abandonment, must be avoided under federal and California law. Implementation of **Mitigation Measure 3.4-3**, **Nesting Bird Protection Measures**, would reduce potential impacts on migratory and special-status birds to a *less-than-significant* level by restricting certain construction activities during breeding bird season, requiring preconstruction surveys, and implementing avoidance measures if active nests are located. In addition, implementing noise **Mitigation Measure 3.11-1**, as discussed in Section 3.11.5.1, would require the use of noise control methods and technologies during Project construction, which would further reduce potential impacts on nesting birds.

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[23] L_{dn} also abbreviated DNL, it is a 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

[24] L_{eq} the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The L_{eq} is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

[25] The noise levels represent maximum noise levels corresponding to a distance of 50 feet from the noisiest piece of equipment associated with a given piece of construction equipment.

Mitigation Measure 3.4-3: Nesting Bird Protection Measures

Nesting birds and their nests shall be protected during construction through the implementation of the following measures:

a) To the extent feasible, conduct initial ground disturbance and site grading, vegetation removal, tree removal, pile driving, and other construction activities that may compromise breeding birds or the success of their nests outside of nesting season (i.e., from January 1 – August 15). Timing of pile driving on NPS-managed lands shall be coordinated with NPS biologists.

b) If construction activities cannot be fully avoided during bird nesting season (i.e., from January 1 to August 15), a qualified wildlife biologist shall conduct preconstruction nesting surveys within 7 days prior to the start of construction or prior to reinitiating construction after any construction breaks of 14 days or more. Lead agencies and/or responsible agencies may, at their discretion, require shorter preconstruction survey periods as a condition of Project approval (e.g., NPS previously has required that surveys occur within less than 7 days prior to the start or re-initiation of construction in other GGNRA locations). Surveys shall be performed for the Project sites and for suitable habitat within 250 feet of the Project sites in order to locate any active passerine (perching bird) nests and within 500 feet of the Project sites to locate any active raptor (birds of prey) nests or double-crested cormorant or heron rookeries.

c) If active nests are located during the preconstruction bird nesting surveys, a qualified biologist shall evaluate if the schedule of construction activities could affect the active nests and if so, the following measures shall apply:

    i. If construction is not likely to affect the active nest, it may proceed without restriction; however, a biologist shall regularly monitor the nest to confirm there is no adverse effect and may revise their determination at any time during the nesting season.

    ii. If construction may affect the active nest, the qualified biologist shall establish a no-disturbance buffer around the nest(s) and all Project work shall halt within the buffer until it is determined no longer in use by a qualified biologist. Typically, these buffer distances are 250 feet for passerines and 500 feet for raptors; however, they may be adjusted if 1) determined to not sufficiently avoid or minimize adverse project effects in which case the buffer would be expanded, or 2) an obstruction, such as a building, is within line-of-sight between the nest and construction in which case the buffer could be reduced, if approved by CDFW. Modifying nest buffer distances, allowing certain construction activities within the buffer, modifying construction, and removing or relocating active nests shall be coordinated with the CDFW as appropriate given the nests that are found on the site. Protective measures surrounding nests found on NPS-managed lands shall be coordinated with NPS.

    iii. Any work that must occur within established no-disturbance buffers (e.g., vegetation removal, grading, work with hand tools, etc.) around active nests shall be monitored by a qualified biologist. If adverse effects in response to Project work within the buffer are observed and could compromise the nest, work shall halt until the nest fledges.

d) Any birds that begin nesting within the Project area and survey buffers amid construction activities are assumed to be habituated to construction-related or similar noise and disturbance levels so exclusion zones around nests may be reduced or eliminated in these cases as determined by the qualified biologist in coordination with respective land managers. Work may proceed around these active nests as long as they and their occupants are not directly impacted. Protective buffers may be established around such nests at any time if Project-related adverse effects to bird, nests, or nestlings are observed.

Significance after Mitigation: Less than Significant.

Special-Status Bats

Impact BIO-4: Project construction could have a substantial adverse effect either directly or through habitat modifications, on bats identified as special-status in local or regional plans, policies, or regulations, or by the CDFW or USFWS. (Less than Significant with Mitigation)

Clearing vegetation (including trees) and removing structures in support of Project construction (including activities required for construction of potential LMP components, potential facility improvements associated with lake level increases, or other future operations and maintenance improvements) could result in direct mortality of special-status bats roosting in tree cavities, under bark, and in structures within the Project site. Direct mortality of special-status bats would be a *significant* impact. Additionally, common bats may establish maternity roosts, which are protected under CEQA in these same locations. Implementation of **Mitigation Measure 3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**, would reduce potential impacts on special-status bats and common bat maternity roosts to a *less-than-significant* level by requiring preconstruction surveys and implementing avoidance measures if potential roosting habitat or active roosts are located.

Mitigation Measure 3.4-4: Avoidance and Minimization Measures for Special-Status Bats

A preconstruction survey for special-status bats shall be conducted by a qualified biologist in advance of tree and structure removal within the project site to characterize potential bat habitat and identify active roost sites. Should the preconstruction survey find no bat habitat or bat roosting sites then no further action is required. Should potential roosting habitat or active bat roosts be found in trees and/or structures to be removed under the project, Daly City shall implement avoidance and minimization measures. These measures include, but are not limited to, the following, subject to modification by the terms of applicable permits issued by the CDFW:

a) Removal of trees and structures shall occur when bats are active, approximately between the periods of March 1 to April 15 and August 15 to October 15; outside of bat maternity roosting season (approximately April 15 – August 31) and outside of months of winter torpor (approximately October 15 – February 28), to the extent feasible.

b) If removal of trees and structures during the periods when bats are active is not feasible and active bat roosts being used for maternity or hibernation purposes are found on or in the immediate vicinity of the project site where tree and structure removal is planned, a no disturbance buffer of 100 feet shall be established around these roost sites until they are determined to be no longer active by the qualified biologist. A 100-foot no disturbance buffer is a typical protective buffer distance however may be modified by the qualified biologist depending on existing screening around the roost site (such as dense vegetation or a building) as well as the type of construction activity which would occur around the roost site.

c) The qualified biologist shall be present during tree and structure removal if potential bat roosting habitat or active bat roosts are present. Trees and structures with active roosts shall be removed only when no rain is occurring or is forecast to occur for 3 days and when daytime temperatures are at least 50°F.

d) Removal of trees with potential bat roosting habitat or active bat roost sites shall follow a two-step removal process:

   i. On the first day of tree removal and under supervision of the qualified biologist, branches and limbs not containing cavities or fissures in which bats could roost, shall be cut only using chainsaws.

   ii. On the following day and under the supervision of the qualified biologist, the remainder of the tree may be removed, either using chainsaws or other equipment (e.g., excavator or backhoe).

e) Removal of structures containing or suspected to contain potential bat roosting habitat or active bat roosts shall be dismantled under the supervision of the qualified biologist in the evening and after bats have emerged from the roost to forage. Structures shall be partially dismantled to significantly change the roost conditions, causing bats to abandon and not return to the roost.

Significance after Mitigation: Less than Significant.

Sensitive Natural Communities

Impact BIO-5: Project construction could have a substantial adverse effect on central dune scrub, a sensitive natural community identified by the CDFW. (Less than Significant with Mitigation)

Central dune scrub is a sensitive natural community with a state rarity ranking of S2.2 that occurs in several locations within the Project footprint. Any vegetation removal, temporary ground disturbance, deposition of materials (e.g., water run-off, sediment accumulation, construction materials stockpiling), or other direct disturbance within central dune scrub would be considered a *significant* impact. Impacts to central dune scrub are expected to occur during Project-related improvements to the Avalon Canyon access road and through use of the proposed staging area at Fort Funston where approximately 0.5 acre of central dune scrub is present on the eastern and southern boundaries. In addition, restored central dune scrub has been established near Impound Lake where the outlet structure is proposed; however, the Project facilities are not located in areas where central dune scrub has been mapped. **Mitigation Measure 3.4-5**, **Avoidance, minimization,**

and compensation for impacts to central dune scrub, would reduce impacts on this sensitive natural community where it would be disturbed under the Project to a *less-than-significant* level.

Mitigation Measure 3.4-5: Avoidance, minimization, and compensation for impacts to central dune scrub

a) Concurrent with focused botanical surveys, prior to establishing staging areas or beginning construction activities, areas of central dune scrub vegetation within the Project footprint and within a 50-foot buffer adjacent to the Project footprint shall be mapped by a qualified botanist using a Global Positioning System (GPS) unit with 3-meter accuracy.

b) To the extent feasible, Project elements shall be designed to avoid and minimize impacts to central dune scrub. This includes minimizing the Project footprint within central dune scrub or siting Project elements outside of this sensitive community. Where central dune scrub can be avoided, protective fencing shall be installed along the edge of construction areas including temporary and permanent access roads where construction will occur within 50 feet of the edge of central dune scrub (as determined by a qualified botanist). The location of fencing shall be marked in the field with stakes and flagging and shown on the construction drawings.

   The construction specifications shall contain clear language that prohibits construction-related activities, vehicle operation, material and equipment storage, trenching, grading, or other surface-disturbing activities outside of the designated construction area. Signs shall be erected along the protective fencing at a maximum spacing of one sign per 25 feet of fencing. The signs shall state: "This area is environmentally sensitive; no construction or other operations may occur beyond this fencing. Violators may be subject to prosecution, fines, and imprisonment." The signs shall be clearly readable at a distance of 20 feet, and shall be maintained for the duration of construction activities in the area.

c) In areas where impacts to central dune scrub cannot be avoided, the Project proponent shall prepare and implement an onsite Revegetation and Restoration Plan for Central Dune Scrub, to be submitted to CDFW and CCC for review and approval. For impacts to central dune scrub on NPS-managed lands, the plan shall also be coordinated with and approved by NPS.

   Restoration and revegetation shall take place onsite following Project completion and will directly restore those areas temporarily impacted. If grading has occurred in these locations to facilitate Project construction, re-contouring of the disturbed areas to pre-project conditions or similar shall be performed prior to restoration.

   If permanent impacts to central dune scrub occur within the Project footprint, central dune scrub adjacent to the restored areas could be enhanced through (1) removal of invasive plants, (2) planting of local central dune scrub species, and (3) continued monitoring and maintenance to compensate for permanent losses.

   The revegetation and restoration plan shall be prepared by a qualified restoration ecologist and shall include specifications for seed and propagule[26] collection prior to the commencement of construction and at the appropriate phonological stage to

[26] A plant structure capable of dispersing from the parent plant and establishing in a new location. Root, rhizome, and stem fragments with buds are common propagules as are bulbs, corms, and tubers. Seeds are also considered propagules.

capture reproductive structures of target central dune scrub plants. The restoration ecologist shall coordinate with a local native plant restoration nursery and NPS for restoration of central dune scrub on NPS-managed lands to either store the propagules until planting or grow the plants so that they are ready to plant once construction is complete. Restoration areas shall be monitored to assess re-establishment for 5 years or until the sites meet the success criteria determined in the plan. At a minimum, total native vegetation cover, composition, and species richness in the restored areas should be monitored and maintained until comparable with suitable reference sites.

Significance after Mitigation: Less than Significant.

Habitat Modification through Removal of Upland Vegetation Including Trees

Impact BIO-6: Project construction would not have a substantial adverse effect on upland vegetation communities identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. (Less than Significant with Mitigation)

The construction of the Lake Merced outlet structure at Impound Lake, the Lake Merced portal, wetland cells A and B, the Fort Funston tunnel shaft, the staging area at Fort Funston, and improvements to the Avalon Canyon access road would require removal of existing upland vegetation. Much of this vegetation includes non-native grassland, ruderal or weedy species that provide marginal habitat for wildlife and are undesirable from both an aesthetic and recreation perspective. The exception to this is the central dune scrub vegetation at the Fort Funston staging area, along the Avalon Canyon access road, and potentially at the Lake Merced outlet structure at Impound Lake; impacts to this sensitive natural community are addressed in under Impact BIO-5, Avoidance, minimization, and compensation for impacts to central dune scrub, above.
Non-central dune scrub upland vegetation consisting of mainly non-native grassland, ruderal or weedy species is locally abundant and is not considered a sensitive habitat. Removal or disturbance of this upland vegetation does not constitute a *significant* impact; however, areas cleared of non-sensitive upland vegetation for Project purposes that are adjacent to sensitive communities, could be adversely affected by the introduction of non-native or invasive plants following construction and facilitate spread of such species into nearby sensitive communities. This effect is addressed under Impact BIO-7.

A few trees are present within the Project footprint along the south side of the existing Vista Grande Canal as well as the north side of the Canal where wetland cells A and B would be located may be trimmed, removed, or damaged during Project construction. These trees are mainly non-native Monterey pine, Monterey cypress, and blue gum eucalyptus and are not considered sensitive habitat. While these trees could provide nesting sites for breeding birds or special-status bats and their removal could have indirect adverse effects on these species, the number of trees potentially impacted by the Project would be very small, and adjacent areas support the same or similar trees. In other words, abundant similar habitat is available in the Lake Merced area, and could be used by various avian and bat species. Furthermore, direct impacts on breeding birds and special-status bats would be avoided by implementing preconstruction nesting bird surveys and protection measures, as described in Mitigation Measure 3.4-3, Nesting Bird Protection Measures, and Mitigation Measure 3.4-4, Avoidance and Minimization Measures for Special-Status Bats.

Trees that may be impacted by the Project during construction occur in an area managed by the San Francisco Department of Public Works (SFDPW) or located on San Francisco owned land. Such areas are subject to Article 16, Section 808 of the Public Works Code as designated street or significant trees. Damage to protected trees in areas under SFDPW jurisdiction and trees located on City owned property is prohibited and removal of street or significant trees is subject to a permit from SFDPW. Implementation of **Mitigation Measure 3.4-6**, **Implement Tree Protection Measures and Plant Replacement Trees**, would reduce these impacts on Project trees to *less-than-significant* levels.

Mitigation Measure 3.4-6: Implement Tree Protection Measures and Plant Replacement Trees

1. A certified arborist shall perform a tree survey of the Project prior to construction to identify trees to be removed, trimmed, or retained and that shall need to be protected during construction.

2. Trees to be trimmed or retained under the Project shall be protected during construction by measures determined by the certified arborist that may include but are not limited to the following:

   a. Establishing a Tree Protection Zone (TPZ) around any tree or group of trees to be retained. The formula typically used is defined as 1.5 times the radius of the dripline or 5 feet from the edge of any grading, whichever is greater. The TPZ may be adjusted on a case-by-case basis after consultation with a certified arborist.

   b. Marking the TPZ of any trees to be retained with permanent fencing (e.g., post and wire or equivalent), which shall remain in place for the duration of construction activities in the area. “Keep Out” signs shall be posted on all sides of fencing.

   c. Prohibiting construction-related activities, including grading, trenching, construction, demolition, or other work within the TPZ; or, if work within the TPZ is necessary, performing the work in a manner that will adequately protect the tree. No heavy equipment or machinery shall be operated within the TPZ. No construction materials, equipment, machinery, or other supplies shall be stored within a TPZ. No wires or signs shall be attached to any tree. Any modifications shall be approved and monitored by a certified arborist.

   d. Pruning selected trees to provide necessary clearance during construction and to remove any defective limbs or other parts that may pose a failure risk. All pruning shall be completed by a certified arborist or tree worker and adhere to the Tree Pruning Guidelines of the International Society of Arboriculture.

3. Trees to be removed under the Project shall follow the SFDPW tree removal permit process and be replaced on the property from which trees are removed at a 1:1 ratio. Non-native trees removed shall be replaced with native tree species determined

suitable for the site by a qualified biologist, horticulturist, landscape architect, or biologist in coordination with the SFDPW.

a. Trees shall be replaced within the first year after completion of construction, or as soon as possible in areas where construction has been completed, during a favorable time period for replanting, as determined by a qualified arborist, horticulturist, or landscape architect.

b. Selection of replacement sites and installation of replacement plantings shall be supervised by a qualified arborist, horticulturist, landscape architect, or landscape contractor. Irrigation of trees during the initial establishment period (generally for two to four growing seasons) shall be provided as deemed necessary by a qualified arborist, horticulturist, landscape architect, or landscape contractor.

c. Trees shall be planted at or in close proximity to removal sites, in locations suitable for the replacement species. The specialist shall work with the SFDPW to determine appropriate nearby off-site locations that are within the same jurisdiction from which the trees are removed if replanting within the well facility sites is precluded.

d. A qualified arborist, horticulturist, landscape architect, or landscape contractor shall monitor newly planted trees at least twice a year for five years. Each year, any trees that do not survive shall be replaced and monitored at least twice a year for five years thereafter.

Implementation of these measures would ensure compliance with Article 16, Section 808 of the San Francisco Public Works Code and therefore reduce impacts associated with conflicts with applicable local policies or ordinances protecting biological resources to a *less-than-significant* level.

Significance after Mitigation: Less than Significant.

Introduction of Invasive Plants

Impact BIO-7: Construction of the Project would have a substantial adverse effect on sensitive communities identified in local or regional plans, policies, regulations, or by CDFW or USFWS through the introduction or spread of invasive plants. (Less than Significant with Mitigation)

Project construction activities (including activities required for construction of potential Lake Management Plan components, potential facility improvements associated with lake level increases, or other future operations and maintenance improvements) could contribute to the spread of invasive plants and/or introduce new invasive plants to the study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events which would be a *significant* impact. Controlling the potential spread of invasive species during construction is of particular concern at Fort Funston as invasive iceplant currently covers a majority of the proposed staging area. The proposed staging area and access road abut restored areas of native vegetation where special-status plants are known to occur and that could be adversely affected by the introduction or spread of iceplant during Project implementation. Implementing **Mitigation Measure 3.4-7a, Control Measures for Spread of Invasive Plants** and **Mitigation Measure 3.4-7b, Restoration of Upland Areas** would reduce this impact to a *less-than-significant* level. Additionally, treatment of temporarily disturbed areas within Fort Funston following construction shall be coordinated with NPS as the proposed Project use areas are included in long-term management plans for the park and require specific methods and materials be used. General measures to be implemented throughout the Project are provided first under Mitigation Measure 3.4-7a, followed by additional requirements for work at Fort Funston.

Mitigation Measure 3.4-7a: Control Measures for Spread of Invasive Plants

Construction best management practices shall be implemented in all construction areas to prevent the spread of invasive plants, seed, propogules, and pathogens through the following actions:

1) Avoid driving in or operating equipment in weed-infested areas outside of fenced work areas and restrict travel to established roads and trails whenever possible.
2) Avoid leaving piles of exposed soil or construction materials in areas with the potential for invasive plants (e.g., Fort Funston staging area). Non-active stockpiles shall be covered with plastic or a comparable material.
3) Clean tools, equipment, and vehicles before transporting materials and before entering and leaving worksites (e.g., wheel washing stations at Project site access points). Inspect vehicles and equipment for weed seeds and/or propagules stuck in tire treads or mud on the vehicle to minimize the risk of carrying them to unaffected areas. Designate areas within active construction sites for cleaning and inspections.

The following additional actions shall be implemented at Fort Funston:

4) An NPS representative shall inspect vehicles and equipment prior to project initiation at any Fort Funston work area work for weed seeds and plant fragments that could colonize within the site. At Project initiation, all construction vehicles must be cleaned to remove soil and plant fragments at the Fort Funston main parking area (or other agreed to location) and vehicles or equipment that are not clean shall be rejected until clear of weed seed and plant fragments. Wheel washing stations or other methods to remove and contain seeds or other plant fragments from vehicles, equipment, boots, and tools shall be performed in designated areas.
5) All equipment and tools involved in soil disturbance at Fort Funston shall be disinfected using a 10% bleach or 70% isopropyl alcohol solution prior to initial use within Fort Funston or prior to returning to Fort Funston if used on another project site.
6) Only certified, weed-free, plastic-free imported erosion control materials (or rice straw in upland areas) shall be used at Fort Funston.

Mitigation Measure 3.4-7b: Post-Construction Treatment of Upland Areas

Upon completion of final grading, and in order to prevent the establishment and spread of invasive plant species in upland areas temporarily disturbed by construction activities, hydroseed or broadcast seed of a native plant seed mix shall be applied to upland areas disturbed during construction. This does not include areas of central dune scrub which will be restored according to Mitigation Measure 3.4-5, Avoidance, minimization, and compensation for impacts to central dune scrub. Native plant seed mix composition shall vary between sites and depend on the surrounding vegetation community of each area.

Post-construction treatment of upland areas on NPS-managed lands (i.e., disturbed dune scrub) shall be coordinated with and approved by NPS and all seeds and propagules shall be collected and grown according to NPS protocols. Fertilizers shall not be used at Fort Funston post construction as they may favor invasive plant species over native perennial species.

Following post construction treatment of these upland areas disturbed during construction (i.e., hydroseeding, broadcast seeding, or planting), monitoring of these areas shall occur quarterly for a minimum of 2 years. If more than 50 percent of the relative plant cover of these areas is composed of invasive plant species, management actions shall be carried out to reduce the invasive plant cover and promote the native species.

Significance after Mitigation: Less than Significant.

Wetlands and Other Jurisdictional Waters

Impact BIO-8: Project construction could have a substantial adverse effect on wetlands and other jurisdictional waters. (Less than Significant with Mitigation)

As discussed in Section 3.4.1.5, potential jurisdictional features occur within the Project site, which have not been verified as such by regulatory agencies. For the purpose of this Project analysis, these features are treated as potentially affected federal jurisdictional wetlands and other waters. Project impacts to these potentially jurisdictional features would involve temporary and permanent discharges of structures and/or fill within waters and wetlands, and/or alterations of the bed and/or banks of a lake or stream, to accommodate Project activities.

Potentially jurisdictional wetlands and other waters would be affected by the placement of permanent or temporary fill material associated with the installation of the collection box and box culvert at the headworks of the Vista Grande Canal, installation of the diversion structure within the Vista Grande Canal, construction of the Lake Merced outlet structure in Impound Lake, construction of the temporary access ramp at the downstream end of the Canal, replacement of the Lake Merced overflow structure in South Lake, and use of the temporary beach access route. Approximately 1,500 feet of the 3,600-foot Canal(potentially jurisdictional other waters) would be replaced.

Temporary and permanent impacts to navigation in the Pacific Ocean, a jurisdictional water body, would occur as a result of construction activities associated with installing a new Ocean Outlet structure on the beach and replacing a section of the existing submarine outfall pipe that crosses the beach. Project construction at the Ocean Outlet and on the submarine outfall pipe would temporarily block access across a portion of the beach. Permanent impacts to navigation within the jurisdictional open waters of Impound Lake would occur due to the placement of the new outlet structure below the normal WSE and the placement of a submerged layer of rip rap to protect the lakebed against erosion in the immediate vicinity of the outlet. Installation of an adjustable-height weir to replace the existing overflow structure in South Lake is not expected to result in permanent impacts to navigable jurisdictional waters. While some temporary impacts to navigable jurisdictional waters may occur from Project use of the beach access route for construction, no permanent impacts to navigable jurisdictional waters would result from Project use of the beach access route.

Within the Project area, wetlands and other waters of the U.S. are regulated under Section 404 of the Clean Water Act, and navigable waters are regulated under Section 10 of the Rivers and Harbors Act. Wetlands and other waters of the state are regulated by the RWQCB under Section 401 of the Clean Water Act and the Porter-Cologne Water Pollution Control Act, and by the City and County and of San Francisco and the CCC under the California Coastal Act. Project activities resulting in the discharge of fill or other disturbance to jurisdictional wetlands and other waters require permit approval from the Corps, a water quality certification and/or waste discharge requirements from the RWQCB, and/or a coastal development permit from the CCC. Project impacts to wetlands and waters would occur within those areas subject to the Western Shoreline Plan Local Coastal Program, and in areas where the CCC has retained jurisdiction, including Lake Merced and its adjacent wetlands, and the Pacific Ocean. Finally, the CDFW has jurisdiction over riparian habitat, including lake and stream bed and banks, pursuant to Sections 1600-1616 of the Fish and Game Code. Any Project activity resulting in an alteration to lake or channel bed or banks, extending to the outer dripline of trees forming the riparian corridor, is subject to CDFW jurisdiction. Construction of the collection box and box culvert at the headworks of the Vista Grande Canal, installation of the diversion structure within the Vista Grande Canal, the discharge structure located at Impound Lake, and potential changes to the South Lake overflow structure would result in disturbance of the bed and bank of these areas, requiring a Lake and Streambed Alteration Agreement (LSAA) from the CDFW.

Collectively, these regulatory agencies and the permits and authorizations they issue for the Project will require that fill of wetlands and waters shall be avoided or minimized to the maximum extent practicable while still accomplishing the Project’s purpose, and will specify an array of measures and performance standards as conditions of Project approval. In addition, unavoidable impacts to wetlands and other waters will trigger a requirement for compensatory mitigation that will be aimed at creating, restoring, or enhancing similar ecological functions and services as those displaced. The types, amounts, and methods of compensatory measures required will differ between the permitting agencies depending on the specific resources they regulate and the policies and guidelines they implement.

Table 3.4-3 summarizes the expected temporary and permanent impacts to potentially jurisdictional wetlands and other waters of the U.S.

TABLE 3.4-3
IMPACTS TO POTENTIAL FEDERALLY JURISDICTIONAL WETLANDS AND WATERS

Feature Type/Name	Impact Type	Preliminary Regulatory Jurisdiction
Waters		
Lake Merced	Temporary and permanent loss Permanent gain	Corps (Section 404 CWA, Section 10 RHA), RWQCB (Section 401, P-C), CCC jurisdiction, CDFW Section 1600
Vista Grande Canal	Permanent loss	Corps (Section 404 CWA), RWQCB (Section 401, P-C), CDFW Section 1600
Pacific Ocean	Temporary and permanent loss	Corps (Section 404 CWA, Section 10 RHA), RWQCB (Section 401, P-C), CCC jurisdiction
Beach at Fort Funston	Temporary and permanent loss	Corps (Section 404 CWA, Section 10 RHA), RWQCB (Section 401, P-C), CCC jurisdiction
Wetlands (Lake Merced)		
Bulrush Wetland (BW)	Temporary and possibly permanent loss	Corps, CCC, RWQCB (Section 401, P-C), CDFW Section 1600
Knotweed Wetland (KW)	Temporary and possibly permanent loss	Corps, CCC, RWQCB (Section 401, P-C), CDFW Section 1600
Arroyo Willow Wetland (AWW)	Temporary and possibly permanent loss	Corps, CCC, CDFW Section 1600

SOURCE: ESA, 2014

Wetlands are ecologically important features that provide habitat for a variety of fish and wildlife, in addition to providing important water quality and hydrological functions. Project construction activities such as grading and excavation would generate loose, erodible soils which could result in erosion or siltation into the Pacific Ocean, Vista Grande Canal, South Lake, Impound Lake, or their associated wetlands or waters. In the case of soil erosion or an accidental release of deleterious materials during construction, the Project could indirectly impact water quality, a *significant* impact. However, as described in Section 3.9.5.1 in Section 3.9, Hydrology and Water Quality, because the Project site exceeds 1 acre in size, Daly City would be required to apply for coverage under the Construction General Permit to comply with federal NPDES regulations, and would be required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that identifies appropriate construction BMPs in order to minimize potential sedimentation or contamination of stormwater runoff generated from the Project site. As described in Section 3.9.5.1, preparation and implementation of the SWPPP would maintain the potential for degradation of water quality in wetlands and other jurisdictional waters at a *less-than-significant* level; however, Project construction activities also could introduce other activities that may have a *significant* indirect impact on wetlands and/or other waters. Implementation of **Mitigation Measure 3.4-8a**, **Wetland Avoidance and Protection**, would reduce such impacts to a *less-than-significant* level. Additionally, the direct loss of jurisdictional wetlands and waters would be a *significant* impact.

Mitigation Measure 3.4-8b, **Compensation for Impacts to Wetlands and Riparian Habitat**, would reduce the impacts associated with direct loss to a *less-than-significant* level.

Mitigation Measure 3.4-8a: Wetland Avoidance and Protection

Access roads, work areas, and infrastructure shall be sited to avoid and minimize direct and indirect impacts to wetlands and waters to the extent feasible. Where work will occur on the Project adjacent to state and federal jurisdictional wetlands and waters, protection measures shall be applied to protect these features. These measures shall include the following:

1) A protective barrier (such as silt fencing) shall be erected around adjacent wetland or water features to isolate them from Project activities and reduce the potential for incidental fill, erosion, or other disturbance;

2) Signage shall be installed on the fencing to identify sensitive habitat areas and restrict construction activities beyond fenced limits;

3) No equipment mobilization, grading, clearing, storage of equipment or machinery, or similar activity shall occur at the Project site until a representative of Daly City has inspected and approved the wetland protection fencing;

4) Daly City shall ensure that the temporary fencing is continuously maintained until all remediation is completed;

5) Equipment maintenance and refueling in support of Project implementation shall be performed in designated upland staging areas and work areas, and spill kits shall be available onsite. Maintenance activity and fueling must occur at least 50 feet from jurisdictional wetlands and other waters or farther as specified in the Project permits and authorizations; and

6) Installation of the cofferdam around the existing outfall structure on the beach below Fort Funston and all subsequent work outside of the cofferdam once installed shall be conducted during periods of low tide, out of the Pacific Ocean, and when beach conditions provide accessible areas for equipment mobilization and storage beyond the reach of tides. Drip pans and/or liners shall be stationed beneath all equipment staged on the beach to minimize spill of deleterious materials into jurisdictional waters and spill kits shall be available within the cofferdam for easy accessibility during beach work.

A fencing material meeting the requirements of both water quality protection and wildlife exclusion may be used.

Mitigation Measure 3.4-8b: Compensation for Impacts to Wetlands and Riparian Habitat

To offset temporary impacts, restoration to pre-project conditions (typically including contours, topsoil, and vegetation) shall be conducted, as required by regulatory permits (e.g., those issued by the Corps, RWQCB, CDFW, and/or CCC). To offset unavoidable permanent impacts to jurisdictional wetlands, waters, and to riparian habitat, compensatory mitigation shall be provided as required by regulatory permits. Compensation may include on-site or off-site creation, restoration, or enhancement of jurisdictional resources, or payment into an approved mitigation bank for in-kind habitat credits, as determined by the permitting agencies. Mitigation bank credits, if available, shall be obtained prior to the start of construction. On-site or off-site creation/restoration/enhancement plans must be prepared by a qualified biologist prior to construction and approved by the permitting agencies. Implementation of creation/restoration/enhancement activities by the permittee shall occur prior to Project impacts, whenever possible, to avoid temporal loss. On- or off-site creation/restoration/enhancement sites shall be monitored by Daly City for at least five (5) years to ensure their success.

Significance after Mitigation: Less than Significant.

Resident Fish in Lake Merced

d) Impact BIO-9: Construction of the Project could impede movement of native resident fish species. (Less than Significant with Mitigation)

No special-status fish species occur within Lake Merced waters; however, a variety of common fish species reside in the lake (see Table 3.4-2) and could be adversely affected by in-water work at Lake Merced associated with the Project (including activities required for construction of potential LMP components, potential facility improvements associated with lake level increases, or other future operations and maintenance improvements). Implementation of Mitigation Measure 3.4-2b, Avoidance and Minimization Measures for Western Pond Turtle, would reduce potential impacts on common fish species to a *less-than-significant* level by requiring the installation of a cofferdam around in-water work areas, monitoring for species during water drawdown of the dammed area, and species relocation outside of the work area by a qualified biologist.

Mitigation: Implement Mitigation Measure 3.4-2b.

Significance after Mitigation: Less than Significant.

Effects of Night Lighting on Resident and Migratory Wildlife

Impact BIO-10: Construction of the Project could interfere substantially with the movement of native resident or migratory species or with established native resident or migratory corridors, or impede the use of nursery sites. (Less than Significant with Mitigation)

The San Francisco Peninsula and the San Francisco Bay are located along the Pacific Flyway, a main north-south travel corridor for migrating birds extending from Alaska to Patagonia. Birds frequently stopover in desirable habitats to forage and rest within San Francisco, on the Bay waters, and along the Pacific shoreline throughout their migration. Lake Merced, Fort Funston, and Ocean Beach serve as stopover locations for migrating avian species. Additionally, the San Francisco Peninsula supports many resident, non-migratory bird species, reptiles, amphibians, and mammals that occur year-round in the Project study area. With limited natural or semi-natural habitats or open space on the San Francisco peninsula, resident wildlife is concentrated in these areas. Nighttime illumination of Project sites, work areas and staging areas, and access roads surrounded by occupied habitat at these locations could result in adverse effects on inhabitant wildlife foraging behavior, breeding behavior, and dispersal movement during periods of nighttime construction.

It is estimated that, in North America alone, between 365 and 988 million birds are killed due to collisions with buildings and other structures each year (Loss, 2014). Collisions are currently recognized as one of the leading causes of bird population declines worldwide (Brown et al., 2007). Many collisions are induced by artificial night lighting, particularly from large buildings, which can be especially problematic for migrating songbirds since many are nocturnal migrants (Ogden, 1996). The tendency of birds to move towards lights at night when migrating, and their reluctance to leave the sphere of light influence for hours or days once encountered (Graber, 1968), has been well documented (Ogden, 1996). It has been suggested that structures located at key points along migratory routes may present a greater hazard than those at other locations (Ogden, 2002). Other research suggests that fatal bird collisions increase as light emissions increase, that weather often plays an important part in increasing the risk of collisions (Verheijen, 1981), and that nights with heavy cloud cover and/or precipitation (e.g., coastal summer fog) present the conditions most likely to result in high numbers of collisions (Ogden, 2002).

Several studies have shown that the presence of artificial light of similar intensity to moonlight affects foraging behavior and range of nocturnal small mammals (rodents); illuminated forage is avoided, reducing food consumption, or accessed at a higher risk of predation. Others have documented that artificial night lighting is as effective as natural light at setting or disrupting the circadian clock (Beier, 2006). Mate choice behavior of female frogs has been shown to be influenced by the presence of artificial lighting and to affect inter- and intrasexual displays through increased visibility and risk of predation (Buchanan, 2006). The effects of artificial night lighting on fish are broad, including "influencing foraging and schooling behavior, spatial distribution, predation risk, migration, and reproduction," though varying greatly among species and maturity (Nightingale et al., 2006).

Evening and/or nighttime construction activities associated with the Ocean Outlet and the submarine outfall at the beach and those associated with the Fort Funston staging area could adversely impact birds migrating along the Pacific Flyway and nearby resident wildlife with the introduction of night lighting into an otherwise dark environment. While Section 2.5.3.5, Lighting, indicates that nighttime illumination would be directed downward, without additional lighting restriction and monitoring to ensure proper installation and use, such effects could still occur. Components of beach construction, including the installation of the cofferdam around the existing outlet structure and replacement of the submarine pipe and piers must be completed during periods of low tide, as described in Section 2.5.4.1, and would likely require periods of 24-hour construction under these conditions. The staging area at Fort Funston would also be lit in support of construction during evening hours and, if permitted, proposed 24-hour tunnel construction. The introduction of artificial night lighting along a migration route can result in an increase in collisions and avian fatality which would be considered a *significant* impact because migratory birds are protected under the MBTA and native resident nongame birds are protected from take under the California Fish and Game Code. Common and special-status bats, and other common wildlife, residing or foraging in habitat nearby illuminated areas could also be adversely affected by the presence of nighttime construction lighting through localized displacement and potential increased predation. Aesthetics **Mitigation Measure 3.2-1** would require screening be applied to the chain-link fence surrounding the staging area at Fort Funston which would minimize light escaping from the staging area into adjacent habitat during periods of nighttime construction. Implementation of **Mitigation Measure 3.4-9, Night Lighting Minimization**, would further reduce these reduce impacts related to nighttime illumination of Project work areas to a *less-than-significant* level.

Mitigation Measure 3.4-9: Night Lighting Minimization

At construction areas set up for nighttime activity and requiring nighttime lighting, the construction contractor shall implement the following measures as long as the safety of workers is not compromised:

a) To the extent feasible, night construction near suitable habitat for nesting and migratory birds and roosting bats (e.g., scrub vegetation, dense wooded areas, unoccupied buildings) shall be avoided during bird nesting season (January 1 – August 15), bat maternity roosting season (approximately April 15 – August 31), and periods of winter torpor (approximately October 15 – February 28).

b) All construction-related lighting shall be fully shielded and focused downward to the maximum extent feasible to ensure no significant illumination passes beyond the immediate work area into surrounding habitat (e.g., central dune scrub, bluffs or the Pacific Ocean), or vertically into the sky. Lighting should be positioned around the perimeter of the work area and oriented toward construction activity rather than toward surrounding habitat. A qualified biologist shall be present at the start of nighttime activities when lights are placed to facilitate appropriate light placement and ensure surrounding wildlife habitat is not unnecessarily illuminated. Maps or other information indicating the location(s) of active nests or nesting habitat nearby nighttime work shall be available at the construction site.

c) Yellow, orange, or other “warm colored” light shall be used where feasible (e.g., unless required by safety regulations, pre-installed in construction equipment, etc.).

d) Construction personnel shall reduce the amount of lighting to the minimum necessary to safely accomplish the work.

e) Construction areas set-up for nighttime activity are subject to all of the same preconstruction surveys for nesting birds and roosting bats listed in Mitigation Measures 3.4-3 through 3.4-4.

f) If active bird nests or bat roosts are identified near nighttime construction areas, a qualified biologist shall monitor nests or roosts for disturbance during night work to determine species tolerance to nearby lights. Illumination methods or shielding shall be modified if disturbance is determined to have potential to compromise the nest or roost. Coordination with CDFW, USFWS, or NPS (on NPS-managed lands) shall occur as appropriate.

Significance after Mitigation: Less than Significant.

Operational Impacts

Impacts would be *significant* if Project operations were to result in substantial effects on the biological resources of Lake Merced, resulting from the increase in lake levels or substantial change in water quality that could adversely affect aquatic habitat. Ongoing maintenance activities, such as debris and sediment removal from the box culvert and altering the height of the overflow weir, could also cause short-term impacts to biological resources in the vicinity of the facility upon which work is being performed. These activities, as they relate to water quality, are discussed in Section 3.9.5.1, Impact HYD-6. Maintenance activities are expected to potentially cause short-term disturbance to adjacent biological resources, such as trampling of vegetation immediately adjacent to the facilities, but not result in substantial effects that would trigger mitigation such as the construction impacts already discussed because maintenance activities would be infrequent and would only require brief periods of activity at each location when maintenance is required.

In general, biological resources around lakes and other water bodies are affected by both water level increases and decreases. Such effects on aquatic habitat and resident fish within Lake Merced are examined in detail below. Under existing conditions, lake levels at Lake Merced are at approximately 5.7 feet City Datum with the maximum possible water surface elevation (WSE) being 13 feet City Datum before water flows from the lake into the Vista Grande Canal through the overflow structure (or weir) located in South Lake. As discussed in Section 2.6.3, Lake Merced water levels have fluctuated from 13 feet City Datum in the 1940s to a low of -3.2 feet City Datum in 1993. The Project would provide a source of water that would allow SFPUC to increase water levels from existing conditions to achieve a target WSE. Three operational scenarios are considered under the Project, which would establish maximum Lake Merced WSEs of 7.5, 8.5, or 9.5 feet City Datum, representing the WSE at which the lake overflow weir would be set in each scenario. Target normal operational lake levels for these three scenarios are approximately 1 to 1.5 feet lower than the maximum, to account for annual evaporation and other losses (Figure 2-5) (Kennedy/Jenks, 2014). **Table 3.4-4** summarizes the range of Lake Merced target normal WSEs that could be sustained (i.e., for at least a two-week period) under each target maximum scenario. Lake levels would fill over approximately 5 years to reach the target WSE that would ultimately be determined by the SFPUC (Kennedy/Jenks, 2014).

TABLE 3.4-4
LAKE MERCED WATER SURFACE ELEVATION RANGES UNDER THE PROPOSED PROJECT

	Lake Merced Water Surface Elevations (feet City Datum)		
Target Maximum	7.5	8.5	9.5
Target Normal Range	6 – 7.5	7 – 8.5	8 – 9.5

The following analysis considers the operational impacts on biological resources associated with Project-related increases in lake levels compared to existing conditions, maintaining the WSE within the range of 6 to 10 feet,[27] and then identifies the severity of impacts that would occur in each scenario within the target WSE.

Approach to Analysis: Operational Impacts – Lake Level Management

As described in Section 3.9.2.2, Lake Merced water sources are primarily precipitation, limited local runoff, and groundwater inflow. Lake Merced water levels have fluctuated widely in the past in response to climatic conditions, water discharges, and regional and local groundwater pumping. Surface water level (hydrologic) modeling conducted in support of this EIR/EIS (Kennedy/Jenks, 2014), as well as the related biological resources impacts analysis, relied on historical data to project estimated water levels over a future 47-year period under several scenarios, including: estimated conditions expected to exist in the future without implementation of the proposed Project (referred to throughout this EIR/EIS as “modeled existing conditions” or “No Project Scenario”), estimated conditions expected to exist in the future with implementation of the proposed Project (or, “Project Scenario”), and a Cumulative Scenario. The Cumulative Scenario takes into account the effects of other reasonably foreseeable projects that, should they be implemented, would influence Lake Merced water levels. The projects considered in the Cumulative Scenario in addition to the Project are the SFPUC Groundwater Storage and Recovery Project and the San Francisco Groundwater Supply Project. See Sections 3.9.7.1 and 3.9.8.4 for further details on the hydrologic modeling.

The following subsections describe the significance thresholds applicable to the biological resources of Lake Merced (described in Section 3.4.1), the approach to analysis for determining the effect of water level changes on those resources, and the results of the lake level modeling. This section is followed by the analysis of operational impacts on the biological resources of Lake Merced.

Significance Thresholds for Influence of Changing Water Levels on Vegetation Types and Associated Biological Resources near Lake Merced

In large part, the annual average water level of lake systems drives the elevational distribution of upland, wetland, and aquatic plant species around lakes and other water bodies, such as Lake Merced, primarily due to variations in adaptation to, and tolerance of, inundation. Seasonal timing, duration, water depth, and frequency of inundation are all critical factors in determining which species would persist in a given area. A rise in water levels could inundate a portion of existing wetland habitats so that they would be under water at too great a depth or for too long to persist. These newly inundated wetlands would then be converted to lacustrine habitat (i.e., open water). Some wetland habitats would persist, although their species composition could change due to the altered pattern (i.e., duration and depth) of inundation. New wetland habitats would then form within the new, higher annual fluctuation zone at elevations currently supporting

[27] The GIS-based analysis for this Project examines vegetation changes that would occur with lake levels between 6 and 10 feet City Datum at 1-foot elevation increments to correspond to topographic data available for Lake Merced. The maximum possible lake level is represented by 10 feet City Datum to capture the effects that would occur within the 0.5 feet elevation above 9 feet when the overflow weir height is 9.5 feet City Datum.

upland habitats, which would be unable to persist under the new inundation regime. As lake levels rise, some wetlands, such as those dominated by giant vetch, may be induced or created at elevations above the new water level. Upland vegetation types would not move upslope with rising water levels, given that their distribution is not tied to water elevation, other than the fact that they can't persist in areas that are regularly inundated. Impacts to upland vegetation as it relates to inundation under Project operation and an increased WSE are discussed below.

The following describes the impact thresholds used in this EIR/EIS to assess the potential for impacts on the biological resources of Lake Merced to result from water level changes caused by the proposed Project (for the resources described in Section 3.4.1).

Special-Status Wildlife

As discussed in Section 3.4.1.3, Lake Merced provides valuable habitat for local wildlife, especially for birds, as the only remaining large coastal lake and wetland between Pescadero to the south and Point Reyes to the north. Many of these are special-status or otherwise protected water birds, which are discussed below relative to their nesting habitat. In addition, large eucalyptus along North and South Lake support rookeries for double-crested cormorant and great blue heron, and red-shouldered and red-tailed hawks nest in large trees around the lake (SFRPD, 2006). This issue is discussed in detail below, under the subsection for adverse effects on wildlife nursery sites. Other birds protected under the MBTA or California Fish and Game Code, Section 3503, such as Wilson's warbler (*Cardellina pusilla*), green heron, and black-crowned night heron (*Nycticorax nycticorax*) nest or have the potential to nest in willow scrub around the lakes (SFRPD, 2006; Murphy, 1999). Impacts on willow scrub are discussed further below under the subsection for adverse effects on wetlands. Still other species, such as California towhee and Bewick's wren, nest in coastal scrub, which may also be lost in small amounts as discussed below in the next subsection.

Several bird species protected under the MBTA or California Fish and Game Code are known to nest or have potential to nest at or near the water line at Lake Merced, including Clark's grebe and pied-bill grebe, sora (*Porzana carolina*), and Virginia rail (*Rallus limicola*) (SFRPD, 2006). Additional species that nest in emergent vegetation at or near the water's edge include marsh wren, ruddy duck, mallard (Murphy, 1999), and the California species of special concern, San Francisco common yellowthroat (Gardali and Evens, 2008). Loss of emergent wetland breeding habitat for these species is discussed below under the subsection for adverse effects on wetlands. Increases in lake levels during breeding season could flood active nests. Research has shown that marsh birds are sensitive to fluctuations in water levels, especially rapid fluctuations. Thus, direct impacts on birds nesting at or near the water line would begin to occur with even seemingly minor fluctuations in lake levels during the breeding season. For example, Virginia rail and sora nest up to 6 inches above the water surface (Desgranges, et al., 2006). Marsh wren typically nest 2 feet or more above the water and San Francisco common yellowthroat typically nest within 3 feet of the ground or water (Baicich, et al, 1997a); therefore these species are expected to be sensitive to water surface level fluctuations during the breeding season.

Virginia rail (Desgranges, et al., 2006) and sora (Erlich et al., 1988) nesting success appear to be highly sensitive to water fluctuations, and these can therefore be utilized as indicator species to determine significance thresholds. An examination of the typical nest height above water for each of these species combined with their egg incubation period of approximately 2.5 weeks[28] (Erlich et al., 1988) suggests that a change in water level of 0.5 feet over a 2.5-week period during the nesting season would impact the reproductive success of birds nesting near the water line. Therefore, Project-caused water level increase of 0.5 feet or more over a 2.5-week period in any single nesting season (conservatively January 1 through August 15) would be considered to result in a *significant* impact on nesting birds.

Western pond turtles are presumed present throughout the entirety of Lake Merced. **Figure 3.4-4** depicts Lake Merced sensitive habitats and species occurrences, including locations of western pond turtle. Typical nesting habitat requirements of the species include dry sandy to hard soils on low gradient slopes with low, sparse vegetation (Jones and Stokes, 2004). Suitable nesting sites can occur as far as 300 feet from the water line (CDFG, 2000) but are typically much closer and thus be more vulnerable to inundation. Females move from aquatic sites to upland sites that are usually located above the floodplain (or in this case, above the highest average annual water level) and can lay their eggs, sometimes more than one clutch, anywhere between April and August, although most oviposition occurs in April and May. Nests must be dry (Jones and Stokes, 2004) but also have a relatively high internal humidity for eggs to develop and hatch properly (CDFG, 2000). Incubation can last up to three months and hatchlings typically overwinter in the nest, emerging the following spring (Jennings and Hayes, 1994).

Loss of potentially suitable turtle nesting habitat due to inundation by rising water levels would not be considered *significant*, since the majority of soils surrounding East and North Lakes are sandy (SFRPD, 2006) and even at the highest potential Project-related water surface elevation of 9.5 feet, sufficient habitat would remain to support ongoing western pond turtle reproduction. Pond turtles typically nest close to the water line but above areas prone to inundation. Since nests must be relatively dry, it would be expected that pond turtles would typically choose nest sites at least 3 feet above the annual high water level in any given year, so gradual increases in water surface elevations over time would not be expected to impact nesting pond turtles. However, loss of occupied nesting habitat inundated during a single year, such that turtle eggs or nestlings were lost, could threaten the Lake Merced western pond turtle population, and would therefore be considered a *significant* impact.

Rare Plants and Sensitive Communities

Rare plants. Three special-status plant species have been documented recently at Lake Merced: San Francisco spine-flower, blue coast gilia, and San Francisco wallflower (May & Associates, 2009; Nomad Ecology, 2011). In addition, eight plant species of local concern occur at Lake Merced: dune tansy, California pipevine, Wight’s paintbrush, Vancouver rye, wild cucumber, canyon live oak, coastal black gooseberry, and thimbleberry (May & Associates, 2009; Nomad Ecology, 2011). See Figure 3.4-4 for locations of rare plants and sensitive plant communities around Lake Merced.

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[28] Nests that are not yet supporting eggs can be rebuilt, and chicks of all the species in question are precocial, meaning they are capable of a high degree of independent activity immediately after hatching and can leave the nest and be relocated by their mother in response to fluctuations in water level.

None of these 11 species are federally or State listed, three are considered California Rare Plant Rank species by CNPS and CDFW, and the rest are considered by CNPS as locally rare and significant in San Francisco.

Normally, only federal, State, and CRPR Rank 1 and 2 species are considered under CEQA. However, all 11 species noted occur in central dune scrub and coastal scrub habitat types, further described below, which have been severely reduced from their original extent within San Francisco and are therefore of higher local significance.

Because special-status plants and their habitat are locally rare and thus at high risk of local extinction, impacts on rare plant habitat at Lake Merced would be considered *significant* under CEQA. All of these plant species occur outside the Lake Merced watershed and most are more common elsewhere throughout their range, and extirpation of a local population would not pose a risk to the overall survival of the species. Given this context, some habitat loss could be acceptable and result in a *less-than-significant* impact. However, due to the general lack of local habitat, a relatively low threshold for loss is appropriate for this CEQA analysis, and impacts on special-status plant habitat would be considered significant for the purposes of this EIR/EIS if an increase in average lake levels were to result in the loss of more than 10 percent of occupied habitat, as mapped by the SFRPD (2006), May & Associates (2009), and Nomad Ecology (2011), for one or more of the special-status or locally sensitive plants known to occur at Lake Merced. As these 11 special-status plant species are concentrated in central dune scrub and coastal scrub habitat types, Project impacts to special-status plants are assessed under the Sensitive Communities discussion, below.

Sensitive Communities. The following have been identified as sensitive vegetation and habitat types at Lake Merced: Central dune scrub, thimbleberry scrub, wax myrtle scrub, and canyon live oak scrub, Vancouver rye grassland (perennial grassland), fish-related habitat, wetlands (including arroyo willow riparian scrub), and blue gum eucalyptus forest. Arroyo willow riparian scrub is discussed below under wetlands, and eucalyptus forest is discussed below under wildlife nursery sites.

Fisheries and fish habitat. The open waters and emergent wetlands of Lake Merced provide aquatic habitat, cover, and foraging habitat for a variety of native and non-native fish. As described in Section 3.4.1.3, there are no special-status fish in Lake Merced, and the species most important for recreational purposes are regularly stocked. Additionally, the San Francisco Regional Water Quality Control Board defines several fish-related beneficial uses for Lake Merced: cold freshwater habitat, warm freshwater habitat, and fish spawning. A substantial degradation or loss of these beneficial uses, for example through significant changes in water quality, loss of littoral habitat, or reduction in dissolved oxygen, would be considered *significant.*

The health of Lake Merced's fisheries is closely tied to availability of littoral habitat, which is directly affected by changes in water depth, and suitable water quality. These factors are likely the main drivers of fish abundance in Lake Merced and can be tied to the lake's beneficial uses. The analysis of potential effects of raising the water surface elevation of Lake Merced on fisheries resources is based on a review of existing information, including a previous assessment

SOURCE: ESA, 2012; USGS, 2011; Nomad Ecology, 2010; May and Associates, 2009; SFRPD, 2006

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Figure 3.4-4
Lake Merced Sensitive Habitats and Species

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of Lake water level increases (EDAW, 2004) and a fish community study conducted by Maristics, Inc. (2007), as well as the water quality evaluations presented in the WQA (ESA, 2015) and Section 3.9, Hydrology and Water Quality. The results of the assessment of potential changes in the temperature, DO, and pH profiles of the Lake were reviewed in light of known habitat requirements of the Lake Merced fish species. Since much of the interest in Lake Merced is in recreational fishing, this analysis focuses on the potential effects to fish species known to be targeted by Lake Merced anglers, from raising the water surface elevation of Lake Merced as compared to the existing conditions.

Wetlands and Other Jurisdictional Waters

The lake's wetlands and willow riparian scrub provide wintering habitat for thousands of birds and resting and foraging habitat for fall and spring migrants and are used as breeding and feeding habitat for nearly 50 terrestrial wildlife species. The lake's wetlands provide cover, foraging habitat, and nursery sites for warmwater fish as well as cover and foraging habitat for western pond turtle. Impacts on wetlands resulting from raising water levels could include direct wetland losses and/or loss of occupied bird nests. Indirect effects could include the transformation of wetland types surrounding Lake Merced resulting from increased lake levels. Such a change in wetlands could eliminate valuable foraging and nesting habitat for certain resident wildlife.

The slopes surrounding Lake Merced currently support approximately 27 acres of willow riparian scrub (see Table 3.4-5, below). Since most of the willow scrub habitat at Lake Merced would also be considered state- and federally jurisdictional, operational impacts on willow scrub are considered as part of the Project's wetlands impact. This vegetation community is common throughout central and coastal California and as such is not always considered a sensitive natural community. However, willow scrub at Lake Merced provides high-quality riparian habitat for a variety of special-status and common birds and is therefore considered sensitive by CDFW. In addition, the CCC often considers willow scrub as an ESHA, whether or not it also has wetland status.

Lake level rise between 2002 and 2012 has resulted in the conversion of a little over 1.5 acres of willow scrub to open water (see Table 3.4-5) and further rise in lake levels is predicted to further reduce the extent of this vegetation type. However, losses could be ameliorated somewhat through new establishment of willow scrub upslope, as has also been observed since 2002 (Nomad Ecology, 2011).

Because wetlands at Lake Merced would likely be considered jurisdictional by the Corps and/or CDFW, RWQCB, and CCC, the federal and State no net loss policies described in Section 3.4.2 would reasonably be applied to the proposed Project when determining the significance of impacts on wetlands that may be caused by the Project.

Wildlife Nursery Sites

Large eucalyptus along the shores of North and South Lakes support several double crested cormorant and great blue heron rookeries, and red-shouldered and red-tailed hawks nest in large trees (eucalyptus, Monterey cypress, and pines) around all of the lakes (SFRPD, 2006). Although red-shouldered and red-tailed hawks nest in parks throughout the City, heron rookeries are found only at Lake Merced and Stow Lake, with one small colony reported at the Palace of Fine Arts (Kelly et al., 2006). A survey performed in May 2012 documented several rookery trees in the same general area as previously mapped in 2006 and most were approximately 1 to 5 feet above the water surface elevation, which was at or near its seasonally highest level of approximately 6.5 to 7 feet City Datum (SFPD, 2013a; SFRPD, 2006). Inundation for more than a month is expected to kill individual upland trees, which would not have an immediate effect on available nesting substrate for herons, cormorants, and hawks, as snags often support nests for these species, but would reduce nesting substrate in the long term once trees die and fall to the ground. Results of the 2012 Lake Merced vegetation mapping update, described below, show that there are a total of 50.5 acres of non-native forest around Lake Merced, including nearly 18 acres of eucalyptus. As noted above, red-tailed and red-shouldered hawks nest in parks, open space, and some residential areas throughout San Francisco and, therefore, with relatively abundant nesting substrate available to raptors elsewhere, the loss of non-native forest at Lake Merced would not be considered significant for raptors.

Rookery trees typically die over time due to bird use and buildup of ‘whitewash’ (uric acid) on their branches. When a tree dies completely, the birds typically move their nests to an adjacent tree so the death of individual trees in and of itself is not considered significant (USFWS, 2011). However, the distance from disturbance is typically important for nesting herons, and a buffer of at least 300 feet is recommended (Vermont Fish and Wildlife Department, 2002). The rookery trees on North and South Lakes are about 80 feet and 200 feet, respectively, from busy roadways and a well-used trail. The third rookery, on East Lake, is more isolated and less prone to disturbance.

Since eucalyptus are an upland species, with distribution not tied to water levels, and the upper limits of most eucalyptus habitat are restricted by adjacent roadways, this habitat type is not expected to move upslope with increasing water levels and would thus be permanently lost.

Predicted rises in water levels would likely result in loss of rookery trees and other eucalyptus that provide potential alternate nesting substrate for great blue herons and cormorants which occur below 10 feet City Datum. The rookery trees at South Lake would be expected to be lost with a rise in annual average water surface elevation to 7 feet City Datum but the eucalyptus stand that supports the rookery is likely large enough that the rookery could move to adjacent trees further upslope and still remain buffered from the roadway and pathways. The trees at North Lake would be inundated with a rise in annual average water surface elevation to 6.5 feet City Datum. Loss of these trees would likely require the rookery to move to a different area as there would be no buffer trees left. The rookery trees at East Lake would not be impacted as they are located at an approximate elevation of 20 feet City Datum.

Although rookeries are locally uncommon, there is sufficient eucalyptus forest present at Lake Merced to sustain the rookeries should small losses of mature eucalyptus occur. In this case, there would still be sufficient trees located at sufficient distance from human disturbance to allow for the rookeries to move from one tree to another. Larger losses of eucalyptus forest could potentially result in the loss of rookery trees altogether, particularly the loss of more isolated stands, if the remaining trees were not suitable due to proximity to human disturbance. Therefore, a relatively low threshold for loss is appropriate for this CEQA analysis and a loss of 10 percent of the eucalyptus forest around Lake Merced as a result of the proposed Project would be considered *significant* for the purposes of this EIR/EIS.

Estimating Vegetation Response to Changes in Lake Levels

To determine whether Project-related impacts on biological resources could reach the thresholds defined above, vegetation responses to changes in lake levels were assessed. In support of this EIR/EIS analysis, and building on the prior studies that are summarized in Section 3.4.1, Environmental Science Associates (ESA) updated a geographic information system-based (GIS-based) vegetation map created by Nomad Ecology in 2011. Using the computer program ArcGIS, ESA overlaid the 2010 vegetation data on high resolution 2010 aerial photographs and then compared the resulting imagery with existing conditions in the field during surveys in 2012. **Table 3.4-5** presents the results of the vegetation mapping update completed in 2012, along with results from 2002 and 2010 for comparative purposes. **Figure 3.4-5** depicts the updated map of Lake Merced vegetation in 2012. This map represents the best available data for the assessment of lake level effects on biological resources.

TABLE 3.4-5
LAKE MERCED VEGETATION ACREAGE: 2002, 2010, AND 2012

Vegetation Community and Cover Type	2002[a] vegetation (acres)	2010[a] vegetation (acres)	2012[a] vegetation (acres)	Acreage change 2002–2012
Annual Grassland	7.11	1.24	1.26	-5.85
Perennial Grassland	0.49	0.01	0.01	0.48
Non-native Herbaceous	17.18	12.52	11.76	-5.42
Coastal Scrub	13.48	14.82	14.78	+1.30
Central dune Scrub	0.00	3.32	3.30	+3.30
Non-native Scrub	0.86	0.29	0.23	-0.63
Coast Live Oak Woodland	0.13	0.58	0.54	+0.41
Non-native Forest	63.32	50.49	50.51	-12.81
Developed	188.82	197.81	198.44	+9.62
Arroyo Willow Riparian Scrub	28.33	26.11	26.78	-1.55
Giant Vetch Wetland	1.13	0.29	0.25	-0.88
Rush Meadow	0.71	0.20	0.32	-0.39
Swamp Knotweed Wetland	6.93	8.97	6.42	-0.51
Cattail Wetland	0.03	0.01	0.01	-0.02
Bulrush Wetland	35.14	21.10	28.16	-6.98
Open Water	244.94	269.91	264.69	+19.75

[a] The mean annual average water surface elevation was 1 foot City Datum in 2002 and was 5.9 feet City Datum in 2010. Water surface elevation survey equipment was offline between approximately May 2011 and October 2012 due to construction activities at the Lake Merced Pump Station. The annual average water surface elevation for 2012 is unknown as a result.

SOURCES: Nomad Ecology, 2011; ESA.

A GIS-based analysis was conducted to estimate vegetation response to changes in lake levels over time using the 2012 vegetation data, topography, bathymetry, slope, and output from the hydrologic modeling, and 'action rules'[29] to dictate how vegetation would respond (Kennedy/Jenks, 2012). See **Appendix D**[30] for further details on the methodology used to analyze vegetation change in response to changing water surface elevations.

For the purpose of the vegetation change analysis, the initial baseline estimates of existing vegetation acreages are those that occur at the mean annual water surface elevation of 6 feet City Datum. This water level is slightly higher than the baseline 2009 water surface elevation of 5.7 feet used for the Kennedy/Jenks hydrologic modeling, but was necessary to correspond to the topographic data, which were created at 1-foot elevation intervals. The 2012 vegetation mapping update was based on an aerial photograph from April 2011; at that time, according to historical water surface elevation data, Lake Merced's water surface elevation was at about 7 feet City Datum (SFPUC, 2011). The GIS-based analysis for this Project examines vegetation changes that would occur with lake levels between 6 and 10 feet City Datum. The maximum possible lake level is represented by 10 feet City Datum to capture the effects that would occur within the 0.5 feet elevation above 9 feet when the overflow weir height is 9.5 feet City Datum. Vegetation mapped above 10 feet, would remain largely unchanged under the Project, except during episodic storm events where lake levels may temporarily exceed the target maximum up to 13 feet City Datum to alleviate local flooding. These storm events are considered to be short-term in that vegetation would not be inundated long enough to change elevational composition of vegetation communities around Lake Merced but may cause some die-off of less water-tolerant species.

Two different approaches were used to estimate changes in vegetation associated with increasing water surface elevations under the Kennedy/Jenks hydrologic models. For impacts associated with water surface elevation increases, ESA biologists applied action rules, developed with the SFPD in 2012, for each vegetation type dictating how vegetation would respond to increasing water surface elevation (see Appendix D for further details). Under rising water level conditions, there is competition and resistance to replacement of existing vegetation types by those that dominate within the inundated or saturated zone. The action rules used by the GIS-based analysis account for this by prioritizing certain vegetation types over others based on their observed capacity to invade and replace existing vegetation as water levels rise. The resulting estimates of vegetative surface area, by type, were used to estimate impacts on vegetation types due to increases in water surface elevation.

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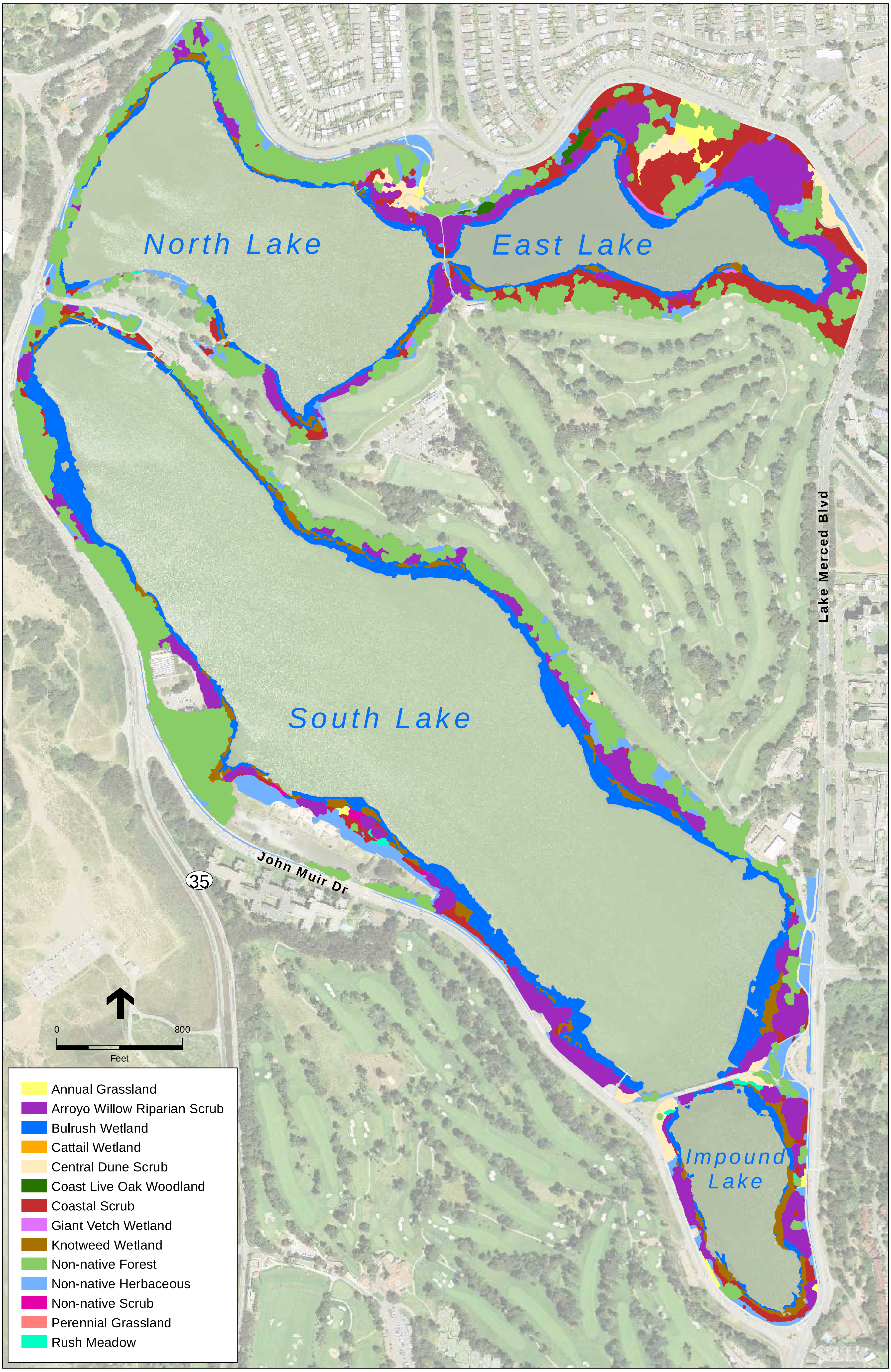
[29] ESA biologists developed action rules for each vegetation type to estimate how vegetation would respond to increases in water surface elevation. For example, bulrush only grows in saturated soils and cannot grow if completely submerged for extended periods of time. The action rules developed for bulrush, therefore, dictate the assumption that bulrush is removed (dies) at depths greater than five feet below the water surface elevation and would establish (grow) at and up to 5 feet below the new water surface elevation.

[30] Appendix D describes the methodology developed for the Regional Groundwater Storage and Recovery Project and has been adapted to this Project.



SOURCE: ESA, 2012; USGS, 2011

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Figure 3.4-5
Lake Merced 2012 Vegetation Types

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Several assumptions were made in the vegetation change analysis:

- The analysis is focused on normal conditions when lake levels are being maintained at the target WSE. Events when lake levels rise rapidly in response to an extreme storm event could result in lake levels that exceed 10 feet City Datum up to 13 feet. However, such exceedances would only last several hours or days during the period of stormwater diversion into Lake Merced and would not trigger a lasting response by inundated vegetation.

- The water surface elevations used represent the annual average WSE. Lake Merced water levels vary seasonally due to hydrologic and climatic conditions; therefore, an annual range in WSE from about 1 foot above and below the mean is assumed, based on the Kennedy/Jenks (2012 and 2014) hydrologic modeling, which predicts a 1.6-foot mean annual range in lake levels over the 47-year model period for the modeled No Project Scenario. So, for example, an elevation of 6 feet City Datum, as seen in Table 3.4-5, actually represents a range in WSE between 5 and 7 feet City Datum.

- The acreages given for each vegetation type at each annual average WSE in Tables 3.4-5, 3.4-5, 3.4-7, and 3.4-8 assume that the water level has been at that particular elevation for a long enough period of time for the changes predicted by the action rules, which incorporate a temporal element based on the tolerances of each general vegetation type, to have taken place. For example, the action rules dictate that upland vegetation types would die if inundated or if soils are saturated for more than 14 consecutive days and that willows would die if inundated for more than 3 consecutive months in the growing season. In addition, the different wetland types are expected to become fully established over periods of time ranging from several months (herbaceous wetlands) to several years (willow riparian scrub).

- The acreages estimated by the GIS-based analysis represent the vegetation that would establish if the mean water surface elevation remained at or near the same level for durations long enough for the various wetland types to establish. The analysis is consistent with the fluctuations depicted in the lake-level model hydrographs in that the rate of change is generally slow and water surface elevations remain relatively consistent for relatively long periods of time (Kennedy/Jenks, 2014). If annual fluctuations are greater, or the rate of change is faster than modeled, then changes in vegetation would not necessarily follow the predictions of the vegetation analysis as vegetation would continuously be reestablishing at new water surface elevations.

The impact analysis sections that follow include the results of the GIS-based analysis of vegetation and habitat changes resulting from water level increases described above; determine the Project's operational impacts on biological resources; and determine whether the Project-related impacts would be significant according to the thresholds described above.

Impacts of Lake Level Changes on Biological Resources at Lake Merced and Mitigation Measures

The following description of the modeled proposed Project Scenario present the data used for the subsequent impact analyses in Impacts BIO-11 through BIO-15 which address the increase in Lake Merced lake levels under the Project, with resulting effects on biological resources at the lake.

For the purposes of this EIR/EIS, changes in water surface elevation modeled for the Project Scenario are compared to baseline conditions to determine whether the potential effects of raising lake levels on biological resources due to the proposed Project would be *significant.* The baseline lake level used for comparison is 6 feet City Datum. The range of WSEs for Lake Merced under the Project examined in this analysis is between 6 and 10 feet City Datum to capture the target water surface elevations (7.5, 8.5, and 9.5 feet City Datum) and expected climatic variations which would influence lake levels on an annual basis.

Additionally, a GIS-based analysis was used to calculate the increased open-water acreage that would occur under the Project with lake levels increased within the target WSE range of 7.5 to 9.5 feet City Datum. The GIS-based calculation of the open water surface area of Lake Merced at baseline conditions of 6 feet is 265 acres. Lake Merced water surface area under the Project would be between 291 and 313 acres, which is an increase of 22 to 48 acres of open water. This increase in open water surface area for the Lake Merced system and its effects on biological resources are considered in the following impact analysis.

Impacts on candidate, sensitive, or special-status wildlife species from Project operation are discussed in Impact BIO-11. The following have been identified as sensitive vegetation communities and habitat types at Lake Merced: central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrub, Vancouver rye grassland (perennial grassland), fish-related habitat, wetlands (including arroyo willow riparian scrub), and blue gum eucalyptus forest. Impacts on central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrub, Vancouver rye grassland, and associated special-status plants are discussed in Impact BIO-12. Impacts on fish habitat are discussed in Impact BIO-13. Impacts on wetlands are discussed in Impact BIO-14, and impacts on blue gum eucalyptus forest are discussed in Impact BIO-15.

Impact BIO-11: Project operation would not adversely affect species identified as candidate, sensitive, or special-status wildlife species in local or regional plans, policies, or regulations, or by the CDFW or USFWS. (Less than Significant)

For special-status nesting birds, Project-related WSE increases of 0.5 feet or more over a 2.5-week period in any single nesting season (conservatively January 1 through August 15) would be considered to result in a *significant* impact on the reproductive success due to flooding of active nests within 0.5 feet of the water. If water level increases of 0.5 feet were to occur rapidly, active nests could be inundated, resulting in the loss of nests and eggs and thus adversely affecting productivity.

Table 3.9-8 and Figure 3.9-13 depict filling period contribution scenarios for Lake Merced to reach target WSEs of 7.5, 8.5, or 9.5 feet City Datum. Under the modeled flow diversion threshold of >35 cfs[31] it would take approximately 17 months to reach 7.5 feet, 30 months to reach 8.5 feet, and

[31] The Project water quality analysis uses the >35 cfs diversion threshold for modeling estimated effects to Lake Merced water quality. The methodology explaining why >35 cfs is the diversion threshold used in modeling supporting the water quality impact analysis is discussed in Section 3.9.5.1.

42 months to reach 9.5 feet from the baseline WSE of 6 feet. Figure 3.9-13 shows simulated lake level elevations resulting from annual contribution patterns and diversion thresholds expected during the filling period when the maximum WSE is 9.5 feet elevation. The inflows are based on the average water year (1953 to 2008 data) and incorporate climatic events representing wet and dry periods into the contribution predictions.

Under proposed conditions, water contributions to Lake Merced during the filling period would be gradual. However, a main objective of the Project is to alleviate flooding of the surrounding urban areas which could require additional stormwater input to the lake during storm events. Should storm events occur during the filling period, lake water level may rise more than 0.5 feet in 2.5 weeks. If this were to occur during the nesting season, shoreline nests could be flooded. While the loss of active nests is a possibility under this scenario, there are significant variables that influence the outcome such as time of the storm event and phase of the nesting cycle. Should a storm event occur during the lake filling period and cause the water level to rise more than 0.5 feet early in the breeding cycle of birds that nest in vegetation at or near the Lake Merced waterline, new nests could be built above the elevated waterline or other existing nests further from the water could be used. If eggs were lost, some affected bird species including Virginia rail could produce a second brood (Baicich et al., 1997b). These impacts to shoreline breeding populations would be most likely to occur during the filling period and not once the target WSE has been achieved, and therefore are considered to be short-term effects and *less than significant*. As discussed in Impact BIO-14, wetland and riparian nesting substrate for avian species would not be significantly altered as a result of rising water levels and therefore long-term impacts to breeding populations which could occur due to loss of habitat would be avoided. Project-related increases in water surface area may provide a marginal benefit to bird species that forage over the lake.

The western pond turtle population at Lake Merced is likely sustained by nesting in upland areas surrounding the lake though specific locations of nesting sites are unknown. A water level rise of greater than 3 feet in any given year (measured from March 1st to March 1st) could inundate western pond turtle nests, causing reproductive failure and/or hatchling mortality, and would be considered *significant* if the increase were caused by the Project. However, the water contribution simulation discussed above shows approximate increases in lake levels on an annual basis which would not exceed 3 feet in any given year, thus Project effects on western pond turtle nests at Lake Merced during the filling period would be *less than significant*.

As shown in Figure 3.9-14 and described in Section 2.6.3, once the target WSE is reached, lake levels are only anticipated to fluctuate by approximately 1 to 1.5 feet below the maximum WSE annually, consistent with existing conditions. This fluctuation would be due to normal climatic conditions and would not exceed the western pond turtle impact threshold of 3 feet in a given year and would therefore be *less than significant.*

During major storms such as the 25-year/4-hour design storm which would contribute 190 acre-feet of stormwater to Lake Merced from the Canal (under a 100 percent flow diversion scenario), the lake level would rise less than a foot (further described in Section 3.9.5). Furthermore, under extreme conditions where the watershed receives sustained precipitation greater than the design storm rate and/or for greater than 4 hours, necessitating short-term storage in Lake Merced to alleviate upstream flooding, a lake level increase in excess of 3 feet could occur in a short period of time. Under these infrequent conditions, impacts could occur on both shoreline nesting birds and nesting western pond turtles. Such extreme events are rare, and resulting wildlife casualties would not be expected to substantially threaten resident populations or be greater than losses due to natural processes or events. Therefore, this impact would be *less than significant*.

Mitigation: None required.

Impact BIO-12: Project operation could adversely affect central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrub, and Vancouver rye grassland associated with Lake Merced. (Less than Significant with Mitigation)

Impacts related to special-status plants are included in the central dune scrub and coastal scrub (thimbleberry scrub, wax myrtle scrub, and canyon live oak scrub) impact discussion as these habitat hosts the documented special-status plant populations at Lake Merced which would be affected by the Project.

Reductions of the central dune scrub, thimbleberry, wax myrtle, and canyon live oak scrubs, or Vancouver rye grassland (perennial grassland) communities at Lake Merced resulting from increased lake levels under the Project would be considered *significant* if losses were to exceed 10 percent of the total area of any of these single communities, when compared to baseline conditions where lake levels are 6 feet City Datum. Based on the vegetation analysis and additional GIS-based analysis comparing elevation contours with locations of sensitive biological resources, **Table 3.4-6** shows how sensitive plant communities are predicted to decrease with rising water surface elevations and the predicted water surface elevation at or near which effects are predicted to begin for each sensitive plant community. The range of potential WSE scenarios that could occur under this Project includes mean WSEs of 6.5 to 8.5 feet, with a maximum high WSE of 9.5 feet. This analysis examines the range of target water WSEs between 6 and 10 feet in order to capture small, natural fluctuations that would occur throughout the year, and to assess change in 1-foot elevation intervals that correspond to the topographic data available for Lake Merced.

This analysis also considers the emergency scenarios when the overflow weir would be set to a maximum of 13 feet City Datum in order to capture stormwater runoff and alleviate flooding of the basin during extreme storm events; this scenario could cause lake levels to rise rapidly above the range of maximum thresholds established under the Project (7.5, 8.5, or 9.5 feet City Datum) and temporarily inundate these sensitive vegetation communities where they occur between 9.5 and 13 feet elevation around Lake Merced.

The presence of these vegetation communities is not specifically dependent on water levels and it is expected that, due to their rarity and small patch size around the lake, they would not likely reestablish if they were inundated over a long period of time and then water levels were to recede (e.g., if target WSE was established at 9 feet and natural conditions such as sustained drought caused lake levels to decrease to 7 feet WSE.). Therefore, unlike changes for wetlands, discussed

TABLE 3.4-6
PREDICTED LOSS OF SENSITIVE COMMUNITIES WITH RISING WATER LEVELS[a]

Sensitive Community	Acres between Mean Annual Water Surface Elevations and Percent Change (City Datum)							
	Permanent WSE					Temporary WSE[b]		
	6 feet	7 feet	8 feet	9 feet	10 feet	11 feet	12 feet	13 feet
Central dune scrub	3.30	3.30	3.29	3.29	3.28	3.24	3.19	3.13
Percent change	--	0.00%	-0.30%	-0.30%	-0.61%	-1.82%	-3.33%	-5.15%
Canyon live oak scrub	--	--	0.13	0.13	0.13	0.12	0.12	0.12
Percent change	--	--	--	0.00%	0.00%	-7.69%	-7.69%	-7.69%
Wax myrtle scrub	--	--	0.08	0.08	0.07	0.05	0.03	0.01
Percent change	--	--	--	0.00%	**-12.50%**	**-37.50%**	**-62.50%**	**-87.50%**
Vancouver rye grassland	--	--	0.013	0.012	0.007	0.005	0.002	0.001
Percent change	--	--	--	-7.69%	**-46.15%**	**-61.54%**	**-84.62%**	**-92.31%**

[a] Values in **bold** indicate that water surface elevation where a habitat loss of 10 percent or greater is predicted to occur. All acreage calculations were performed in GIS and therefore have a high degree of precision. However, this GIS analysis may not precisely predict actual changes in habitat on the ground, especially at very small scales.

[b] Percent change and acreage lost under temporary water surface elevations reflect impacts on sensitive communities from sustained WSE where vegetation die-off would occur but are presented for reference as worst-case scenarios.

below in Impact BIO-14, predicted vegetation losses are considered permanent for these vegetation types once they are inundated to the target WSE and the elevations at which they are affected are considered absolute. Impacts of short-term inundation on each vegetation type are discussed below.

As shown on Table 3.4-6, loss of central dune scrub would be less than 1 percent under the Project and canyon live oak would be unaffected. Thus, impacts on these habitat types would be *less than significant*. A less than 1 percent loss of central dune scrub habitat would result in a *less-than-significant* impact on special-status plant populations within the habitat type. The losses would be expected to occur primarily at Impound Lake in areas where several special-status plant species have been mapped (May & Associates, 2009; Nomad Ecology, 2011), although most special-status plant populations at Lake Merced are located above 13 feet City Datum.

Wax myrtle scrub would be unaffected by increased lake levels up to 9 feet City Datum but would incur a 12.50 percent loss at a 10 feet City Datum WSE, which would be considered *significant.* Thus, impacts to special-status plant populations within this habitat type would also be considered *significant* if lake levels were to be maintained above 9 feet City Datum (i.e., if the target maximum of 9.5 WSE was selected). Thimbleberry scrub occurs above 13 feet City Datum and would not be inundated by rising water surface elevations under any scenario. Special-status plants in this habitat type are also considered unaffected. Vancouver rye grassland would incur losses below 10 percent with an increase in lake levels up through 9 feet City Datum but would experience *significant* impacts at 10 feet where there would be a 46.15 percent loss (i.e., if the target maximum of 9.5 WSE was selected).

The losses of wax myrtle scrub are assumed to be permanent as this vegetation type was planted, is not expected to regenerate naturally, and is constrained by other surrounding upland vegetation types. Vancouver rye grassland at Lake Merced is small at 0.013 acre and therefore any amount of encroachment from increased and maintained lake levels would result in a substantial percentage loss of this community, which is the case if lake levels are raised above 9 feet. However, as shown in Table 3.4-5, a water surface elevation of 9 feet City Datum is predicted to result in a less than 10 percent loss of wax myrtle scrub and Vancouver rye grassland. If the target maximum WSE selected is 9 feet or lower, this impact would be *less than significant*. If the target maximum WSE of 9.5 feet City Datum is selected and Lake Merced lake levels are maintained above 9 feet for more than 14 days for wax myrtle scrub and Vancouver rye grassland or for more than one month for eucalyptus forest (discussed in detail under Impact BIO-15), permanent loss of these sensitive communities at quantities above 10 percent is assumed (based on existing data), which would be *significant*. Implementation of **Mitigation Measure 3.4-10a, Lake Level Management**, and/or **Mitigation Measure 3.4-10b, Compensation for Loss of Sensitive Communities at Lake Merced**, would serve to reduce potential impacts on wax myrtle scrub and Vancouver rye grassland resulting from Project implementation to less-than-significant levels through management of water levels to avoid Project-related losses of sensitive communities or through compensatory mitigation if these losses cannot be avoided. Therefore, with implementation of Mitigation Measure 3.4-10a and/or 3.4-10b, Project impacts on these sensitive communities would be reduced to *less than significant.*

Mitigation Measure 3.4-10a: Lake Level Management

The Lake Merced overflow weir in South Lake shall be set at no greater than 9 feet City Datum to prevent lake water surface elevation from exceeding 9 feet City Datum during normal operations to avoid significant effects on wax myrtle scrub, Vancouver rye grassland, and eucalyptus forest. Lake Merced water levels shall be maintained at no more than 9 feet City Datum during normal operations. Should an operating WSE above 9 feet City Datum be selected or an extreme storm event requires temporary storage in Lake Merced that would increase WSE above 9 feet City Datum for more than 14 days (at which time vegetation die-off could occur), Mitigation Measure 3.4-10b is required.

Mitigation Measure 3.4-10b: Compensation for Loss of Sensitive Communities at Lake Merced

a) If 9.5 feet City Datum is selected as the target maximum WSE and Lake Merced water levels are not maintained at or below 9 feet City Datum during normal operations, or a storm event requires storage in Lake Merced that would increase WSE above 9 feet City Datum for more than 14 days for wax myrtle scrub and Vancouver rye grassland or for more than one month for blue gum eucalyptus forest, a resurvey of these sensitive vegetation communities around the Lake Merced shoreline to which a significant impact is predicted to occur (i.e., more than 10 percent loss) shall be performed post-inundation to determine actual percent loss.

    i. The resurvey shall be performed by qualified botanists and document the post-inundation conditions (extent) of the wax myrtle scrub, Vancouver rye grassland, and blue gum eucalyptus around Lake Merced between the new inundation limit (above 9 feet WSE) and 13 feet WSE City Datum. Information on the extent of these sensitive natural communities gathered during this exercise may be applied to subsequent storm events during which WSE exceeds 9 feet WSE or if an operating WSE maintains lake levels above 9 feet WSE, for use in quantifying loss of these sensitive communities at various inundation limits above 9 feet City Datum.

ii. Surveyors may use a combination of on-the-ground vegetation community and habitat type mapping with an assessment of current aerial imagery for informing cover estimates, similar to the mapping exercise performed in 2012 that informed the vegetation change analysis for this EIR/EIS.

iii. Once the updated vegetation mapping exercise is complete, the new vegetation polygons shall be compared with the 2012 vegetation polygons to quantify change. The polygon comparison shall also consider the new inundation line, to assess whether or not the change in vegetation communities is attributable to inundation or saturation.

iv. If the updated mapping exercise and comparison assessment determine impacts to wax myrtle scrub, Vancouver rye grassland, or blue gum eucalyptus are less than 10 percent following inundation above 9 feet WSE, no further mitigation is required.

v. If the updated mapping exercise and comparison assessment determine impacts to wax myrtle scrub, Vancouver rye grassland, or blue gum eucalyptus vegetation communities are 10 percent or more, an onsite revegetation and restoration plan shall be developed for permanently impacted (inundated/lost) communities and habitat types, as detailed in part b), below.

b) An onsite revegetation and restoration plan shall be prepared to compensate for the affected sensitive vegetation communities and habitat lost (in excess of 10 percent) with a maintained WSE above 9 feet City Datum for 14 days or more for wax myrtle scrub and Vancouver rye grassland and for one month or more for eucalyptus forest. The plan shall be submitted to CDFW and CCC for review and approval, as appropriate. Typical compensation ratios for these communities shall be between 1:1 and 3:1 with native plant replacement quantities that shall be determined by the appropriate permitting agencies. Restoration and revegetation shall take place onsite where possible, and occur above the maximum water surface elevation to be maintained at Lake Merced so that future inundation impacts are avoided, and be implemented in coordination with SFRPD.

i. The revegetation and restoration plan shall be prepared by a qualified restoration ecologist and shall include specifications for seed and propagule[32] collection prior to the commencement of construction and at the appropriate phonological stage to capture reproductive structures of target plants within each affected sensitive vegetation community or habitat type. The restoration ecologist shall coordinate with a local native plant restoration nursery to either store the propagules until planting or grow the plants so that they are ready to plant once construction is complete. Restoration areas shall be monitored to assess re-establishment for 5 years or until total native vegetation cover, composition, and species richness in the restored areas are similar to suitable reference sites.

32 A plant structure capable of dispersing from the parent plant and establishing in a new location. Root, rhizome, and stem fragments with buds are common propagules as are bulbs, corms, and tubers. Seeds are also considered propagules.

ii. Individual special-status plants within the affected wax myrtle scrub and Vancouver rye grassland communities shall be mitigated according to the guidelines established in Mitigation Measure 3.4-1, Avoidance, Minimization, and Compensation for Special-Status Plants, items d and f regarding additional compensation location and revegetation and restoration plan performance standard details. Eucalyptus forest communities shall be mitigated according to guidelines established in Mitigation Measure 3.4-6, Implement Tree Protection Measures and Plant Replacement Trees, item 3 regarding appropriate replacement tree types, techniques, and performance standards.

Under extreme storm events when a high volume of stormwater is diverted into Lake Merced, lake levels would temporarily rise above the target maximum WSE to alleviate local flooding. During these episodic events, lake levels are likely to exceed 9 feet City Datum and temporarily inundate portions of these sensitive communities that would be otherwise unaffected by a maintained lake level at or below 9 feet City Datum. Wax myrtle scrub and Vancouver rye grassland communities are fairly tolerant to periods of inundation or changes to soil saturation and periodic inundation during storm events when WSE of 9 feet City Datum is exceeded are not expected to significantly adversely affect these communities. Wax myrtle scrub can thrive in riparian and wetland environments with moist soil conditions and Vancouver rye grasslands maintain extensive regenerative root networks should inundation last more than a couple days and cause aboveground vegetation to be compromised. Because of this tolerance, the threshold for inundation at which time permanent loss of these communities is assumed was determined to be 14 days.

The xeric[33] communities of coastal dune scrub and canyon live oak scrub are highly sensitive to changes in soil saturation, a sensitivity that increases with the frequency of inundation of the root zone. Due to this particular sensitivity, even short periods of inundation during storm events would compromise vegetation within these communities likely resulting in loss. However, as shown in Table 3.4-6, the elevations of central dune scrub and canyon live oak scrub around Lake Merced are such that even if the maximum WSE of 13 feet City Datum were to be reached during a storm event, there would be a loss of less than 10 percent of these vegetation types which would be *less than significant*.

Significance after Mitigation: Less than Significant.

Impact BIO-13: Project operation would not adversely affect resident fisheries and fish habitat associated with Lake Merced. (Less than Significant)

The following discussion addresses potential Project-related impacts to Lake Merced fisheries and fish habitat associated with increased the lake levels and potential changes to the key habitat parameters of temperature, DO, pH, and water depth. The analysis of impacts to resident fisheries and fish habitat is informed by the water quality modeling conducted in support of the EIR/EIS (ESA, 2015). Section 3.9 provides detailed analysis of both construction and operations phase

[33] Vegetation communities in which plants require little moisture to survive or have adapted to dry habitat conditions.

impacts to water quality and conclude neither adverse impacts to water quality nor beneficial uses associated with water quality resulting from the diversion of stormwater into Lake Merced.

Temperature. Baseline temperature ranges documented within Lake Merced are within the tolerance limits for all species present. Based on the results of temperature modeling (Section 3.9, Hydrology and Water Quality) to compare observed temperatures for 2012 water surface elevations to temperatures expected to occur with the potential WSE increases of 0.5 feet, 1.5 feet, and 2.5 feet, only minor changes in the temperature regime of the Lake are expected to occur. The largest difference among scenarios occurred between temperatures of 19 °C and 22 °C (66 °F and 72 °F). As an example, for the baseline case, surface layer temperatures exceeded 20 °C (68 °F) for roughly 7 percent of the time in 2012 (approximately 600 hours), whereas increasing the depth of the Lake by 2.5 feet would likely slightly reduce the frequency of surface layer temperatures exceeding 20 °C (68 °F) to 5 percent of the time (approximately 420 hours). For higher temperatures (21 to 22 °C) however, the differences in modeled temperature exceedance under different depth scenarios became progressively smaller. Moreover, under the 2.5-foot depth increase, the model dampened the daily range of temperature by 0 to 0.7 °C, indicating that the additional depth may allow the upper mixed layer to partially buffer rapid temperature fluctuations. In summary, the temperature model indicates that increasing the depth of Lake Merced would likely slightly decrease the occurrence of surface water temperatures above 19 °C, and could marginally reduce temperature fluctuations.

Although only surface water temperature effects were modeled, potential water temperature-related effects on fisheries resources would be expected to be minor. A slight reduction in the frequency of surface water temperatures at the upper end of the coldwater species' (e.g., rainbow trout) preference range would be expected to result in a negligible improvement in habitat suitability for these species in the lake surface waters, while resulting in a negligible reduction in habitat suitability for warmwater species, such as largemouth bass and channel catfish, that are already limited by the prevalence of cool water within the Lake. It should be noted, however, that most fish species avoid surface layers during most of their life cycle. Water temperatures within mid-level depths frequently occupied by species such as trout and bass would be expected to remain largely unchanged, and the availability (i.e., volume) of these mid-depth temperature conditions would increase, thereby increasing overall habitat availability over existing conditions, particularly for rainbow trout.

Dissolved Oxygen. Lake depth has an effect on DO content by influencing the frequency and duration of stratification (see Section 3.9, Hydrology and Water Quality, for detailed discussion). Stratification contributes to low levels of DO in the deeper waters, where algal respiration and decaying organic matter remove oxygen, which is not replenished by mixing with more oxygen-rich water higher in the water column. Historic measurements show that increased depth reduces DO in deep water due to less frequent mixing, so it is expected that operating the Lake under any of the WSE scenarios would result in increases in the frequency and duration of stratification periods and therefore of excursions below 5 mg/L (the minimum DO objective in the Basin Plan) in the deeper portions of the Lake. However, because the WSE would increase, a greater overall Lake volume would be provided that is expected to have DO concentrations above 5 mg/L. As a result, increasing the Lake levels is expected to result in an overall improvement in aquatic life habitat conditions. While the bottom layer of the Lake would likely continue to experience periodic reduced DO levels that are outside the optimal range for most species present, the volume of water with suitable DO concentrations at mid-water column depths would increase over existing conditions, thereby effectively increasing the total amount of habitat containing suitable DO levels for fish and other aquatic species.

pH. As discussed in detail in Section 3.9, Hydrology and Water Quality, Lake Merced has relatively high alkalinity with an estimated equilibrium pH of about 8.5. Under current conditions, the pH level frequently peaks above 8.5 during sunny afternoons as a result of algal photosynthesis. Under the proposed project, once the steady state is achieved after the filling period, there would be a slight decrease of 6 to 10 percent in algal concentrations. However, it is expected that upper mixed layer (epilimnion) pH would continue to exceed 8.5. The lower mixed layer (hypolimnion) pH is expected to remain relatively unchanged, with values below 8.5. Thus, pH conditions for fisheries resources would remain similar to baseline conditions and within the upper portion of the tolerance range of freshwater fish. However, the relatively high equilibrium pH levels to which resident fish are acclimatized in Lake Merced, as well as the relatively gradual nature of periodic pH increases, are expected to maintain the fish assemblage of Lake Merced.

Water Depth. In 2004, the SFPUC assessed the effect of water level increases on Lake Merced fisheries (EDAW, 2004) and anticipated that the greatest potential effect would come from reductions in littoral habitat (defined as areas with 3 feet or less of water around the lake perimeters) with rising lake levels. However, it was predicted that most of the loss would be in Impound Lake, which does not represent a significant portion of the Lake Merced fisheries habitat due to shallow depths and small surface area. Additionally, much of the loss of littoral habitat assessed by EDAW (2004) has likely already occurred under existing conditions. Average lake levels have risen to nearly 6 feet City Datum under existing conditions and EDAW's 2004 models predicted that over 85 percent of littoral habitat would be lost at elevations of six feet or more. Decreases in littoral area predicted to occur by EDAW (2004) were expected to impact warmwater species, given their habitat requirements for foraging and reproduction (described in Section 3.4.1.3). The EDAW study found, however, that littoral area was already a very small component of the overall lake habitat, and that since there were other factors more likely to control warmwater species (i.e., temperature, cover, and water clarity) loss of littoral habitat from increases in WSE would have only minimal impacts on warmwater fish population abundance, growth rates, or ability to reproduce. Coldwater fish at Lake Merced, such as prickly sculpin, appeared to be self-sustaining as of 2007. Trout are not self-sustaining due to a lack of suitable spawning habitat and are regularly stocked by CDFW. In summary, the 2004 EDAW report prepared for the SFPUC assessed potential impacts on beneficial uses in relation to an increase in WSE of up to 8 feet City Datum and found that no effect on beneficial uses related to fisheries was expected.

The fishery-related ecosystem of Lake Merced can be summarized as a moderately enriched Lake that supports self-sustaining populations of native and non-native warm water and cold water fish species. The results of the assessment of potential changes to available habitat area or to the water quality of Lake Merced (temperature, DO, and pH profiles) were reviewed in light of known habitat requirements of the Lake Merced fish species. Loss of aquatic habitat, such as littoral habitat, from increases in WSE would have only minimal impacts on fish population abundance, growth rates, or ability to reproduce. Temperature, DO, and pH profiles are not expected to change significantly with increased water surface elevations. Therefore, no significant changes to habitat conditions relating to water quality are anticipated for warm water or cold water fish. The impact would be *less than significant* and no mitigation is required.

As described in Section 2.4.1.3, during periods of very low or no flow, a recirculating pump would draw water from Lake Merced to maintain the wetland. This expanded use of the proposed wetlands would be adaptively managed to maximize the filtration and removal of algae, skimmed directly from the lake surface and pumped to the wetlands. The use of a skimmer to target areas of concentrated algae accumulations (>1,000 times background epilimnion levels) in surface water for removal via use of the constructed treatment wetlands would, over time, result in an overall improvement of Lake Merced water quality through achieving decreases in chlorophyll concentrations and removing nuisance algal blooms. Further, the skimmer would be composed of a small floating flexible hose intake for diversion of surface waters at a low rate (approximately 1.4 cfs) and would not entrain or impinge fish or otherwise result in stress, harm, or mortality of resident fish. It is probable that fish species would behaviorally avoid the skimmer due to movement and noise associated with the intake.

Should the additional in-lake treatment components of the LMP be implemented, such as aeration or other in-lake water quality management and treatment measures, overall water quality, and thus aquatic habitat conditions relevant to fish species, would be improved. Specifically, implementation of an aeration system under the adaptive management approach outlined in the LMP would raise DO levels in the deepest portions of the lake during summer and fall months, improving baseline conditions where anoxia (DO <2 mg/L) has been documented to occur during seasonal stratification. The existing anoxic or low DO conditions are stressful to the majority of resident fish species and reduce available habitat area. Similarly, use of the siphon would, over time, lower pH levels in Lake Merced, which can exceed Basin Plan WQOs (representing levels stressful to some resident species) in surface waters during summer months. Such a water quality improvement over baseline conditions would increase available habitat for fish species. Impacts would be *less than significant* (and beneficial), and no mitigation would be required.

Mitigation: None required.

Impact BIO-14: Project operation would not adversely affect wetland habitats and other waters of the United States associated with Lake Merced. (Less than Significant)

To determine the proposed Project's effect on wetlands, the threshold of no net loss of wetlands was compared with the simulated Lake Merced lake levels (Kennedy/Jenks, 2014) to assess whether wetland impacts would be expected to occur under the Project and Cumulative Scenarios, relative to baseline conditions.

Wetland extent at Lake Merced is determined primarily by water levels and topography, and has moved up slope with the water levels over time (Stillwater, 2009; Nomad Ecology, 2011), although the capacity for upward migration is not limitless. As listed in Table 3.4-5, there are five distinct freshwater marsh and seasonal wetland types at Lake Merced, and the wetlands vegetation type is one of the most widespread around the lake, although overall wetland acreage has decreased since 2002 as mean annual lake levels have risen and the area of open water has increased. As noted above, willow riparian scrub also has decreased in acreage since 2002 as a result of inundation of the shallow margins of the previous lakeshore.

As lake levels rise to target WSEs, emergent wetlands are expected to follow closely, as would willow riparian scrub, although relative proportions of the various wetland types are expected to change as they re-establish and reconfigure in response to the target WSE, depending on topography and adjacent plant communities. Since this basic pattern has been observed and is borne out in the predictions of the GIS-based vegetation change analysis, it is predicted to continue to occur over the time period modeled for the various scenarios under consideration in this EIR/EIS.

The amount of shoreline available for wetland establishment at a given water surface elevation differs according to the topography of the lakeshore, which generally is steeper at higher elevations and flatter at lower elevations.

The GIS-based analysis predicted vegetation changes for increasing water levels compared to baseline. **Table 3.4-7** presents a summary of the predicted vegetation changes for increasing water levels to the range of mean target WSEs between 6.5 and 8.5 with a maximum of 9.5 feet City Datum, captured in the table between 7 and 10 feet City Datum compared to the baseline WSE of approximately 6 feet City Datum.

Overall, the vegetation change analysis predicts incremental increases in wetlands at average annual WSEs between 7 and 10 feet City Datum (Table 3.4-7). This is due primarily to the fact that between 6 and 10 feet City Datum, water level increases would inundate several large areas of low gradient topography at depths conducive to emergent wetland establishment (between 5 below and 2 feet above the maintained WSE). Above 6 feet City Datum, bulrush wetlands are predicted to increase in extent at each incremental rise up to 10 feet City Datum. Bulrush wetlands are predicted to replace willow scrub, as this vegetation type would die with prolonged deep inundation, as well as knotweed wetlands, rush meadow, and cattail wetlands, due primarily to changes in topography and water depth. Therefore, herbaceous wetlands would expand between 7 percent and 47.5 percent with lake level increases between 7 and 10 feet City Datum, and total wetlands would expand between 4 percent and 9.8 percent, which accounts for the significant decrease in riparian vegetation of between 26.1 and 63.9 percent that would occur with lake level increases under the Project.

As discussed above, extreme storm events resulting in a high volume of stormwater being diverted into Lake Merced would cause lake levels to temporarily rise above the target WSE to alleviate local flooding. During such events, lake levels would likely exceed 9 feet City Datum and temporarily inundate wetland types that occur above the target WSE. These episodic events are not anticipated to result in lasting effects on wetland composition around Lake Merced as

TABLE 3.4-7
PREDICTED CHANGE IN VEGETATION ACREAGES AND PERCENT CHANGE RELATIVE TO A 6-FOOT WATER SURFACE ELEVATION: RISING WATER LEVELS

	Acres between Mean Annual Water Surface Elevations of 6 to 10 feet and Percent Change (City Datum)[a,b,c,d]				
Wetland Type	**6 feet**	**7 feet**	**8 feet**	**9 feet**	**10 feet**
Arroyo willow riparian scrub	17.03	*12.59*	*11.86*	*8.44*	*6.14*
Percent change	--	-26.1%	-30.4%	-50.4%	-63.9%
Bulrush wetland	25.05	**28.15**	**32.57**	**38.18**	**44.74**
Percent change	--	+12.4%	+30.0%	+52.4%	+78.6%
Giant vetch wetland	0.25	*0.17*	*0.17*	*0.16*	*0.13*
Percent change	--	-32.0%	-32.0%	-36.0%	-48.0%
Knotweed wetland	7.02	*6.42*	*6.89*	*6.13*	*3.26*
Percent change	--	-8.5%	-1.8%	-12.6%	-53.5%
Rush meadow	0.40	*0.29*	*0.31*	*0.26*	*0.14*
Percent change	--	-27.5%	-22.5%	-35.0%	-65.0%
Cattail wetland	0.01	*0.00*	*0.00*	*0.00*	*0.00*
Percent change*	--	-100.0%	-100.0%	-100.0%	-100.0%
Total herbaceous wetland	32.73	**35.03**	**39.94**	**44.73**	**48.27**
Percent change	--	+7.0%	+22.0%	+36.7%	+47.5%
Total wetland (riparian + herbaceous)	49.76	*47.62*	**51.80**	**53.17**	**54.41**
Percent change	--	-4.5%	+4.3%	+7.2%	+9.8%
Open water	256.40	**264.86**	**266.15**	**266.46**	**268.62**
Percent change	--	+3.3%	+3.8%	+3.9%	+4.8%

[a] Acreages in table are for vegetation at and below 10 feet City Datum.
[b] Values in **bold** indicate an increase in cover type.
[c] Values in italic indicate a decrease in cover type.
[d] Predicted vegetation change is measured against a baseline 6-foot City Datum mean annual water surface elevation.

* While the model *predicts* 100% loss of the cattail wetland type, this is only for a small patch of vegetation that vegetation mappers differentiated as cattail wetland. Increased WSE above 6 feet may compromise this single 0.01-acre feature; however, cattails are resilient vegetation that are still expected to occur as an important component of other wetland types such as bulrush, willow, and knotweed wetlands at Lake Merced. Cattail is a common early colonizer and is likely to naturally recruit at any WSE in these wetland types, over an area equal or greater to .01 acre. This realistic scenario would result in no or minor change, as opposed to the extreme prediction of -100%.

vegetation migration discussed above is gradual and responds to extended periods of saturation and inundation. Any loss of wetland vegetation associated with these events is also expected to be negligible as vegetation within these communities is adapted to various wet conditions including periods during which the average WSE is substantially exceeded. Therefore, short term effects on wetlands causing temporary inundation of vegetation above 9 feet City Datum associated with storm events would be *less than significant*.

Project operations would maintain lake levels at an average WSE between 6.5 and 8.5 with a maximum of 9.5 feet City Datum (captured as the range between 7 and 10 feet within Table 3.4-7) which would result in a shift in the composition of wetland types along the Lake Merced shoreline; however, there would be no net loss in wetlands. Therefore Project impacts on wetlands would be *less than significant*.

Mitigation: None required.

Impact BIO-15: Project operation could adversely affect native wildlife nursery sites associated with Lake Merced. (Less than Significant with Mitigation)

Large eucalyptus along the shores of North and South Lakes support several double crested cormorant and great blue heron rookeries. A loss of 10 percent or more of the eucalyptus forest that could support rookeries around Lake Merced, particularly the more isolated stands, as a result of the proposed Project would be considered *significant*. **Table 3.4-8** shows how eucalyptus forest is predicted to decrease with rising WSEs and shows the predicted average annual WSE at or near which effects are predicted to begin. This analysis also considers storm events where lake levels may reach a maximum of 13 feet City Datum and temporarily inundate eucalyptus forest and rookery trees where present below this elevation around Lake Merced.

TABLE 3.4-8
PREDICTED LOSS OF EUCALYPTUS FOREST WITH RISING WATER LEVELS[a]

Sensitive Community	Acres of Eucalyptus Forest at Mean Annual Water Surface Elevation (City Datum)							
	Permanent WSE					Temporary WSE[b]		
	6 feet	7 feet	8 feet	9 feet	10 feet	11 feet	12 feet	13 feet
Blue gum eucalyptus forest	17.63	*17.24*	*15.79*	*14.93*	*14.39*	*13.96*	*13.58*	*13.22*
Percent change[c]	--	-2.2%	-10.6%	-15.6%	-18.7%	-21.1%	-23.3%	-25.4%

[a] Values depicted in *italic* indicate a decrease in cover type.
[b] Percent change and acreage lost under temporary water surface elevations reflect impacts on sensitive communities from sustained WSE where vegetation die-off would occur but are presented for reference as worst-case scenarios.
[c] Due to the canopy cover over the lake shoreline, the predicted change for blue gum eucalyptus is likely overestimated.

As shown, the results of the vegetation modeling prepared for this EIR/EIS indicate that a 10 percent loss of eucalyptus forest would begin to occur at a sustained WSE of 8 feet City Datum. However, since the vegetation mapping relies on aerial photograph interpretation of the canopy and individual eucalyptus stems were not mapped, the potential losses at this elevation are likely overestimated. Currently, there are healthy eucalyptus trees at the high water line. Most trees are located at higher elevations than that, and on steeper slopes the trunks may be located well above the 8-foot contour. Therefore, it is conservatively assumed for this analysis that a substantial loss of eucalyptus forest would occur if a WSE of 9 feet City Datum were to be exceeded and persist for more than one month (the threshold of time when vegetation die-off is predicted to occur), as it would if 9.5 feet City Datum was selected as the overflow weir elevation.

As shown in Table 3.4-8, water level increases above 9 feet City Datum under the Project that persist for more than one month (i.e., with a target maximum WSE of 9.5 feet) would result in the change in habitat attributed to the Project in excess of 10 percent which would be considered a *significant* impact on these wildlife nursery sites. Implementation of **Mitigation Measure 3.4-10a**, **Lake Level Management**, would maintain lake levels at 9 feet City Datum and therefore serve to reduce potential impacts on eucalyptus forest resulting from Project implementation to *less-than-significant* levels through management of water levels to avoid Project-related losses of this habitat, along with other sensitive communities (see Impact BIO-12). Should 9.5 WSE be selected as the maximum elevation and lake levels persist above 9 feet during normal target operations for more than one month, implementation of **Mitigation Measure 3.4-10b**, **Compensation for Loss of Sensitive Communities at Lake Merced**, would require an updated mapping exercise and comparison analysis of vegetation polygons for wax myrtle scrub, Vancouver rye grassland, and eucalyptus forest be performed post-inundation to confirm percent loss of these sensitive natural community with lake levels sustained above 9 feet City Datum, and subsequent development of a revegetation and restoration plan as compensation for quantities lost and to restore affected sensitive communities onsite above the maximum water surface elevation to be maintained at Lake Merced to a degree that impacts to the wildlife nursery sites around the lake are not *significant*. Restoration plantings for loss of eucalyptus forest would be native species that offer similar structural elements to nesting herons and cormorants as specified in Mitigation Measure 3.4-6, Implement Tree Protection Measures and Plant Replacement Trees.

Inundation of eucalyptus trees for one month or more are is predicted to cause tree die-off; however, short-term inundation of eucalyptus trees above 9 feet WSE is not expected to result in *significant* adverse effects on this community. As with the central dune scrub and canyon live oak scrub sensitive communities previously described, sensitivity to soil saturation or inundation increases with the frequency and duration of episodic storm events that would raise the lake levels above the elevation of 9 feet City Datum. Eucalyptus trees are less sensitive than other communities around the lake. While some losses of eucalyptus forest and associated rookeries may occur where located around the lake at elevations between 9 and 13 feet City Datum as a result of inundation during storm events, they are not expected to reflect the absolute high percentages listed in Table 3.4-8 and are predicted to be *less than significant*.

Mitigation: Implement Mitigation Measure 3.4-10a and Mitigation Measure 3.4-10b.

Significance after Mitigation: Less than significant.

NEPA Analysis

Construction Impacts

Vegetation

For the reasons described in the above CEQA analysis, Project construction would have short-term, minor adverse impacts on vegetation communities within the Project site. Effects would be measurable or perceptible, but they would be localized within the relatively small Project work areas and facility sites. The overall viability of plant communities within and surrounding the Project would not be affected. Adverse effects on vegetation, as quantified below when known based on current site designs, could be mitigated through avoidance, minimization, and mitigation measures as described below.

Central dune scrub, a sensitive natural community, occurs on the far east and south sides of the proposed Fort Funston staging area (approximately 0.5 acre) and at the base of the of Avalon Canyon access road where sandy soils are present at the transition to the beach. Central dune scrub also occurs at Impound Lake in the vicinity of the proposed discharge structure but not within the direct footprint. This community could be disturbed during vegetation removal and temporary ground disturbance in support of Project staging and work areas, deposition of materials, introduction of invasive plants and other direct disturbance such as trampling during Project construction activities in those areas. Implementing **Mitigation Measure 3.4-5**, **Avoidance, Minimization, and Compensation for Impacts to Central Dune Scrub**, would reduce these construction-related impacts on this sensitive natural community.

Few non-native trees and areas with non-native grassland or ruderal upland herbaceous vegetation would be removed from the wetland cell locations along the Vista Grande Canal. Impacts to trees adjacent to the Canal work area or trees to be retained during construction would be avoided or minimized through protection measures described in **Mitigation Measure 3.4-6**, **Implement Tree Protection Measures and Plant Replacement Trees**. Native trees would be planted following construction for trees removed along the Canal work area under this same measure. In order to prevent the introduction or spread of invasive plants into temporarily disturbed areas during construction, especially when working in locations where invasive species are prolific, the Project would implement **Mitigation Measure 3.4-7a**, **Control Measures for Spread of Invasive Plants**. Following construction activities, temporarily disturbed areas would be re-contoured (as necessary) and **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**, would either hydroseed or broadcast seed native plants in these upland areas disturbed under the Project to minimize potential colonization by opportunistic weedy species. Disturbed dune scrub vegetation, consisting mainly of expansive non-native iceplant rafts, unvegetated visitor trails, and dune deflation planes with few native plants comprises most of the proposed Project work areas at both the tunnel shaft staging area and concrete pump staging area and hose alignment at Fort Funston. Use of each of these areas under the Project would require minor grading and removal of existing disturbed dune scrub vegetation. Restoration of this area with native seed or propagules following construction would contribute to long-term, beneficial effects of removing invasive plant species and restoring native vegetation communities within Fort Funston; further, such actions align with goals of the 2015 GGNRA/Muir Woods National Monument General Management Plan and USFWS Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula (USFWS, 2003) for the location of the proposed Project staging area. As described in Section 2.5.2.2, the bluff face would be protected from impact by the concrete hose with jute netting or burlap installed along the hose alignment. Minimal disturbed dune scrub occurs along the bluff face in this area impacts during use of the concrete pump and hose are expected to be negligible and short-term during construction.

Wetlands and Other Jurisdictional Waters

For the reasons described in the above CEQA analysis, potentially jurisdictional state- and federally protected wetlands, other waters, and riparian habitats that occur within the Project site would be temporarily or permanently impacted during Project construction and operations. Adverse Project impacts to these features would be moderate and involve both temporary (short-term) and permanent (long-term) discharges of structures and/or fill to accommodate Project activities and structures, including the construction of the Lake Merced outlet structure in Impound Lake, the replacement of the Lake Merced overflow structure in South Lake, and replacement of the Ocean Outlet structure and a portion of the submarine outfall pipeline on the beach at Fort Funston. Effects would be readily apparent over areas with permanent Project facilities, though these impacts would not expand over time. Temporary impacts would be restored to pre-project conditions (typically including contours, topsoil, and vegetation) as described in **Mitigation Measure 3.4-8b**, **Compensation for Impacts to Wetlands and Riparian Habitat**, and unavoidable permanent adverse impacts would be mitigated by on-site or off-site creation, restoration, or enhancement of previously lost or degraded waters, wetlands, and/or riparian habitats, or payment to a mitigation bank for in-kind credits. Expected temporary and permanent impacts to wetlands and other waters of the U.S., navigable waters, and state-regulated waters and wetlands are depicted in Table 3.4-3. Implementing **Mitigation Measure 3.4-8a**, **Wetland Avoidance and Protection**, would minimize the nature of and reduce the extent of impacts on affected wetlands and other waters within the Project footprint, resulting in a moderate impact.

Terrestrial Wildlife and Aquatic Wildlife

Adverse impacts on common terrestrial wildlife are expected to be minor and short-term during Project construction and include temporary disturbance of habitat or perhaps the loss of a limited number of individuals of a common species. However, these disturbances would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them.

As described in Section 3.4.1.3, terrestrial animal species that could occur on the Project sites, such as striped skunk, raccoon, Botta's pocket gopher, deer mice, gopher snake, alligator lizard and fence lizard, would be accustomed to an urban fringe environment and human disturbance. While uses of Project sites, work and staging areas, and access roads would differ in noise, visual disturbance, and artificial illumination (during night work) from existing conditions, the altered environment that may adversely affect animal foraging behavior, territories, or dispersal movements will be limited to the period of construction. Through implementation of **Mitigation Measure 3.4-2a**, **Worker Environmental Awareness Program Training**, Project workers would be educated about sensitive species and common wildlife found within the Project study area, avoidance measures and procedures to ensure Project impacts on wildlife are minimized, and the regulatory requirements and penalties for noncompliance. The WEAP would provide specific protection measures and protocols for encountering wildlife that could occur within or around the Project sites, work and staging areas, and access roads on NPS-managed lands to minimize Project-related disturbance. Implementation of noise **Mitigation Measure 3.11-1** would require the use of noise control methods and technologies during Project construction, which would reduce potential impacts on surrounding wildlife. The staging area at Fort Funston would be surrounded by fencing to exclude large common wildlife (striped skunk or raccoon) and domestic animals (dogs) from entering Project work areas. Implementing **Mitigation Measure 3.4-9**, **Night Lighting Minimization**, during night work would limit illumination to active Project sites and staging areas by directing warm-colored lights down and inward and not toward adjacent habitat or the night sky. A qualified biologist would be onsite while lights are positioned to ensure appropriate positioning to minimize light escape. Screening would be installed on the chain-link fence surrounding the Fort Funston staging area per **Mitigation Measure 3.2-1** to further limit unnecessary light spillover into adjacent habitat.

Common aquatic species at the Lake Merced and Canal Project sites may include Pacific tree frog, bullfrog, and red-eared slider in addition to the many native and non-native fish species found within Lake Merced such as largemouth bass, Sacramento blackfish, common carp, tule perch, goldfish, prickly sculpin, and three spine stickleback (Lake Merced Task Force, 2007). Implementing **Mitigation Measure 3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would afford protection to western pond turtle and other local common terrestrial and aquatic species should they occur on the Project sites around Lake Merced. Mitigation Measure 3.4-2b would exclude the western pond turtle and common terrestrial and aquatic wildlife species from construction sites located at South Lake and Impound Lake by requiring the installation of terrestrial exclusion fencing around these lakeside construction areas, requiring the installation of a cofferdam around in-water work areas, monitoring for species during water drawdown of the dammed area, and species relocation outside of the work area by a qualified biologist. Should western pond turtle and/or common wildlife be identified within the construction exclusion zones, work would halt around the species until qualified personnel are contacted or the individual leaves the work area on its own accord depending on the level of protection and sensitivity associated with the encountered species (special-status species vs. common wildlife). With implementation of Mitigation Measure 3.4-2b, impacts to terrestrial and aquatic wildlife at and around the Lake Merced and Canal Project sites would be minor.

Special-Status Species

For the reasons described above in the CEQA analysis, the Project would have short-term, minor adverse effects on special-status plants and animal species in the study area. The Project may affect some individual plants and a portion of the special-status vegetation community as a whole. Impacts to special-status species would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. No loss of special-status species individuals would be expected to occur. Adverse effects would be avoided, minimized, or offset by the mitigation measures described in the following discussions, resulting in a minor impact.

Special-Status Plants

Northern coastal scrub communities and coastal dune habitats at several locations within the Project site provide suitable habitat for special-status plants that could be disturbed during Project construction. Construction activities that could compromise special-status plants within these communities include initial grading and use of the staging areas at Fort Funston, maintenance and use of the Avalon Canyon access road, and construction of the Impound Lake discharge structure.

Implementing **Mitigation Measure 3.4-1**, **Avoidance, Minimization, and Compensation for Impacts to Special-Status Plants**, would reduce potential impacts on special-status plants by requiring preconstruction protocol-level surveys, implementing avoidance measures, and compensating for impacts to special-status plants, if present.

Special-Status Animals

Western pond turtle, special-status and migratory birds, and special-status bats may occur within the Project site and could be impacted by construction activities. Western pond turtle is known to Lake Merced and could be adversely affected by construction of the Lake Merced overflow structure in South Lake and the Lake Merced outlet structure on the bank and within waters of Impound Lake. Implementing **Mitigation Measure 3.4-2a**, **Worker Environmental Awareness Program Training**, and **Mitigation Measure 3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would reduce potential impacts on this species by requiring Project personnel to attend an environmental training on biological resources in the study area, the installation of terrestrial exclusion fencing around these lakeside construction areas, requiring the installation of a cofferdam around in-water work areas, conducting preconstruction surveys, and requiring additional measures during site construction, such as monitoring during construction or relocation of an individual by a qualified biologist. Further, specific avoidance, minimization, and protection measures for special-status species that could occur on Project sites within NPS-managed lands would be incorporated into the WEAP training, as already described (e.g., procedures for encountering overwintering western snowy plovers on the beach near the Ocean Outlet work area).

Special-status resident and migratory birds known to nest and forage in the study area could be adversely affected by Project construction, particularly during the breeding season. Noise and visual disturbance from construction equipment and human presence at Project sites located within attractive nesting habitat, such as coastal scrub vegetation at the Avalon Canyon access road, riparian vegetation bordering Impound Lake and South Lake, or mature trees lining the Vista Grande Canal, could disrupt nesting efforts, cause nest abandonment, or result in direct take of nest or birds. Implementing **Mitigation Measure 3.4-3**, **Nesting Bird Protection Measures**, would reduce potential impacts on migratory and special-status birds by restricting certain construction activities during breeding bird season (e.g., vegetation removal and pile driving), requiring preconstruction surveys, and implementing avoidance measures if active nests are located.

In addition, nighttime lighting associated with construction activities located on the beach at the Ocean Outlet and at the Fort Funston staging area could cause avian entrapment or increase collisions resulting in avian mortality if utilized during periods of avian migration. Illumination of occupied nests in the vicinity of nighttime construction activities, if allowed, could disrupt breeding birds and general artificial illumination of wildlife habitat surrounding Project work areas during periods of nighttime construction could adversely affect a variety of species foraging behavior, breeding behavior, and dispersal movement. Implementing **Mitigation Measure 3.4-9, Night Lighting Minimization**, would reduce these impacts on migrating birds and nearby resident wildlife. Special-status bats documented at Lake Merced could roost in tree cavities, under bark, or on structures within the Project site and be adversely affected by construction activities such as removing inhabited trees or performing work on structures with active roosts.

Implementing **Mitigation Measure 3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**, would reduce potential impacts on special-status bats by requiring preconstruction surveys and implementing avoidance measures if active roosts are located.

Operational Impacts

Maintenance activities are expected to potentially cause short-term disturbance to adjacent biological resources, such as trampling of vegetation immediately adjacent to the facilities, but would not result in substantial effects that would trigger mitigation such as the construction impacts already discussed. Maintenance activities would be infrequent and would only require brief periods of activity at each location when maintenance is required.

Vegetation

For the reasons described above in the CEQA analysis, Project-related lake level increase would have minor long-term effects on vegetation surrounding Lake Merced that would be measurable or perceptible in elevation at which certain communities are present, but localized in context of the vegetation communities as a whole which surround the lake. However, the overall viability of plant communities within and surrounding the Project sites would not be affected. Changes in vegetation composition at certain elevations are expected with increased lake levels due to variation in the existing vegetation's adaptation to, and tolerance of inundation. Some communities, such as bulrush wetland are expected to migrate upslope and expand with rising lake levels, while others, such as arroyo willow riparian scrub, may experience die-off or have expansion limited by other physical barriers such as John Muir Drive.

A GIS-based vegetation community and habitat type change analysis (described in Appendix D) was used to predict vegetation response to raising water levels and inform the impact analysis. Following this analysis, and shown in Table 3.4-6, sensitive communities of central dune scrub and canyon live oak scrub would experience a less than 1 percent loss with lake level increases to between 7.5 and 9.5 feet City Datum, which is negligible. Loss of wax myrtle scrub and Vancouver rye grassland of more than 10 percent would occur if lake levels were increased above 9 feet City Datum. Implementation of **Mitigation Measure 3.4-10a**, **Lake Level Management**, would require maintenance of lake levels at or below 9 feet City Datum, which would prevent significant impacts to wax myrtle scrub and Vancouver rye grassland. If 9.5 feet City Datum is selected as the target maximum and lake levels are sustained at 9 feet or above for more than two weeks, **Mitigation Measure 3.4-10b**, **Compensation for Loss of Sensitive Communities at Lake Merced**, would require an updated mapping exercise and comparison analysis of vegetation polygons for wax myrtle scrub and Vancouver rye grassland be performed post-inundation to confirm percent loss of these sensitive natural communities with lake levels sustained above 9 feet City Datum, and subsequent development of a revegetation and restoration plan as compensation for quantities lost, to restore inundated sensitive vegetation communities, habitat types, and special-status plants onsite at elevations above maximum possible lake levels. Short-term, negligible impacts to these sensitive vegetation communities would occur during episodic storm events in which lake levels would temporarily rise above 9 feet City Datum to accommodate stormwater flows into Lake Merced and alleviate local flooding. No measurable or perceptible changes in plant community size or continuity, or integrity would occur, as listed in

Table 3.4-6, due to the interim nature of these storm events, the elevation location of these communities around the lake, and their tolerance to wet soil conditions.

Mature eucalyptus trees located along the shore of Lake Merced host raptor nests and certain populations support several double crested cormorant and great blue heron rookeries during breeding season. Increased lake levels under the Project would inundate stands of eucalyptus and ultimately cause trees to die and topple, thus reducing avian nesting substrate around the lake. Although rookeries are locally uncommon, there is sufficient eucalyptus forest present at Lake Merced to sustain the rookeries should small losses of mature eucalyptus occur. However, the location of trees in proximity to human disturbance limits desirable locations for rookeries to succeed around the lake. Therefore, a relatively low threshold of less than 10 percent loss of eucalyptus trees was determined to avoid major impacts to this eucalyptus forest vegetation community and avian nesting habitat. Following the GIS-based vegetation change analysis, and listed in Table 3.4-8, a water surface elevation at or below 9 feet City Datum would result in less than 10 percent loss of eucalyptus trees. Implementation of Mitigation Measure 3.4-10a, Lake Level Management, would maintain lake levels at 9 feet City Datum which would prevent major Project-related losses and avoid a drastic alteration of the size or integrity of this community and nesting habitat. Alternatively, implementation of Mitigation Measure 3.4-10b, Compensation for Loss of Sensitive Communities at Lake Merced, would mitigate for the loss of eucalyptus forest if target WSE is maintained above 9 feet City Datum by restoring native trees around Lake Merced above the maximum lake level that could support heron or cormorant rookeries. Restoration quantities would be determined by actual loss of eucalyptus forest through the updated mapping exercise and comparison analysis of vegetation polygons post-inundation and subsequent development of the revegetation and restoration plan to compensate for actual loss. Short term, negligible impacts to this community are anticipated following episodic storm events in which lake levels would temporarily exceed 9 feet City Datum, after which no measurable or perceptible changes in plant community size or continuity, or integrity would occur.

Wetlands and Other Jurisdictional Waters

For the reasons described above in the CEQA analysis, Project operations would have minor long-term effects on wetlands resulting from increasing the water level at Lake Merced above existing conditions to a target WSE of 7.5 to 9.5 feet City Datum. Effects would be detectable, but small in terms of the area (see Table 3.4-7) and the nature of the change. Because the SFPUC would determine the target maximum WSE at which to set the overflow height, and the lake level could only exceed that height temporarily and in the case of rare storm events, these effects would not have the potential to expand if left alone. Methodology for determining anticipated percent change in wetland cover type resulting from increased water surface elevations is the same as described in the CEQA analysis above. The five distinct freshwater marsh and seasonal wetland types at Lake Merced would experience change in overall percent cover with rising water levels above 6 feet City Datum, as listed in Table 3.4-7. Total herbaceous wetlands would increase with lake levels above 7 feet City Datum and total riparian and herbaceous wetlands would increase with lake levels above 8 feet City Datum. There would be no net loss of wetlands resulting from the Project if water surface elevations are increased to between 7.5 and 9.5 feet City Datum, but a shift in wetland type and composition around the shoreline of Lake Merced would occur. Operations at the Ocean Outfall would be negligible and not differ from current operations. Maintenance needs on the structure related to bluff retreat would depend on the rate of erosion and resulting protrusion of the tunnel and outlet beyond bluff face. Impacts associated with the periodic removal of the protruding tunnel and outlet and reconstruction of the outlet would be moderate and require similar methods described under the proposed Project. The estimated recurrence for such maintenance is considered long-term at approximately 25-year intervals (depending on the rate of erosion and other factors).

Terrestrial and Aquatic Wildlife

There would be negligible effects on terrestrial wildlife resulting from operation of the Project. No measurable or perceptible changes would occur to the amount, distribution, connectivity, or integrity of wildlife habitat or populations as a result of lake level increase. Common terrestrial wildlife such as striped skunk, deer mice, or gopher snake that inhabit or forage in vegetation around Lake Merced will not be significantly constrained by the increased water level or experience adverse effects resulting from changes in vegetation composition associated with the Project. Project impacts on aquatic habitat of Lake Merced would be negligible or minor and are likely to be beneficial as a result of the increased volume of aquatic habitat available to Lake Merced fish species and the maintenance or improvement of water quality.

Special-Status Species

For the reasons described above in the CEQA analysis, rising water levels in Lake Merced resulting from operation of the Project would have minor short-term and long-term effects on special-status plants and animal species in the study area. The Project may impact individual plants or a small percentage of sensitive vegetation communities around the lake through inundation as discussed under Vegetation. These impacts, however, would not be expected to be outside the natural range of variability of species’ populations, their habitats, or the natural processes sustaining them.

Rising water levels at the lake during the filling period would result in minor short-term effects to western pond turtle and avian species that nest along the waterline and are protected under the MBTA and California Fish and Game Code. Raising lake levels more than 3 feet in a given year could inundate western pond turtle nests and compromise the suspected breeding population at Lake Merced. However, the lake filling scenarios do not simulate an increase on an annual basis in excess of this amount. Avian species that nest in dense vegetation along the waterline could be adversely impacted by rising water levels of more than 0.5 feet in any two-week period during the nesting season when nests could be flooded and unhatched eggs could be lost. The lake filling scenario depicted in Figure 3.9-13 and listed in Table 3.9-8 indicate gradual contributions to the lake water level which reflect annual climatic conditions of wet and dry periods. Under preferred conditions, water contributions to Lake Merced during the filling period would be gradual however a main objective of the Project is to alleviate flooding of the surrounding urban areas during storm events. Thus, should storm events occur during the filling period, lake water level may rise more than 0.5 feet in 2.5 weeks, or under extreme conditions such as the design storm (see Section 3.9.5.1), more than 3 feet in a given year. If this were to occur during the avian nesting season, shoreline nests could be flooded and eggs could be lost. These impacts to shoreline breeding populations would be most likely to occur during the filling period and not once the target water surface elevation has been achieved, and are therefore considered to be short-term impacts. As discussed above in Vegetation, wetland and riparian nesting substrate for avian species would not be significantly altered as a result of rising water levels and therefore long-term impacts to breeding populations which could occur due to loss of habitat are avoided.

Extreme storm events that would raise the water level rapidly in excess of 3 feet are rare, and resulting wildlife casualties would not be expected to substantially threaten resident populations or be greater than losses due to natural processes or events. Impacts to special-status wildlife would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them.

3.4.5.2 Tunnel Alignment Alternative

The following describes the biological resources effects associated with construction and operation of an alternative tunnel alignment. The canal components and treatment wetland(s) would be the same as described in Section 3.4.5.1, Proposed Project, or Section 3.4.5.3, Canal Configuration Alternative, depending on the option selected to accompany the Tunnel Alignment Alternative. Thus, biological resources effects for the canal portion (including special-status plant and animal species, sensitive vegetation communities, aquatic habitat, trees, wetlands, other waters, and riparian habitat), would be as described in those sections.

CEQA Analysis

Construction Impacts

Under the Tunnel Alignment Alternative, the tunnel would be located within an area between the existing tunnel and a line approximately 50 feet to the south. The same staging area and construction methods as the proposed Project would be used for the Tunnel Alignment Alternative. The methods and duration to construct this alternative would not change substantially compared to the proposed Project, and similar impacts on biological resources (including special-status plant and animal species, sensitive vegetation communities, wetlands, and other waters) are expected. New facilities under this alternative include an up to 12-foot diameter, 3,200-foot sub-surface tunnel and a rehabilitated Ocean Outlet structure at the same location as, or to the south of, the existing outlet. As under the Project, there are no impacts to jurisdictional features from the tunnel component itself. Impacts to jurisdictional waters associated with rehabilitating the existing Ocean Outlet would not exceed those described under the Project as the location of this work would occur within the same or similar footprint (potentially located up to 50 feet to the south of the existing location), and methods such as beach access and isolation of the work area with a cofferdam would be similar to the proposed Project. The same concrete pump staging area and methods to pump concrete from the top of the bluffs above the Ocean Outlet to the structure would be used under the Tunnel Alignment Alternative as the proposed Project. As the new tunnel would follow a new alignment under this alternative, excavation methods could include either a digger shaft or a micro-tunnel boring machine (MTBM). Methods to remove and stockpile excavated materials and line the tunnel would be consistent with those described under the Project. The new tunnel would connect to the existing Canal at a point up to approximately 50 feet south of the existing Lake Merced Portal using the same methods described for the Project, including for construction of the Lake Merced overflow. No new impacts to biological resources are anticipated with the construction of these elements.

Like with the Project, work areas, staging areas, and access roads cleared of non-sensitive upland vegetation could contribute to the spread of invasive plants and introduce new invasive plants to the Project study area through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events. Implementing **Mitigation Measure 3.4-7a**, **Control Measures for Spread of Invasive Plants**, would minimize such opportunities by enacting several best management practices throughout construction. To avoid invasive plant colonization in these cleared upland areas following construction, the Project would implement **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**, to introduce native plants into these temporarily disturbed areas. Together these measures would reduce potential *significant* impacts associated with the colonization or spread of invasive plants to a *less-than-significant* level.

Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding birds season, the use of nighttime lighting, and increased noise and visual disturbance would be reduced to a *less-than-significant* level under the implementation of **Mitigation Measure 3.4-3**, **Nesting Bird Protection Measures**, and **Mitigation Measure 3.4-9**, **Night Lighting Minimization**. Adverse effects on special status bats associated with tree removal and structure modification would be similar to the Project and reduced to a *less-than-significant* level by implementation of **Mitigation Measure 3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**.

Operational Impacts

The Tunnel Alignment Alternative would not change operational impacts on biological resources (including special-status plant and animal species, sensitive vegetation communities, aquatic habitat, wetlands, other waters, riparian habitat, or wildlife nursery sites), associated with Project implementation and therefore, effects would be the same as described in Section 3.4.5.1, Proposed Project.

NEPA Analysis

Construction Impacts

Ruderal upland vegetation, non-native grassland, and non-native trees would be removed from the project footprint along the Vista Grande Canal, as would invasive iceplant located within the disturbed dune scrub vegetation of the Fort Funston staging area. Like with the Project, work areas, staging areas, and access roads cleared of non-sensitive upland vegetation could contribute to the spread of invasive plants and introduce new invasive plants through earth moving, transport of vehicles, equipment and materials, and unanticipated sediment dispersal during rain events. Implementing **Mitigation Measure 3.4-7a**, Control Measures for Spread of Invasive Plants, would minimize such opportunities by enacting several best management practices throughout construction. To avoid invasive plant colonization in these cleared upland areas following construction, the Project would implement **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**, to introduce native plants through hydroseed, broadcast seed, or propagules into these temporarily disturbed areas which would result in an overall beneficial effect through enhancement of native vegetation communities within the watershed.

Impacts to common aquatic and terrestrial wildlife and special-status wildlife would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. No loss of special-status animal species individuals would be expected to occur and avoidance of and compensation for the loss of special-status plant species would occur under Mitigation Measures 3.4-1 and 3.4-5, as discussed above. Impacts on special-status and migratory birds and special-status bats associated with construction of the Tunnel Alignment Alternative would be minor and short-term. Implementation of **Mitigation Measures 3.4-3**, **Nesting Bird Protection Measures**; **3.4-9**, **Night Lighting Minimization**; and **3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**, would minimize these impacts. Construction impacts on special-status animal species, western pond turtle, as well as common terrestrial and common wildlife inhabiting the Tunnel Alignment Alternative construction areas would be minor and short-term. Through implementation of **Mitigation Measure 3.4-2a**, **Worker Environmental Awareness Program Training**, Project workers would be educated about sensitive animal species and common wildlife found within the Project study area, avoidance measures and procedures to ensure project impacts on wildlife are minimized, and the regulatory requirements and penalties for noncompliance. Specific protocols and protection measures for Project work within NPS-managed lands that would be incorporated into the WEAP training would further protect resident wildlife. Implementing **Mitigation Measure 3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would reduce potential impacts on this species by physically excluding species from work areas on the lakeside bank and within the lake waters with fencing and a cofferdam, conducting preconstruction surveys, and requiring additional measures such as species relocation during construction.

Operational Impacts

The Tunnel Alignment Alternative would not change operational impacts on special-status plant and animal species, sensitive vegetation communities, aquatic habitat, wetlands, other waters, riparian habitat, or wildlife nursery sites associated with Project implementation; therefore, effects would be the same as described in Section 3.4.5.1, Proposed Project.

3.4.5.3 Canal Configuration Alternative

The following describes the biological resources effects associated with the construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.4.5.1, Proposed Project, or Section 3.4.5.2, Tunnel Alignment Alternative, depending on the option selected to accompany the Canal Configuration Alternative. Thus, biological resources effects for the tunnel portion (including special-status plant and animal species, sensitive vegetation communities, other waters, or wildlife, and special-status species) would be as described in those sections.

CEQA Analysis

Construction Impacts

The Canal Configuration Alternative would entail less construction in and modifications to the Canal portion than under the proposed Project. The methods and duration to construct the Canal Configuration Alternative would not change substantially compared to the proposed Project, and similar impacts on biological resources (including special-status plant and animal species, sensitive vegetation communities, aquatic habitat, wetlands, other waters, riparian habitat, and wildlife nursery sites) are expected. Under the Canal Configuration Alternative, new facilities associated with the diversion structure, John Muir Drive crossing, and Lake Merced Outlet would be the same design as described for the Project, though these facilities would be located within the first 350 feet of the Canal and at the south end of Impound Lake. Furthermore, the box culvert replacing the upstream portion of the Canal under the proposed Project would not be constructed. A single wetland cell (1.7 acres) would be created along John Muir Drive that would have a reduced size and water treatment capacity compared to the two wetlands cells of the Proposed Project. This smaller treatment wetland would also offer 0.4 acre less habitat to wildlife than the treatment wetlands proposed under the Project and described in Section 3.4.5.1.

Impacts to potentially jurisdictional wetlands, waters, and riparian habitat associated with constructing the new facilities at Lake Merced would be less than those described under the Project due to the reduced modifications to the Canal (350 feet compared to 1,350 feet for the proposed Project), which would result in reduced permanent impacts to potentially jurisdictional other waters. Implementation of **Mitigation Measures 3.4-8a**, **Wetland Avoidance and Protection**, and **3.4-8b**, **Compensation for Impacts to Wetlands and Riparian Habitat**, would minimize or compensate for impacts to wetlands, other waters, and riparian habitat within the construction footprint resulting in a *less-than-significant* impact.

Like the Project, construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could adversely affect western pond turtle and common fish species. Implementation of **Mitigation Measures 3.4-2a**, **Worker Environmental Awareness Program Training**, and **3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would reduce these impacts on both fish and western pond turtle to a *less-than-significant* level by educating workers about species within the work area, physically excluding species from work areas on the lakeside bank and within the lake waters with fencing and a cofferdam, conducting preconstruction surveys, and requiring additional measures such as species relocation during construction.

Like with the Project, adverse effects on special-status and migratory birds associated with construction during the breeding bird season, the use of nighttime lighting, and increased noise and visual disturbance would be reduced to a *less-than-significant* level with the implementation of **Mitigation Measures 3.4-3**, **Nesting Bird Protection Measures**, and **3.4-9**, **Night Lighting**

Minimization. Adverse effects on special-status bats associated with tree removal and structure modification would be similar to the Project and reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**.

Like with the Project, potential impacts to special-status plants and the sensitive natural community central dune scrub would be minimized and reduced to a *less-than-significant* level by implementation of **Mitigation Measures 3.4-1**, **Avoidance, Minimization, and Compensation for Impacts to Special-Status Plants**, and **3.4-5**, **Avoidance, Minimization, and Compensation for Impacts to Central Dune Scrub**. Trees within or adjacent to the Canal Configuration Alternative work areas to be retained under the project would be protected during construction and trees removed from the project footprint would be compensated for with the implementation of **Mitigation Measure 3.4-6**, **Implement Tree Protection Measures and Plant Replacement Trees**. Implementation of **Mitigation Measure 3.4-7a**, **Control Measures for Spread of Invasive Plants**, would prevent the colonization or spread of invasive plants into areas cleared of non-sensitive upland vegetation in support of project construction, and temporarily disturbed upland areas would be seeded with native species following construction completion under **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**, resulting in a *less-than-significant* impact.

Operational Impacts

Operation of the Canal Configuration Alternative would result in similar impacts on biological resources (including vegetation, wetlands, other waters, riparian habitat, wildlife and fisheries, and special-status species) as the proposed Project. Open water habitat in Lake Merced gained from increasing lake levels would be the same as under the Project as described in Section 3.4.5.1. As indicated in Section 3.9.5.3, water quality impacts in Lake Merced would be similar; therefore, this alternative would have similar less-than-significant impacts on fish and other aquatic species. Other operational impacts on Lake Merced's biological resources, including shoreline nesting birds, western pond turtle, fisheries, sensitive vegetation communities, wetlands, and rookeries resulting from the Canal Configuration Alternative would be the same as those described for the proposed Project.

NEPA Analysis

Construction Impacts

Moderate temporary (short-term) and permanent (long-term) impacts to potentially jurisdictional federally and state-protected wetlands, other waters, and riparian habitat would occur as a result of construction of the Lake Merced outlet structure in Impound Lake and potentially from the installation of the new facilities at the Canal. Effects would be readily apparent over areas with permanent facilities, though these impacts would not expand over time. Temporary impact areas would be restored to pre-project conditions (typically including contours, topsoil, and vegetation) as described in **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**, to prevent the colonization of invasive vegetation. The spread of such species into areas disturbed under the project would be minimized during construction through implementation of **Mitigation Measure 3.4-7a**, **Control Measures for Spread of Invasive Plants**. Permanent impacts to potentially jurisdictional other waters would include 350 linear feet of replacement associated with modifications to the Canal. Permanent impacts to jurisdictional wetlands, other waters, and riparian habitat would be avoided, minimized, and mitigated through the implementation of **Mitigation Measures 3.4-8a**, **Wetland Avoidance and Protection**, and **3.4-8b**, **Compensation for Impacts to Wetlands and Riparian Habitat**.

Impacts to special-status species would be detectable, but they would not be expected to be outside the natural range of variability of species' populations, their habitats, or the natural processes sustaining them. No loss of special-status animal species individuals would be expected to occur. Special-status plant impacts are discussed in detail, below. Impacts on special-status and migratory birds and special-status bats associated with construction of the Canal Configuration Alternative would be minor and short-term. Implementation of **Mitigation Measures 3.4-3**, **Nesting Bird Protection Measures**; **3.4-9**, **Night Lighting Minimization**; and **3.4-4**, **Avoidance and Minimization Measures for Special-Status Bats**, would minimize these impacts. Minor, short-term construction impacts on the special-status species western pond turtle, common terrestrial wildlife, and common aquatic wildlife of the Lake Merced watershed would occur under implementation of this alternative. Implementing **Mitigation Measures 3.4-2a**, **Worker Environmental Awareness Program Training**, and **3.4-2b**, **Avoidance and Minimization Measures for Western Pond Turtle**, would reduce potential impacts on these species by educating workers about the variety of wildlife species within the work area, physically excluding species from work areas on the lakeside bank and within the lake waters with fencing and a cofferdam, conducting preconstruction surveys, and requiring additional measures such as species relocation during site construction.

The Canal Configuration Alternative would result in minor and short-term impacts on vegetation communities within the construction footprint. Effects would be localized within the footprints of work areas and the overall viability of plant communities within and surrounding the construction sites, including sensitive natural communities and special-status plants, would not be affected due to avoidance and minimization measures described in this discussion. Potential impacts to special-status plants and central dune scrub in the Canal Configuration Alternative construction area would be minimized by the implementation of **Mitigation Measures 3.4-1**, **Avoidance, Minimization, and Compensation for Impacts to Special-Status Plants**, and **3.4-5**, **Avoidance, Minimization, and Compensation for Impacts to Central Dune Scrub**. Construction of the Canal Configuration Alternative would remove trees and upland non-native grassland and ruderal weedy plants along the Canal and within the footprint of the treatment wetland cell. Impacts to trees adjacent to this construction work area or trees to be retained would be avoided or minimized during construction through protection measures described in **Mitigation Measure 3.4-6**, **Implement Tree Protection Measures and Plant Replacement Tre**es. Any trees removed along the Canal in support of the Canal Configuration Alternative would be replaced according to this mitigation measure as well. Implementation of **Mitigation Measure 3.4-7a**, **Control Measures for Spread of Invasive Plants**, would prevent the colonization or spread of invasive plants into areas cleared of non-sensitive upland vegetation in support of project construction, and temporarily disturbed upland areas would be seeded with native species following construction completion under **Mitigation Measure 3.4-7b**, **Post-Construction Treatment of Upland Areas**. Temporarily disturbed upland work areas restored with native vegetation through hydroseed or broadcast seeding of native seed mix, or propagules would be an overall beneficial impact on surrounding vegetation communities.

Operational Impacts

The Canal Configuration Alternative would result in similar operational impacts on shoreline nesting birds, western pond turtles, sensitive vegetation communities, jurisdictional wetlands, other waters, riparian habitat, and wildlife nursery sites as described in Section 3.4.5.1, Proposed Project. These impacts would be avoided or minimized through implementation of **Mitigation Measure 3.4-10a, Lake Level Management**, which would maintain lake levels at 9 feet City Datum, and thereby prevent major Project-related losses and avoid a drastic alteration of the size or integrity of sensitive natural communities and nesting habitat of the Lake Merced shoreline; or implementation of **Mitigation Measure 3.4-10b**, **Compensation for Loss of Sensitive Communities at Lake Merced**, which would mitigate for the permanent loss of sensitive natural communities through inundation if target WSE is maintained above 9 feet City Datum by restoring wax myrtle scrub, Vancouver rye grassland, and blue gum eucalyptus forest (with native trees) around Lake Merced above the maximum lake level that could be inundated.

The creation of the single treatment wetland along the Vista Grande Canal would contribute to the long-term improvement of the water quality within the Lake Merced watershed, though would not serve as wetland mitigation for the impacts on wetlands caused by the Canal Configuration Alternative (pursuant to the RWQCB's Policy on the Use of Constructed Wetlands for Urban Runoff, Resolution No. 94-102). The treatment capacity of the 1.7-acre wetland cell would be less than the two cells described under the proposed Project and offer less habitat for local wildlife due to the smaller size; however, the increase in open waters of Lake Merced resulting from implementation of this alternative would be similar to the proposed Project.

3.4.5.4 No Project/No Action Alternative

Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Basin would not be implemented. This stormwater from the watershed area would continue to be diverted into the existing Canal to its terminus in the Pacific Ocean. In addition, Daly City would continue to use the existing Ocean Outlet structure at Fort Funston.

With the No Project Alternative there would be no change to jurisdictional wetlands, other waters, riparian habitat, sensitive natural communities, wildlife nursery sites, or special-status plants and animals in the study area. However, the beneficial effects of implementation of the Project or Alternatives on the biological resources of the watershed, resulting from increases to open water habitat under the Project or Alternatives, also would not occur. The open water habitat of the Canal would be retained under the No Project Alternative, but this habitat is of marginal quality compared with the 22 to 48 acres of open water habitat that would be gained with an increase in lake levels within the target range WSE under the Project or an alternative (beneficial to foraging birds). The increased availability (i.e., volume) of mid-depth temperature conditions preferred by trout and bass would not occur under the No Action Alternative. The improved habitat conditions for local wildlife with the conversion of non-native grassland and ruderal habitat which currently occurs between John Muir Drive and the Canal into a wetland also would not be gained.

3.4.6 Cumulative Effects

3.4.6.1 Geographic Extent/Context

The geographic scope of potential cumulative impacts on biological resources encompasses the species occurrences, habitats, and sensitive natural communities within the Project area, as well as biologically linked areas sharing the Lake Merced area, the Fort Funston area of GGNRA, and the beach and Pacific Ocean below. The cumulative analysis utilizes a list-based approach to analyze the effects of Project construction and operations in combination with other past, present, and probably future projects in the immediate vicinity.

The cumulative impact analysis assumes that construction and operations of other projects in the geographical area would have to comply with the same regulatory requirements as the Project, which would serve to avoid and reduce many impacts to *less-than-significant* levels on a project-by-project basis. The analysis then considers whether or not there would be a significant, adverse cumulative impact associated with Project implementation in combination with past, present, and probable future projects in the geographical area, and if so, whether or not the Project's incremental contribution to the cumulative impact would be considerable. Both conditions must apply in order for a project’s cumulative effects to rise to the level of significance.

3.4.6.2 Past, Present, and Reasonably Foreseeable Projects

The following current and reasonably foreseeable projects may result in impacts to biological resources and are included in the analysis of the Project’s cumulative impacts. Table 3.1-1 provides a summary description of each project and project status and schedule. Figure 3.1-1 depicts the locations of these projects.

- Lake Merced Boathouse Renovations (SFPUC and SFRPD) – construction-related short-term impacts to biological resources
- San Francisco Westside Recycled Water Project (SFPUC) – construction-related short-term impacts to sensitive habitats and species
- Regional Groundwater Storage and Recovery Project (SFPUC) – construction-related short-term impacts to sensitive habitats and species and operational long-term impacts to biological resources
- Groundwater Supply Project (SFPUC) – construction-related short-term impacts to sensitive habitats and species and operational long-term impacts to biological resources
- Ocean Beach Master Plan (SPUR) – construction-related short-term and long-term impacts to sensitive habitats and species

- GGNRA/Muir Woods National Monument General Management Plan and Fort Funston Site Improvements (NPS) – construction-related short-term impacts and long term impacts to sensitive habitats and species
- Significant Natural Resource Areas Management Plan (SFRPD) – construction-related short-term impacts to sensitive habitats and species
- Lake Merced Pump Station Essential Upgrade (SFPUC) – construction-related short-term impacts to sensitive habitats and species
- Parkmerced (private developer) – construction-related short term impacts to sensitive habitats and species and long term impacts to biological resources
- San Francisco State University Campus Master Plan 2007 – 2020 (SFSU) – construction-related short-term impacts to sensitive habitats and species
- Pacific Rod and Gun Club Upland Soil Remedial Action Project – construction-related short-term impacts to sensitive habitat and species

Past cumulative projects, including the development of civic facilities, residences, commercial and industrial areas, and infrastructure, have already caused substantial adverse cumulative changes to biological resources in the San Francisco peninsula. For example, portions of the Project area were converted from its original sand dune habitat beginning over a century ago, with near complete loss of the original habitat types and any of the species that once occurred. Revegetated areas have matured over time and provide a “new normal” in terms of habitat, often simplified in terms of diversity, and supporting a different suite of species than once existed. Overall, this is true of many areas throughout the region. The effects of these past projects are reflected in the baseline conditions described in Section 3.4.1, Affected Environment.

Of the projects listed above, the Lake Merced Boathouse Renovations, the SF Westside Recycled Water Project, the SFPUC Regional Groundwater Storage and Recovery Project, the SF Groundwater Supply Project, the Lake Merced Pump Station Essential Upgrade, the Parkmerced private development, and the Pacific Rod and Gun Club Upland Soil Remedial Action Project have already undergone environmental review and environmental impacts have been avoided or minimized to the extent feasible. Some of these projects are expected to have mostly temporary impacts to biological resources during the construction phase of the project and of these, the Lake Merced Boathouse Renovations and Lake Merced Pump Station Essential Upgrade projects were completed in 2014. Other projects, such as the Ocean Beach Coastal Plan, the GGNRA/Muir Woods National Monument General Management Plan, and the Significant Natural Resource Areas Management Plan, would include elements likely to result in beneficial effects on biological resources.

3.4.6.3 Construction Impacts

Special-Status Species

As described above, Project construction has the potential to adversely affect special-status species, if present, including special-status plants, western pond turtle, migratory and special-status birds, and special-status bats (see Section 3.4.5.1). The removal of trees could affect habitat that provides potential foraging opportunities, cover, and nesting and roosting habitat for birds and bats. There could be direct and indirect impacts on central dune scrub and riparian habitat, wetlands and shoreline habitat, and aquatic habitat. It is assumed that the cumulative projects described above could affect at least some of the same special-status species, which if not mitigated, could result in a potentially *significant* cumulative impact on biological resources. These projects include infill development or renovation of facilities, such as the Fort Funston Site Improvements, the Parkmerced Project, and the SFSU Campus Master Plan. Parkmerced includes measures to locate and avoid populations of San Francisco gumplant and other special-status plants in and around that project area. Construction of the development's stormwater outfall into Lake Merced may disrupt breeding birds, including San Francisco common yellowthroat, in the surrounding riparian vegetation or western pond turtles at the shoreline. Preconstruction surveys, avoidance measures, and biological monitoring are included as mitigation for this project to minimize impacts to these special-status species. The SFSU Campus Master Plan also includes mitigation measures to minimize construction impacts on special-status plants and special-status birds. Other projects with potential cumulative impacts on special-status species also adversely affected under the proposed Project are the construction of new pipelines and facilities for the San Francisco Westside Recycled Water Project and the San Francisco Groundwater Supply Project, and remediation of the Pacific Rod and Gun Club upland and transitional wetland areas on the southwest shore of South Lake Merced. These projects would primarily have temporary construction-related impacts on biological resources and, with implementation of the mitigation measures described above, are not expected to convert or remove more than minor areas of habitat for plants and wildlife.

As discussed in Section 3.4.5.1, the proposed Project's temporary impacts on special-status species would be reduced to a *less-than-significant* level with the implementation of Mitigation Measure 3.4-1, Avoidance, Minimization and Compensation for Impacts to Special-Status Plants; Mitigation Measure 3.4-2a, Worker Environmental Awareness Program Training; Mitigation Measure 3.4-2b, Avoidance and Minimization Measures for Western Pond Turtle; Mitigation Measure 3.4-3, Nesting Bird Protection Measures; and Mitigation Measure 3.4-4, Avoidance and Minimization Measures for Special-Status Bats. These measures address temporary impacts on special-status species by requiring preconstruction surveys, monitoring to ensure that Project activities do not result in direct mortality of any special-status species potentially present, and require compensation in the form of restoration or revegetation for lost special-status species habitat. Therefore, with implementation of mitigation for all projects described above, the Project's impacts in combination with the minor impacts of the cumulative projects would not result in a *significant* cumulative impact and the Project's incremental contribution to this cumulative impact would not be cumulatively considerable.

Sensitive Natural Communities

Establishment of the construction staging area at Fort Funston and improvements to the beach access route along Avalon Canyon access road could result in temporary and potentially permanent impacts to central dune scrub. Impacts to this sensitive natural community could occur as a result of the Fort Funston Site Improvements. However, the Ocean Beach Coastal Plan, the GGNRA/Muir Woods National Monument General Management Plan, and the Significant

Natural Resource Areas Management Plan may result in enhancement of sensitive coastal communities and habitats.

With the restoration of temporary disturbance areas within coastal dune scrub and revegetation and enhancement this habitat type in locations adjacent to potential permanent impact areas through implementation of Mitigation Measure 3.4-5, Avoidance, minimization, and compensation for impacts to central dune scrub, the Project would minimize the loss of central dune scrub. In addition, the impacted central dune scrub is located within a larger area of central dune scrub- the expectation is that this community would reestablish well in restored areas after Project completion. Therefore, with project-level mitigation, the Project's incremental contribution on this sensitive natural community would not be cumulatively considerable.

The geographic scope of potential fisheries resources impacts encompasses the jurisdictional waters and aquatic habitat within Lake Merced. Section 3.4.5, Impact Analysis, evaluates the impacts of the Project on biological resources, including fisheries resources and aquatic habitat. Cumulative impacts on fisheries resources and aquatic habitat could occur when the construction impacts of the proposed Project are considered in combination with the construction impacts of other projects in the vicinity (listed and described in Section 3.4.6.2). The potential exists for cumulative impacts on fisheries resources related to the amount of activity in and adjacent to Lake. For all of the proposed projects with potential for construction-related impacts (such as direct disturbance or water quality impacts) within and adjacent to Lake Merced, compliance with applicable state and federal regulations, identified mitigation measures, and project-specific permitting requirements would mitigate these cumulative construction impacts by protecting water quality, maintaining beneficial uses designated for Lake Merced, and implementing measures to avoid and minimize direct impacts on fish. For the Project, implementation of Mitigation Measure 3.4-2b, which requires fish rescue and relocation be completed on isolated in-water construction areas, and Mitigation Measure 3.9-1, which requires the implementation of standard BMPs to remove sediment from the dewatering discharge direct to receiving waters, as well as preparation of a SWPPP for construction activities (described in Sections 3.9.2 and 3.9.5) would ensure the Project does not result in a cumulatively considerable contribution cumulative impacts on fisheries resources in Lake Merced. With implementation of these measures, the proposed Project would not have a cumulatively considerable impact on fisheries resources or aquatic habitat.

Upland Vegetation Including Trees

Some of the cumulative projects listed above could result in construction-related temporary disturbance to upland vegetation or the removal of trees, such as the Pacific Rod and Gun Club Soil Remediation Project and the San Francisco Groundwater Project. The Pacific Rod and Gun Club Soil Remediation Project would replace non-native trees removed under the project with native trees and restore coastal scrub habitat disturbed during construction. The San Francisco Groundwater Project would require trees removed under the project be replaced according to applicable city municipal code tree policies to where trees were removed.

Temporary disturbance to construction areas, staging areas, access routes, and other areas during construction would result in minor impacts to ruderal and non-native/invasive upland vegetation that occurs in the Project area including trees that occur along the Vista Grande Canal. Colonization of disturbed areas by invasive plant species would be minimized through implementation of Mitigation Measure 3.4-7a, Control Measures for Spread of Invasive Plants. Temporary construction areas shall be restored upon Project completion with native coastal grassland or coastal scrub species as appropriate under Mitigation Measure 3.4-7b, Post-Construction Treatment of Upland Areas. Monterey pine and Monterey cypress trees located in the construction area or footprint of the new Canal facilities or the treatment wetlands are under the jurisdiction of the SFPRD. These non-native trees would be replaced by native trees following construction through implementation Mitigation Measure 3.4-6, Implement Tree Protection Measures and Plant Replacement Trees. Trees adjacent to the construction work areas or trees to be retained under the Project would also be protected from construction activities under this mitigation measure. Given the abundance of similar habitat within the Project study area, short-term nature of disturbance to upland vegetation within the Project area, and project-level mitigation for onsite restoration with native species, the Project's incremental contribution to cumulative impacts on upland vegetation including trees would not be cumulatively considerable.

Wetlands and Waters

Some of the cumulative projects listed above could result in a temporary impacts on, or permanent loss of potentially jurisdictional features. The SFSU Campus Master Plan would cause temporary and permanent impacts to wetlands and riparian vegetation around Lake Merced associated with construction of the bridge underpass, creek inlet, and path connection, and the discharge of storm water; however, mitigation measures require these project components to be sited to minimize permanent impacts wherever possible and restore temporarily impacted areas. Similarly the Parkmerced development would cause temporary and permanent impacts to riparian vegetation and shoreline wetlands with construction of the project's stormwater outfall into Lake Merced.

Construction-related Project impacts to potentially jurisdictional wetlands, waters, and riparian habitat would be small in scale and mostly temporary. Temporary impacts would be mitigated by minimizing the impact footprint (Mitigation Measure 3.4-8a, Wetland Avoidance and Protection), protecting adjacent wetlands and water resources through implementation of the SWPPP, and on-site restoration at the conclusion of the construction period (Mitigation Measure 3.4-8b, Compensation for Impacts to Wetlands and Riparian Habitat). Permanent impacts to potentially jurisdictional wetlands, waters, and riparian habitat would occur at the site of the outlet structure in Impound Lake, which would be small in scale, and within the Canal where new facilities are proposed. The Project, along with other local and regional projects, would obtain all required permits from the Corps, RWQCB, CCC, and CDFW and would comply with all measures and requirements of the regulatory agencies.

Therefore, due to the small scale and short duration of Project-related temporary impacts, and the small permanent footprint along with on- or off-site compensation for those permanent impacts, the incremental contribution of the Project's contribution to cumulative impacts on jurisdictional wetlands and waters is not cumulatively considerable.

Resident and Migratory Wildlife

Construction activities requiring night lighting at the Fort Funston staging area and on the beach associated with the Ocean Outlet could adversely impact birds and bats moving along the Pacific Flyway with the temporary introduction of night lighting into an otherwise dark environment. Most of the projects listed above do not require night work or night lighting or require minimal night work and lighting (e.g., Regional Ground water Storage and Recovery Project during 9 days of drilling and pump testing) which would not substantially contribute to overall nighttime illumination and light pollution of the night sky along the Pacific Flyway. Night lighting associated with the proposed Project could occur during evening and/or nighttime construction proposed at the Fort Funston staging area during the tunnel construction period, as well as during necessary periods of 24-hour construction on the Ocean Outlet as discussed in Impact BIO-10. Adverse impacts on birds and bats nesting or roosting in suitable habitat near the lighted areas or flying along the coast during these periods of 24-hour construction would be minimized by measures included in Mitigation Measure 3.4-9, Night Lighting Minimization. Therefore, with project-level mitigation, the Project's incremental contribution to night sky illumination during construction would not be cumulatively considerable (*less than significant*).

3.4.6.4 Operational Impacts

Lake Merced Water Levels

Not all the projects listed above would affect Lake Merced lake levels and the biological resources supported by the lake and its surrounding habitat. Of these projects, the Regional Groundwater Storage and Recovery Project and the San Francisco Groundwater Supply Project would affect lake levels and are considered in this Lake Merced operational cumulative analysis. Both of these projects have undergone environmental review and technical analysis (Kennedy/Jenks, 2014) to assess lake levels under a model scenario that includes the hydrologic effects of the Regional Groundwater Storage and Recovery Project and Groundwater Supply Project in addition to the proposed Project to evaluate the cumulative effects of these three projects on lake levels. This technical assessment and modeling is discussed in greater detail under Impact HYD-8 in Section 3.9, Hydrology and Water Quality.

The Regional Groundwater Storage and Recovery Project is an aquifer storage and recovery project that would affect Lake Merced water levels through groundwater pumping and non-pumping periods. During periods of excess surface water supply, pumping by SFPUC, Daly City, South San Francisco, and San Bruno are reduced. During periods of drought, the pumping is increased when all four entities pump their wells. The Groundwater Supply Project would affect lake water levels most directly through groundwater pumping at six wells in western San Francisco by SFPUC including one well near Lake Merced. These wells are assumed to operate during every year.

The results of the Lake Merced Lake Level Model (Model) analysis for the Cumulative Scenario demonstrate the cumulative effects on lake levels of adding consistent pumping in western San Francisco and the in-lieu recharge and pumping of the Regional Groundwater Storage and Recovery Project operations in Daly City area. The cumulative effect of the combined projects is generally lower lake levels than observed for the proposed Project alone, but generally higher than the No Project Scenario (see Figure 3.9-14). During the first 35 years of the Cumulative Scenario, the lake levels range between 9.5 and 6.5 feet City Datum. During extended drought periods lake levels have declined to near 1.5 feet City Datum but have then recovered back to 9.5 feet. During the multi-year drought on record, the cumulative scenario lake levels closely approximate the No Project Scenario lake levels (see Figure 3.9-14). Just prior to and following the drought, lake levels for the No Project Scenario are higher than the Cumulative Scenario because of the difference in overflow elevations between the scenarios (see Table 3.9-10).

The Model analysis shows that the addition of the Regional Groundwater Storage and Recovery Project and Groundwater Supply Project (Cumulative Scenario) result in lower lake levels than the Project Scenario (see Figure 3.9-21). The comparison between the Project Scenario (described under Impact HYD-8 in Section 3.9, Hydrology and Water Quality, and summarized in Figure 3.9-14) and the Cumulative Scenario shows that lake levels for the Project Scenario and the Cumulative Scenario are generally higher than the No Project Scenario lake levels, the only exception being during very wet periods when lake levels in the No Project Scenario rise above the Project Scenario and Cumulative Scenario overflow elevation of 9.5 feet City Datum. The simulated lake levels for the Project Scenario range within a narrow band that would regularly include flow over the overflow so that the lake levels are generally several feet higher than the No Project Scenario. In the Cumulative Scenario, the lake levels are sustained through the shorter drought periods as a result of the proposed Project diversions, but drop to 1.5 feet City Datum during an extended drought period. However, the lake levels are nearly the same as the No Project Scenario during this period. Therefore, additions to Lake Merced as part of the proposed Project would result in an increase in mean lake levels relative to the modeled existing conditions and under the Cumulative Scenario.

As discussed in the San Francisco Groundwater Supply Project Final EIR (SFPD, 2013b), cumulative impacts on Lake Merced water levels as a result of the Groundwater Supply Project could be *significant* because water level declines could occur as compared to the Project Scenario. Impacts associated with water level declines include exposure and loss of shoreline bird nests, loss or degradation water quality and aquatic fisheries habitat, and loss of wetlands. The proposed Project would not contribute to such water level declines, and would beneficially offset water level declines potentially occurring as a result of the Groundwater Supply Project. As with the proposed Project, the Groundwater Supply Project incorporated a Lake Level Management program (Mitigation Measure M-HY-9, Lake-Level Management) for Lake Merced to reduce potential impacts on lake water quality and biological resources to a *less than significant* level (SFPD, 2013b). Mitigation Measure M-HY-9, Lake Level Management requires the SFPUC to implement lake level management procedures to maintain Lake Merced at water levels similar to 2012 conditions that would likely occur without the project. Similar to the proposed Project, the Regional Groundwater Storage and Recovery Project included a Mitigation Measure M-BR-7, Lake Level Management for Water Level Increases for Lake Merced that would implement procedures to maintain water levels to avoid significant impacts to biological resources.

Special-Status Species

Under the Cumulative Scenario, effects of water level decreases in Lake Merced on shoreline nesting birds associated with the Regional Groundwater Storage and Recovery Project and Groundwater Supply Project would be offset by maintained lake levels within the target range WSE as required under the Groundwater Supply Project's M-HY-9. The methods for groundwater withdrawal under the Regional Groundwater Storage and Recovery Project and Groundwater Supply Project would be gradual and not result in rapid decreases or increases in lake levels which could adversely affect local shoreline wildlife at Lake Merced. Like with the Project, shoreline nesting birds and western pond turtles are most vulnerable to rising lake levels during the filling period, and particularly if a major storm event were to occur during the filling period and a large volume of stormwater was diverted into Lake Merced over a short period of time. Therefore the loss of shoreline nests or in very extreme storm events, the loss of western pond turtle nests, under this scenario remains a possibility. However, once the lake has reached the target WSE, the cumulative effect of water level increases are still anticipated to be below the 0.5 feet over a 2.5-week period impact thresholds for shoreline nesting birds and the 3 feet in a given nesting season for western pond turtle. Like with the Project, loss of shoreline nesting birds during the filling period under cumulative conditions could occur but would be considered short-term and temporary and not cumulatively considerable; this impact is *less than significant.*

Sensitive Natural Communities

Sensitive Vegetation Communities

As discussed in Section 3.4.5.1, the sensitive vegetation communities of central dune scrub, thimbleberry scrub, wax myrtle scrub, canyon live oak scrub, and Vancouver rye grassland occur at Lake Merced and portions of these communities would be compromised by inundation or saturation with the increased lake levels maintained within to the target WSE range of 7.5 to 9.5 feet City Datum under the Project. Decreases in lake levels associated with the Regional Groundwater Storage and Recovery Project and the Groundwater Supply Project would not affect these sensitive vegetation communities; however, lake level increases under the Cumulative Scenario are expected to occur as they would under the proposed Project. Lake levels under the Cumulative Scenario are predicted to range between 6 and 9.5 feet City Datum for 84 percent of 50-year model period and between 1.5 and 6 feet City Datum for the remaining 16 percent of the model period which represents a period of extreme drought.

As with the Project, Thimbleberry scrub would not be inundated by rising WSE under any of the modeled conditions (proposed Project, Cumulative, or No Project scenarios) as it occurs entirely above 13 feet City Datum which is the maximum height for the overflow weir in South Lake. For central dune scrub and canyon live oak scrub, a significant loss of greater than 10 percent would not occur for water surface elevations up to 13 feet City Datum, as predicted by the GIS-based vegetation change analysis conducted in support of this EIR/EIS. Wax myrtle scrub would be unaffected by increased lake levels up to 9 feet City Datum but would incur a 12.50 percent loss

(0.01 acre) between 9 and 10 feet City Datum WSE, which would be considered *significant*. Vancouver rye grassland would incur losses below 10 percent with an increase in lake levels up through 9 feet but would experience *significant* impacts at 10 feet where there would be a 46.15 percent loss (0.005 acre).

While lake levels above 9 feet City Datum are predicted under the Cumulative Scenario, the Regional Groundwater Storage and Recovery Project's mitigation measure M-BR-7, Lake Level Management for Water Level Increases for Lake Merced, and the proposed Project's Mitigation Measure 3.4-10a, Lake Level Management, recommend restricting WSE at or below 9 feet City Datum to avoid or minimize significant impacts to these communities where they occur above 9 feet City Datum. If WSEs are maintained at or below 9 feet City Datum, this would avoid significant impacts on these sensitive vegetation communities. Alternatively, should 9.5 feet City Datum be selected as the maximum elevation and lake levels persist above 9 feet during normal target operations or during storm events for more than 14 days for wax myrtle scrub and Vancouver rye grassland, Mitigation Measure 3.4-10b, Compensation for Loss of Sensitive Communities at Lake Merced, would be required. This measure would require an updated mapping exercise and comparison analysis of vegetation polygons for wax myrtle scrub and Vancouver rye grassland be performed post-inundation to confirm percent loss of these sensitive natural communities with lake levels sustained above 9 feet City Datum. If permanent loss attributable to inundation or saturation with a sustained WSE above 9 feet City Datum is determined for these sensitive natural communities in excess of 10 percent, which would be *significant*, a revegetation and restoration plan would be developed for quantities lost that would restore inundated sensitive vegetation communities, habitat types, and special-status plants onsite at elevations above maximum possible lake levels. With implementation of these mitigation measures, the incremental impact on sensitive natural communities from Project operation would not be cumulatively considerable and *less than significant.*

Fisheries and Aquatic Habitat

Operational impacts relating to hydrology and water quality in Lake Merced from implementing the Project are described in detail in Section 3.9. As described in Section 3.9.5.1, the overall effect of the Project, with the diversion protocols and treatment wetland proposed as part of the Project to ensure the protection of water quality in Lake Merced, would be an improvement in water quality that would be progressive with increases in depth. Operation of the in-lake management actions proposed as part of the Project would likely further improve water quality within Lake Merced through the removal of algae and the flushing of the Lake to reduce the elevated background pH. The impact discussion in Section 3.4.5 evaluates the operational impacts of the Project on biological resources, including fisheries resources and aquatic habitat, in a manner that incorporates the water quality analysis presented in Section 3.9.5.1 specifically assessed against the habitat requirements of identified fisheries species and associated aquatic habitat. As described in detail in Section 3.4.5, Project impacts on fisheries resources and aquatic habitat of Lake Merced would be *less than significant* and the Project would likely be beneficial as a result of the increased volume of aquatic habitat available to Lake Merced fish species and the maintenance or improvement of water quality. If in-lake water quality management and treatment measures in the LMP are implemented, further improvement would occur. Further, as described in Section 3.9.6.4, Operation and Maintenance, the diversion of flows to Lake Merced as part of the proposed Project would result in an increase in mean lake levels relative to the modeled Cumulative Scenario, which considered the influence of the Regional Groundwater Storage and Recovery Project and the Groundwater Supply Project on Lake Merced WSE. Therefore, Project operation would not contribute to long-term cumulative impacts on fisheries resources and associated habitats. Therefore, no cumulative impacts on fisheries resources would be associated with operation of the Project when considered in combination with past, present, and foreseeable future projects.

Wetlands and Waters

As discussed in Section 3.4.5.1, the Project operations would result in no net loss to potentially jurisdictional wetlands and other waters. Distribution and composition of wetland types at Lake Merced would respond to increased water surface elevations, as shown in Table 3.4-5. Herbaceous wetland acreage would increase under any of the Project WSEs between 7 and 10 feet City Datum (12.4 to 78.6 percent gain) and the combination of herbaceous and riparian wetlands would increase in acreage with lake levels above 8 feet City Datum. Additionally, the Project would result in an increase in 22 to 48 acres of open water surface area at Lake Merced with maintained water surface elevations between 7.5 and 9.5 City Datum. Thus, Project operations alone would result in no net loss of potentially jurisdictional wetlands or other waters.

Under the modeled Cumulative Scenario, the WSE of Lake Merced is predicted to fluctuate between 1.5 and 9.5 feet City Datum over the 50-year model period (Kennedy/Jenks, 2014). This is generally higher than the modeled No Project Scenario where WSEs would fluctuate between extremes of just below 0 feet City Datum and 11 feet City Datum, with a majority of the model period predicting lake levels between 1.5 and 6 feet City Datum.

The WSE under cumulative conditions is predicted to be between 6 and 9.5 feet City Datum for about 84 percent of the model period which is representative of normal climatic variations; lake levels at which the extent of wetlands is predicted increase such that there would be minor or no net loss of wetlands. As discussed under the Project analysis, a change in lake levels between 6 and 7 feet City Datum would result in a minor loss of total wetlands (-4.5 percent) which include both herbaceous and riparian wetlands along the Lake Merced shoreline. While herbaceous wetlands would expand by 7 percent under this change, there would be significant losses of riparian vegetation (-26.1 percent). Operating lake levels between 7 and 10 feet City Datum, however, would result in a combined gain of 4.3 to 9.8 percent in total wetlands. The remaining 16 percent of the model period reflects a multi-year drought where the WSE of Lake Merced is predicted to be between 1.5 and 6 feet City Datum and last for approximately 8 years. This duration would provide ample time to induce a loss of wetlands associated with receding waters and their conversion to other habitat types.

The GIS-based vegetation change analysis prepared for the Groundwater Storage and Recovery Project and Groundwater Supply Project predicts losses, when compared to existing conditions, of up to 37 percent of wetland area (about 16 acres) at a lake surface elevation of 1 foot City Datum (SFPD, 2013a, 2013b). Therefore, wetland loss is also expected under cumulative conditions, but the losses would be less than those under modeled existing conditions, due to the longer periods of stabilized water surface elevations between 6 and 9.5 feet City Datum which is commensurate with minor wetland loss or no net loss conditions. With implementation of the cumulative projects, WSEs would promote wetland loss for about 16 percent of the model period, and would promote wetland increases for about 84 percent of the model period. Therefore, over the model period, it is not expected that there would be a permanent cumulative loss of potentially jurisdictional wetlands, and therefore the potential cumulative impact relative to loss of wetlands would be *less than significant.*

Wildlife Nursery Sites

The GIS-based vegetation change analysis was also used in determining effects of rising lake levels on eucalyptus forest, as this community hosts double-crested cormorant and great blue heron rookeries around Lake Merced. Under the Cumulative Scenario, lake levels are predicted to fluctuate between 6 and 9.5 City Datum for approximately 84 percent of the model period, and operate between 6 and 1.5 feet City Datum during 16 percent of the model period which represents extended drought conditions. Receding waters under the Cumulative Scenario would not compromise this vegetation community or jeopardize the associated wildlife nursery site. Table 3.4-8 predicts significant losses to eucalyptus forest above 10 percent begin with an increase in lake levels to 8 feet City Datum which would occur under the Cumulative Scenario. As discussed in Section 3.4.5.1, since the vegetation mapping relies on aerial photograph interpretation of the canopy and individual eucalyptus stems were not mapped, the potential losses at this elevation are likely overestimated. Currently, there are healthy eucalyptus trees at the high water line. Most trees are located at higher elevations than that, and on steeper slopes the trunks may be located well above the 8-foot contour. Therefore, it is conservatively assumed that a substantial loss of eucalyptus forest would occur if a WSE of 9 feet City Datum were to be exceeded and persist for more than one month, causing tree die-off and eventual loss of rookery habitat at Lake Merced.

The Regional Groundwater Storage and Recovery Project's mitigation measure M-BR-7, Lake Level Management for Water Level Increases for Lake Merced, and the proposed Project's Mitigation Measure 3.4-10a, Lake Level Management, recommend restricting operating WSEs at or below 9 feet City Datum to avoid this potentially *significant* impact on wildlife nursery sites. However, even with the potential loss of 10 percent of Lake Merced's eucalyptus forest, if lake levels were to exceed 9 feet City Datum and persist long enough to lose trees at this contour around the lake, this habitat type is abundant within the watershed. Trees upslope of rookery trees vulnerable to inundation under the Project (i.e., between 9 and 9.5 feet City Datum) would be readily inhabited if adjacent inundated trees would eventually die and fall into the lake.

Alternatively, should 9.5 feet City Datum be selected as the maximum elevation and lake levels persist above 9 feet during normal target operations for more than one month, implementation of Mitigation Measure 3.4-10b, Compensation for Loss of Sensitive Communities at Lake Merced, would require an updated mapping exercise and vegetation polygon comparison analysis for eucalyptus forest be performed post-inundation to confirm permanent impacts to sensitive communities in excess of 10 percent which would be *significant*. Should impacts to this sensitive community at Lake Merced exceed 10 percent, a revegetation and restoration plan would be developed to restore this sensitive natural community at Lake Merced above the maximum inundation limit as compensation for eucalyptus forest lost due to inundation. Restoration plantings for loss of eucalyptus forest would be native species that offer similar structural elements to nesting herons and cormorants as specified in Mitigation Measure 3.4-6, Implement Tree Protection Measures and Plant Replacement Trees. With Project-level mitigation to minimize the loss of eucalyptus forest through restricting operating lake levels at or below 9 feet WSE, or compensating for the permanent loss of eucalyptus forest above 9 feet City Datum if 9.5 feet is selected as the maximum elevation or WSE above 9 feet City Datum is maintained for more than one month, the cumulative impact would be *less than significant*, and the Project's contribution would not be cumulatively considerable.

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3.5 Cultural Resources

This section provides an assessment of potential impacts on cultural resources that might be present in the vicinity of the proposed Project. Mitigation measures to reduce the significance of impacts are identified, where feasible. Impacts associated with groundborne vibration from drilling and pile driving activities during construction is analyzed in detail in Section 3.11, Noise and Vibration, which is cross-referenced in this section with respect to potential impacts on historic structures.

Cultural resources include historic architectural resources, archaeological resources, and human remains. Key definitions are as follows.

Historic architectural resources include buildings, structures, objects, sites, and historic districts. Military-related cultural features include earthen batteries, concrete foundations, rock alignments, water-conveyance features, and other artifact concentrations.

Archaeological resources consist of prehistoric or historic-period archaeological resources. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs). Historic-period materials (not associated with military installations or activities) might include stone, concrete, or adobe footings and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse.

3.5.1 Affected Environment

The following affected environment section has been excerpted from a Cultural Resources Survey Report (CRSR) prepared by ESA in October 2014 (ESA, 2014). The section includes brief contexts for the natural environment and the prehistoric, ethnographic, and historic-period setting in the study area (referred to as the Area of Potential Effects or APE). The APE is the area of direct impact for the Project including areas of ground disturbance, staging areas, access, and work areas, including the Avalon Canyon access road, as well as the area of indirect impact due to construction vibration.

Also included in this section is a summary of the findings of the records search and survey efforts, as well as the findings of the historic resource evaluation efforts, including recommendations of historic significance for properties identified within the APE.

3.5.1.1 Natural Environment

The proposed Project is on the San Francisco Peninsula, which is within the Coast Range Geomorphic Province. The topography of the Coast Ranges is characterized by northwest-southeast-trending mountain ridges and intervening valleys that have formed over millions of years due to movements of the earth's crust. Much of the bedrock underlying the northern Coast Ranges is referred to as the Franciscan Complex—a mixture of ancient seafloor sediments and volcanic rocks that have been altered by heat and pressure deep within the earth. The prominent northwesterly structural and topographic trend of the northern Coast Ranges is not readily evident in the city of San Francisco, except for minor hills and valleys and the orientation of structural blocks of the Franciscan Complex underlying the city. The present local topography is the result of the erosion of Franciscan Complex rocks of varying hardness overlain by scattered areas deposits of relatively recent shallow marine, estuarine and coastal terrestrial deposits including windblown sand that locally overlie cover bedrock exposures. In addition, artificial fill has also contributed to the local topography in portions of the proposed Project area (CDMG, 2000).

Vegetation includes Monterey pine and cypress, eucalyptus, a variety of horticultural shrubs, a coastal dune scrub restoration area, and several mature coast live oaks. To the west of the canal is a golf course with large expanses of turf grass. With the exception of the restoration area the majority of vegetation along the canal is non-native annual grasses and weeds. The restoration area contains a number of native species that were reintroduced but is also heavily infested by weedy species.

The Fort Funston staging area is located in highly disturbed coastal dune scrub dominated in large part by non-native ice plant, although there are a number of native dune sub-shrubs still present, such as coyote brush, goldenbush, and lupine. The outlet is sited on the beach below nearly vertical coastal bluffs.

3.5.1.2 Geological Context

The California coast has undergone dramatic landscape changes since humans began to inhabit the region more than 10,000 years ago. Rising sea levels and increased sedimentation into streams and rivers are among some of the changes (Helley et al., 1979). In many places, the interface between older land surfaces and Holocene-age landforms is marked by a well-developed buried soil profile, or a paleosol. Paleosols preserve the composition and character of the earth’s surface prior to subsequent sediment deposition; thus, paleosols have the potential to preserve archaeological resources if the area was occupied or settled by humans (Meyer and Rosenthal, 2007). Because human populations have grown since the arrival of the area’s first inhabitants, younger paleosols (late Holocene) are more likely to yield archaeological resources than older paleosols (early Holocene or Pleistocene).

Dune sand deposits are located along the length of the proposed Vista Grande Tunnel, which consist of windblown, loose to medium dense, poorly graded sands derived predominantly from Ocean Beach and transported by prevailing winds (CDMG, 2000). Dune sand deposits are estimated to be at least 100 feet thick in the Project vicinity (Schlocker et al., 1958). Most dune fields can be described as being in a state of dynamic equilibrium. There may be no net accumulation or depletion of material within the system as a whole, but constant winds cause continual erosion on the windward side of dunes and deposition on the leeward side. Because human habitation began during a time when the San Francisco peninsula dune field was already established, the presence of buried evidence of prehistoric human use or occupation is more likely to be located on the protected side of the dunes—where significant amounts of dune wind-blown sand are more likely to have accumulated. Although Holocene dune sands as a whole are described as having a moderate potential to contain buried archaeological sites (Meyer and Rosenthal, 2007), dunes sands in the highlands on the eastern side of San Francisco may be more sensitive than those on the unprotected western side of the City in the vicinity of the proposed Project. However, fewer documented archaeological investigations have been conducted on the western side of the City, including in the vicinity of the APE.

According to published geologic maps of the area, the Project area is predominantly underlain by the Plio-Pleistocene age (approximately 5 million to 10,000 years ago) Merced Formation (estimated to be 500,000 years in age in the Fort Funston area; Andersen et al., 2001) and late Pleistocene age (up to approximately 125,000 years ago) Colma Formation (Witter et al., 2006). Merced Formation beds are well exposed on the face of the bluffs at the western edge of Fort Funston. The Merced is characterized as medium- to very fine-grained, poorly indurated to friable sandstone, siltstone, and claystone, with some conglomerate lenses and a few friable beds of white volcanic ash. In many places, the sandstone is silty, clayey or conglomeratic (Brabb et al., 1998). In the Lake Merced area, steeply tilted fossiliferous beds of the Merced Formation are overlain by nearly horizontal beds of the Colma Formation (Schlocker, 1974).

The Colma Formation is described as poorly consolidated beach, estuarine, eolian, stream and colluvial deposits that are distributed discontinuously throughout the northern part of the San Francisco Peninsula (Schlocker, 1974). Throughout most of the Project area, Colma Formation deposits are blanketed by Holocene age (11,000 years to present) eolian sand dune deposits. These deposits are transported from prevailing onshore winds and are composed mainly of very fine-to fine-grained, well-sorted sand with occasional organic-rich interbeds. Other identified Holocene deposits throughout the Project area include artificial fill, landslide deposits, and slope debris observed on the steep bluffs at Fort Funston, artificial fill along the western shores of South Lake and Impound Lake, and wave-deposited beach sand at the base of the bluffs.

While the Merced and Colma formations have a low potential to contain paleosols, the upper 3 feet of the Colma has a moderate potential to contain prehistoric deposits that have been covered by later deposits of Holocene-age dune deposits (Meyer and Rosenthal, 2007). Additionally the streams and ravines that historically cut into the slope east of Lake Merced have, in many places, been capped by artificial fill associated with urban development and roads; prehistoric archaeological sites located on a Pleistocene-age landform may also be covered by various amounts of modern artificial fill and/or built upon.

Treadwell and Rollo completed a geotechnical study for the proposed Project (2013) along the Tunnel and Canal alignments to include all components of the proposed Project. Treadwell and Rollo drilled nine borings, designated B-1 through B-9, between November 28 and December 14, 2012. The borings were drilled to depths between 50 and 200 feet below existing ground surface (bgs). Results of the borings indicate that the Project APE has a low potential to contain intact buried paleosols (ESA, 2014, p. 32-33).

3.5.1.3 Prehistoric Context

When U.C. Berkeley archaeologist N.C. Nelson conducted the first intensive archaeological survey of the region between 1907 and 1908, he recorded nearly 425 “earth mounds and shell heaps” (also known as middens) on or near the shoreline of the Bay. They were encountered in a wide variety of places, including adjacent to springs or streams, on exposed bluffs or headlands, or in salt marshes, but the majority were located within 50 feet of the Bay and the largest mounds were typically encountered at the head of sheltered coves (Nelson, 1909). The most notable sites, such as the Emeryville shellmound (CA-ALA-309), the Ellis Landing Site in Richmond (CA CCO-295), and the Fernandez Site in Rodeo Valley (CA-CCO-259), have been scientifically excavated (Morrato, 1984). Countless others have been lost to urban development.

Archaeologists developed individual cultural chronological sequences tailored to the archaeology and material culture of each sub-region of California. Each of these sequences is based principally on the presence of distinctive cultural traits and stratigraphic separation of deposits. Milliken et al. (2007) has provided a framework for the interpretation of the San Francisco Bay and divided human history in the San Francisco Bay Area into four broad periods: the *Paleoindian Period* (11,500–8000 B.C.), the *Early Period* (8000–500 B.C.), the *Middle Period* (500 B.C.–A.D. 1050), and the *Late Period* (A.D. 1050–1550). Economic patterns, stylistic aspects, and regional phases further subdivide cultural patterns into shorter phases. This scheme uses economic and technological types, socio-politics, trade networks, population density, and variations of artifact types to differentiate between cultural periods.

The *Paleoindian Period* (11,500–8000 B.C.) was characterized by big-game hunters occupying large geographic areas. Evidence of human habitation during the *Paleoindian Period* has not yet been discovered in the San Francisco Bay Area. During the *Early Holocene* (*Lower Archaic*, 8000–3500 B.C.), geographic mobility continued from the *Paleoindian Period* and is characterized by the millingslab and handstone as well as large wide-stemmed and leaf-shaped projectile points. The first cut shell beads and the mortar and pestle are first documented in burials during the *Early Period* (*Middle Archaic*, 3500–500 B.C.), indicating the beginning of a shift to sedentism. During the *Middle Period*, which includes the *Lower Middle Period* (*Initial Upper Archaic*, 500 B.C.–A.D. 430), and *Upper Middle Period* (*Late Upper Archaic*, A.D. 430–1050), geographic mobility may have continued, although groups began to establish longer term base camps in localities from which a more diverse range of resources could be exploited. The first rich black middens are recorded from this period. The addition of milling tools, obsidian, and chert concave-base projectile points, as well as the occurrence of sites in a wider range of environments, suggest that the economic base was more diverse. By the *Upper Middle Period*, mobility was being replaced by the development of numerous small villages. Around A.D. 430, a “dramatic cultural disruption” occurred as evidenced by the sudden collapse of the *Olivella* saucer bead trade network. During the *Initial Late Period* (*Lower Emergent*, A.D. 1050–1550), social complexity developed toward lifeways of large, central villages with resident political leaders and specialized activity sites. Artifacts associated with the period include the bow and arrow, small corner-notched projectile points, and a diversity of beads and ornaments.

3.5.1.4 Ethnohistorical Setting

Based on a compilation of ethnographic, historic, and archaeological data, Milliken (1995) describes a group known as the Ohlone, who once occupied the general vicinity of the Project APE. While traditionally the anthropological literature portrayed the Ohlone peoples as having a static culture, today it is better understood that many variations of culture and ideology existed within and between villages. While these “static” descriptions of separations between native cultures of California make it an easier task for ethnographers to describe past behaviors, this masks Native adaptability and self-identity. California’s Native Americans never saw themselves as members of larger “cultural groups,” as described by anthropologists. Instead, they saw themselves as members of specific villages, perhaps related to others by marriage or kinship ties, but viewing the village as the primary identifier of their origins.

Levy (1978) describes the language group spoken by the Ohlone, known as “Costanoan.” This term is originally derived from a Spanish word designating the coastal peoples of Central California. Today Costanoan is used as a linguistic term that references to a larger language family spoken by distinct sociopolitical groups that spoke at least eight languages (as different as Spanish is from French) of the same Penutian language group. The Ohlone once occupied a large territory from San Francisco Bay in the north to the Big Sur and Salinas Rivers in the south. (Milliken, 1995).

Economically, Ohlone engaged in hunting and gathering. Their territory encompassed both coastal and open valley environments that contained a wide variety of resources, including grass seeds, acorns, bulbs and tubers, bear, deer, elk, antelope, a variety of bird species, and rabbit and other small mammals. The Huchuin-Aguasto and their neighbors along the Carquinez Strait caught salmon that were returning to the Sacramento and San Joaquin Rivers to spawn. The Ohlone acknowledged private ownership of goods and songs, and village ownership of rights to land and/or natural resources; they appear to have aggressively protected their village territories, requiring monetary payment for access rights in the form of clamshell beads, and even shooting trespassers if caught. After European contact, Ohlone society was severely disrupted by missionization, disease, and displacement. Today, the Ohlone still have a strong presence in the San Francisco Bay Area, and are highly interested in their historic and prehistoric past.

3.5.1.5 Historic-period Background

The first European expedition into the San Francisco Bay Area occurred in 1772 when Pedro Fages and his party explored the east shore of San Francisco Bay up to San Pablo Bay, then traveling east along the south shore of the Carquinez Strait, and returning to the San Jose area through the Diablo and Livermore Valleys near Concord. The Fages expedition encountered numerous Native American villages. Diarist Juan Crespí reported that the villagers welcomed the Spaniards, giving them food and gifts, expressing their desire that the Spaniards should come and stay with them.

Three years later, the ship San Carlos sailed through the Golden Gate, tasked with charting the bay. The ship’s commander, Lieutenant Juan Manuel de Ayala, and his crew encountered many Ohlone and neighboring Coast Miwok villagers (from the Marin County shore). In August of

1775, Huchuin-Aguasto speakers greeted the ship's longboat. They recounted the earlier visit by Fages, and provided food and gifts to the new arrivals (Milliken, 1995).

In 1777, Spanish explorers led by Don Fernando Rivera and Father Francisco Palou reportedly camped just north of where present-day Lake Merced Boulevard intersects the San Francisco–San Mateo County line (within the vicinity of the proposed Project). The following year Father Palou returned and named the lake La Laguna de Nuestra Señora de la Merced, or The Lake of Our Lady of Mercy. The Spanish established three missions in the immediate Bay Area between 1776 and 1797. Missions at San Jose, Santa Clara, and San Francisco (Mission Dolores) attempted to Christianize the Bay Area Ohlone groups, including the Huchuin-Aguasto speakers that lived in the Project vicinity. Between November 1794 and May 1795, a large wave of Ohlone people were baptized and moved into Missions Santa Clara and Dolores, including 360 people to Mission Santa Clara and entire populations of East Bay villages to Mission Dolores. This migration was followed almost immediately by catastrophic epidemics of European diseases, as well as food shortages, resulting in alarming death rates among the mission inhabitants. Many neophytes fled the missions, returning to their home villages despite efforts by the Franciscan fathers and Spanish soldiers to bring them back to the missions. This had the unfortunate consequence of spreading the European diseases to those who had never left their homes, further decimating the populations of the remaining Ohlone villages. Later epidemics proved equally disastrous to the Ohlone population; it is estimated that one-quarter of San Francisco Bay Area Mission Indians died of measles or related complications in the spring of 1806 (Milliken, 1995). Due to introduced European diseases, a declining birth rate and high infant mortality, the overall Ohlone population decreased from at least 10,000 (pre-contact) to approximately 2,000 by 1832, and no more than 1,000 by 1852 (Cook, 1957).

Most of California south of Sonoma was under Mexican rule from the 1820s to 1848. In the years following the 1810 Mexican Revolution, political instability added to the diminishing conditions at (and funding to) the Missions. As a result, the Missions' power and influence waned during this period. Historic settlement in the region began in earnest in 1823 the Mexican government awarded large grants of land to wealthy and politically influential individuals willing to settle in what was still known as Alta California. In 1833–1834, the Mexican government secularized the Spanish missions, and many mission lands were also subsequently granted to individuals who established vast cattle raising estates, or ranchos.

In September 1835 a land grant of 2,200 acres, including the lake, was given to Jose Antonio Galindo who named it Laguna de la Merced. Two years later, Galindo sold the grant to Don Francisco de Haro for 100 cattle and $25.00 in goods. In 1835 de Haro had been elected San Francisco's (then Yerba Buena) first city mayor. He built a house at the southern end of the lake, but traveled between the lake house and other property he owned.

Lake Merced was also the location of the famous 1859 duel between Senator David Broderick and Associate Justice of the Supreme Court of California David Terry. The official duel site is located in a small gully just to the east of the southern tip of Lake Merced, and over 650 feet east from the southern tip of the Vista Grande Canal. Located at 1100 lake Merced Boulevard in Daly City, the Broderick-Terry Duel Site is California Registered Historical Landmark No.19.

Spring Valley Water Company

In the late 1850s to early 1860s, Anthony Chabot and two partners formed the San Francisco Water Works (JRP, 2000), which later became the Spring Valley Water Company (SVWC), in turn a predecessor to the SFPUC. Recognizing throughout the 1860s that the City would soon demand a large and dependable water supply, SVWC began purchasing the land surrounding Lake Merced and obtaining the water rights to the lake. By 1877 the company secured the Lake and its watershed totaling over 2,800 acres of surrounding land, most of it in San Francisco County (Shoup and Baker, 1981).

In order to convey drinking water to San Francisco, and to convey wastewater away from the Lake and toward the ocean, the SVWC developed a complex water transport system in and around Lake Merced in the 1890s consisting of dams, pipelines, canals, flumes, drainage ditches, pumping engines, storage tanks, wharfs, a railroad spur, a bridge over North Lake, a powerhouse, an engineer's residence, walks and fences, a bunk house, a stable and chicken house, a wagon shed, oil tank houses, and a well house at Lake Merced. The SVWC was also innovative in its use of iron piping for inverted siphons (JRP, 2000). Most of this development took place in the mid-1890s. Two earthen dams were built in 1895; the first was built at North Lake as part of the Great Highway expansion, impounding the water and permanently severing the Lake’s connection to the ocean. Another separated North and South Lakes (Shoup and Baker, 1981).

The Vista Grande Canal and Tunnel were built in 1897 to prevent heavy runoff from contaminating Lake Merced water, which at the time constituted the water supply for San Francisco along with Crystal Springs Reservoir. Wooden box flumes, which no longer exist, were constructed on the eastern and western edges of the Lake to transport water runoff to the canal and eventually to the ocean (Shoup and Baker, 1981).

Civil engineer Henry Dockweiler designed many of the SVWC’s water works. Dockweiler may have been responsible for the design and construction of the Vista Grande Canal and Tunnel, although no record of this association survives (Dockweiler, 1916). John Dockweiler was a consulting civil engineer for several water and power companies in Northern California near the San Francisco area. He represented SVWC, Cuyumaca Water Company, San Francisco's City Distribution System, and Marin County Water and Supply Company. He was born in Lancaster, New York, in 1864, and in 1891, he became City Engineer of Los Angeles, serving four years, until the end of 1894. In 1895 and 1896 he was engaged in general engineering work, and in 1897 again became San Francisco’s City Engineer, serving for two years. He worked on water projects during the early 20th century.

The canal and tunnel now carry stormwater runoff from the Vista Grande Watershed in Daly City to the ocean outlet, and in dry weather the tunnel also carries treated effluent from the Daly City wastewater treatment plant to a submarine outfall. The canal and tunnel may be among the last physical remnants from the SVWC’s water system around Lake Merced, built at a time when the lake was an important water source for San Francisco, prior to the development of the Hetch Hetchy water system. The concrete outlet structure that exists today, completed in the early 1960s, was attached to, and immediately in front of, the original outlet.

The only historic photo of the tunnel known to exist was taken in 1906 as part of a public inspection of potential damage to the tunnel following the great earthquake and fire of that year (State Earthquake Investigation Commission, 2014). **Figure 3.5-1** shows the end of the tunnel at the ocean outlet as it existed in 1906 (now covered over by the 1960s era concrete outlet structure). This photo clearly shows the brickwork and oval shape of the tunnel behind the outlet structure, and the brick buttresses to either side of the tunnel end wall. Although not visible today due to the newer outlet structure, it is presumed that the tunnel shape and materials are consistent with the photograph shown in Figure 3.5-1.

SOURCE: UC Berkeley, Bancroft Library

Figure 3.5-1
Vista Grande Tunnel Ocean Outlet. 1906

An inventory of buildings and structures owned by the SVWC was completed in 1913 to provide an account of the value of all SVWC properties prior to the purchase of all company facilities by the public (SFPUC, 1914). This account lists a total of nine structures constructed between 1895 and 1910 under the subheading, “Lake Merced Reservoir Facilities.” These include:

- One Lake Merced Tunnel, 5 feet 8 inches by 8 feet 6 inches by 3,036 feet long, brick lined, oval shape, including excavated drainage drifts (773 feet) and drainage shaft (170 feet), both brick lined, cast iron pipes 6-inch diameter, double line running through tunnel (1897)
- One Colma Brick Drainage Conduit. Excavated ditch cut, brick-lined (1897)
- Two dams, one at North Lake, 78 feet long by 12 feet wide by 10 feet high, and another between North and South Lakes, 125 feet long by 40 feet wide by 9 feet high, earth fill (1895)
- One Wagon bridge at east end of dam, 22 feet long by 13 feet wide (1895)
- One Wagon road bridge across brick canal (1897)
- One Ocean View Pond Dam, settling pond South of Lake Merced, 5 feet high by 190 feet long by 20 feet wide, earth fill with concrete (1910)
- One Pipe drain, 30-inch wrought iron pipe 12 feet long, and two 30-inch gate valves (1897)
- One Brick Forebay and Gate Well. Excavated earth, brick, redwood (1897)

The inventory goes on to list another 20 facilities, for a total of 29, including pipes, pumps, flumes, trestles, bridges, wharves, cottages, sheds, and stables, which made up the entire Lake Merced water supply and drainage facility as it existed in 1913. Of these facilities, only the Vista Grande Canal and Tunnel and the dams currently exist.

In 1907–08, Daly City's Vista Grande sewer system, also constructed by the SVWC, was integrated into the earlier 1897 Vista Grande Canal and Tunnel system to further protect the waters of Lake Merced.

Between 1931 and 1935, Lake Merced Boulevard was constructed around the Lake under the Federal Civil Works Administration. By 1956, the roadway had reached its present configuration as a four-lane boulevard and a bridge had been constructed across lower Lake Merced. In February 1962, the name of the southwest section of Lake Merced Boulevard was changed to John Muir Drive, in honor of the well-known naturalist, conservationist, and founder of the Sierra Club (Shoup and Baker, 1981).

Seacoast Defense and Fort Funston

Seacoast defense of San Francisco Bay dates back to the 1770s with the establishment of the Presidio; however it was not until World War I that Fort Funston was established. The following general history of Fort Funston has been adapted and excerpted from GGNRA's historic resource study on the seacoast fortifications in San Francisco Harbor (GGNRA, 1979). This information was supplemented from the California State Military Museum's information about Fort Funston (Chappell, 2014).

At the beginning of the Endicott period in 1890, two mortar batteries were proposed on a tract of land between Laguna de la Merced (Lake Merced) and the ocean. The SVWC, which had a monopoly on providing water to San Francisco, owned this land. While the company was agreeable to selling the land at $1,000 per acre, a friendly condemnation suit was required because of the existence of three mortgages on the land by which the company had secured bonds. Before his retirement Colonel Mendell had selected a tract of 45 acres west of the north arm of the lake. The condemnation suit was completed in December 1900, with the federal government acquiring 44.95 acres at $900 per acre. From that date until World War I the army undertook no construction or development at the new reservation, then called the Lake Merced Military Reservation.

In June, 1917, the War Department named Lake Merced Military Reservation in honor of Major General Frederick Funston, who had fought with the rebels in Cuba before the Spanish-American War, won the Medal of Honor for action in the Philippines, captured the insurrection leader, Emilio Aguinaldo, and had come to San Francisco's aid during the 1906 earthquake. Funston died in February 1917. In July of that year, the post was enlarged through the purchase of 150 acres to the south, also from the SVWC at a cost of $226,151. Enlisted men lived in tents while they constructed their own barracks and other buildings. On August 21, 1917, Fort Funston's flag was raised for the first time.

During the war, the Pacific Coast Artillery District of the U.S. Army placed four 12-inch mortars and two rapid-fire guns at Fort Funston. When the war ended in 1919, these weapons were removed and by 1921, the garrison at Fort Funston was reduced to caretaker status.

As early as 1915 the chief of artillery wanted to emplace 16-inch guns and 16-inch mortars at Fort Funston. Without these weapons, a hostile squadron could lie off San Pedro Point beyond the extreme range (20,000 yards) of the only gun that lay south along the beach and within the range of naval ordnance (21,000 yards) and could effectively bombard the greater part of the city of San Francisco. If more powerful naval guns were used, within a range of 25,000 yards, the entire city could be destroyed. Sixteen-inch guns at Fort Funston would preclude this; 16-inch mortars would also cover the South Channel approach to the Golden Gate.

Although the planning for the emplacement of two 16-inch guns at Fort Funston and other locations around the bay entrance had been planned since at least 1915, it was not completed until the late 1930s. The appropriation of the “Seacoast Defenses, United States, 1937" made available an initial funding for San Francisco’s 16-inch guns. The approved expenditure program allotted $318,500 for the purchase of land at Tennessee Point and $300,000 to initiate construction of the battery at Fort Funston.

Before the battery at Fort Funston was completed, as early as August 1937, it was officially named Battery Richmond P. Davis after a distinguished Coast Artillery Corps officer who had during his career served at San Francisco. Battery Davis with its two massive, 16-inch guns, was completed February 15, 1939.

When the Army engineers turned Battery Davis over to the Coast Artillery Corps in September 1940, the structures and functions of the battery consisted of a the Central Traverse Magazine with two large-caliber mounted guns, a plotting/switchboard room, radio room, a battery commander station, water supply system, and fire-fighting equipment.

With the battery in place by the beginning of World War II (also known by this point as Battery Bluff for their placement in the bluff at Fort Funston), the garrison complex grew with the construction of a new class of “temporary” barracks and quarters and other structures. By the end of 1942, a total of 86 buildings had been constructed. After the war, nearly all of the barracks were demolished.

The Army also built three fire control stations, two of which, FC Funston Group and B5S5 Const. 244, are in the vicinity of the Project area, and an antiaircraft artillery battery near the northern end of the post.

As for the batteries themselves, Battery Bluff was declared obsolete only six months after it had been turned over to the Coast Artillery Corps, making it the shortest-lived battery in the San Francisco Bay defenses.

After the original military area was transferred to San Francisco, a portion was retained by the Department of the Army and permitted to the California National Guard for the housing of an Antiaircraft Artillery Battalion. A map from 1957 documenting the Fort Funston Military Reservation shows that Battery A, 271st Antiaircraft Artillery Gun Battalion had four 90mm Antiaircraft Guns just west of the cantonment area. The California National Guard used the magazines at Battery Howe and Antiaircraft Battery Number 3 for ammunition storage and the balloon hanger as a storage shed for the mobile antiaircraft guns. This site was on San Francisco land outside of the California National Guard leased area and the area retained by the Army.

The last military use of Fort Funston was as a Nike missile battery location. Development started in 1946 on a surface-to-air missile that came to be called the Nike-Ajax. These rocket missiles were controlled by a computer that was fed by three radars. One radar tracked the target; one followed the missile itself; and the third acquisition radar detected distant aircraft and transferred the information to the target-tracking radar.

In the late 1950s, the Nike-Hercules began replacing Nike-Ajax. The new missile was larger, faster, and had a much greater range. Still later a third model, the Nike-Zeus, was adapted. About 1957 construction began on Nike sites in the Bay Area. Six of these batteries were located in today's GGNRA: Presidio of San Francisco, Fort Funston, Sweeney Ridge, Fort Barry, Fort Cronkhite, and Angel Island. A Nike battery included the launcher area, where the missiles were stored in underground rooms brought up in elevators and launched; the control area usually at a high elevation and with its radar, which had to have an unobstructed view of the launch area; and the cantonment area, including quarters, mess hall, and recreation rooms. At Fort Funston, two underground rooms were provided, each with its own elevator. Nearby were the several buildings at the missile site; the ready room, generator room, and other support buildings.

In July of 1959, several of the batteries in the San Francisco Defense Area were turned over to the California Army National Guard and the battery at the former Fort Funston became the home of Battery D, 2nd Missile Battalion, 250th Artillery Regiment (1st California). Concurrent with this change was the posting to the 2nd Battalion's Headquarters and Headquarters Battery at the site.

The California Army National Guard remained at the Site until March of 1963 when the Site was inactivated.

Fort Funston, including the former Nike Missile Defense Site, was transferred to the GGNRA in 1973. Nike Site SF-59L (former launch area) is a public parking area and the former Missile Assembly Building, which is now used as storage and office uses for Fellow Feathers, a hang gliding organization. Site SF-59A (former barracks) serves as an Environmental Science Center as well as the headquarters for the Ocean District Maintenance, Native Plant Nursery, and the Law Enforcement offices, Golden Gate National Recreation Area (Chappell, 2014).

Olympic Golf and Country Club

Located outside of, but adjacent to, the APE is the Olympic Golf and Country Club. Provided below is a brief historical context of the club.

Beginning in the late 1800s and early 1900s, SVWC leased and then sold much of its remaining properties surrounding Lake Merced as they became more valuable as property assets than as areas to protect the Lake Merced watershed; the lake having been demoted to providing only emergency supplies to SVWC's water delivery to San Francisco. Promoting the development of five golf courses on its land around Lake Merced during the early twentieth century, SVWC called the area a "golfer's paradise" in 1923 for its location, terrain and weather. These courses included the Lake Merced Golf Course (now known as Harding Park Municipal Golf Course), the San Francisco Golf Course, and the Olympic Golf and Country Club (OGCC).

The OGCC was founded in San Francisco in 1860 as a private boxing club. In 1918, the club took over the Lakeside Golf Club, which had just opened in 1917 on the shores of Lake Merced. Lakeside had one 18-hole golf course designed by Wilfred Reid, but following additional land purchases the club decided to replace it with two courses (the Lake and Ocean courses). The OGCC's Lake Course is just west of the APE, while its Ocean Course is located south along the Pacific Ocean off Skyline Boulevard. Both courses were designed by Willie Watson, a well-known Scottish architect, and both opened in 1924. In 1953, the Lake course was modified by Robert Trent Jones in preparation for the 1955 U.S. Open. In 2000, Tom Weiskopf again redesigned the course.

3.5.1.6 Previously Identified Cultural Resources in the APE

ESA conducted a records search at the Northwest Information Center (NWIC) of the California Historical Resources Information System at Sonoma State University on November 5, 2012 (File No. 12-0449) and updated on February 12, 2014 (File No. 13-1228). The purpose of the records search was to: (1) determine whether known cultural resources have been recorded within or adjacent to the APE; (2) assess the likelihood for unrecorded cultural resources to be present based on historical references and the distribution of nearby resources; and (3) develop a context for the identification and preliminary evaluation of cultural resources.

The records search consisted of an examination of NWIC base maps, resource inventories such as the California Office of Historic Preservation (OHP) Directory for San Francisco and San Mateo

County, investigations on prehistoric archaeology, ethnographic sources, historic background sources, and historic maps. The records research indicated that 14 cultural resources investigations have been completed within 0.5 mile of the APE. Background research indicates that no previously recorded archaeological resources are located within the proposed Project APE; 10 archaeological resources, including shipwreck remains, are located within 2 miles of the proposed Project APE. Two historic-period archaeological sites have been identified in the vicinity, but outside of the APE: a glass-filled well and a concrete coal bin foundation. Both of these resources have likely been destroyed by subsequent development since recordation. Eight prehistoric archaeological sites have been previously identified in the Project vicinity; none are located within the proposed Project APE. The eight sites are all localized shell midden sites, some with charcoal, lithic debitage, and faunal remains.

The 1882 schooner *Neptune* wrecked in 1900 approximately 900 feet south of the Ocean Outlet structure (designated CA-SFR-107H). In 1982, a 48-foot-long section of the starboard side of the hull was hand-excavated, documented, and reburied (Delgado, 1983). In order to determine whether other shipwrecks are located along Ocean Beach, archaeologists surveyed 3 miles within GGNRA lands, including a portion of the current Project APE, with a proton-procession magnetometer (Jablonowski, 1995). Thirty-eight anomalies, 19 of which were tested by hand excavation, were located. No shipwreck remains were identified during the hand excavation although unexcavated anomalies were noted. Other shipwrecks in the general vicinity included the *William Frederick*, which wrecked on the beach in 1887 below Sloat Boulevard, and the *W.H. Gally*, which wrecked in 1880 about 5 miles south of Fulton Street, just south of the San Francisco/San Mateo County line (Delgado and Haller, 1989).

The records search also identified two historic-period resources of the built environment in the APE: the Spring Valley (Vista Grande) Water Canal and Fort Funston. Each of these prior evaluations is described below.

Spring Valley (Vista Grande) Water Canal

In 1981, archaeologists Lawrence Shoup and Suzanne Baker recorded and evaluated the Spring Valley (Vista Grande) Water Canal (Shoup and Baker, 1981). Shoup and Baker identified the canal as having “strong local and moderate regional historical significance relative to the City of San Francisco and to the development of local and regional water systems and relative to regional economic impact,” and “the canal possesses integrity of location and condition.” They concluded that the canal and the remaining Spring Valley Water Company features at Lake Merced are eligible for nomination to the National Register of Historic Places (National Register). The resource was recorded as site CA-SFR-102H, but is not currently listed in, or officially determined eligible for listing in, the California or National Registers by the California OHP. The Vista Grande Tunnel was not recorded or evaluated during the 1981 survey.

Fort Funston

In 1979, Erwin N. Thompson of the NPS evaluated Fort Funston in a Determination of Eligibility for the National Register. Fort Funston was determined eligible as a historic district (Fort Funston

National Register Historic District) on July 31, 1980, for its possession of "local significance in military history for its associations with the evolution of the Bay Area's coastal defense system between World War I and World War II" (Thompson, 1979). The period of significance was established as 1900–1948. The Fort Funston National Historic District, although determined eligible, was never formally listed in the National Register.

According to the historic resources study of seacoast fortifications completed by the GGNRA in 1979, Battery Davis possessed considerable historical significance for being the first 16-inch gun battery undertaken at San Francisco, for being a representative of this mighty climax to coastal guns, and for being the prototype for gun casemates of modern batteries. The report found that the remaining portions of the installation, including structures associated with the former Nike Missile Defense System, lacked historical significance (GGNRA, 1979).

In 2006, the NPS prepared an addendum to the 1979 National Register nomination, and found that the Fort Funston National Register Historic District no longer retained historic integrity due primarily to the forces of coastal erosion. As a result, it was recommended that Fort Funston be removed from the list of National Register eligible properties (NPS, 2006a). The California OHP concurred with the NPS that the Fort Funston Historic District, including the former Cold War-era Nike Missile structures within it, lacked sufficient integrity to warrant inclusion in the National Register (Donaldson, 2006). Fort Funston is currently listed in the Historic Properties Database with a National Register status code of "6Y" (ineligible for listing in the National Register). Therefore, none of the buildings or structures at Fort Funston are considered historic properties.

The NPS also stated in its addendum that "half of the Fort Funston Historic District contributors that were determined eligible for inclusion in the National Register [in 1979] have poor integrity. Of the structures that retain integrity, Battery Davis is by far the most significant resource located at Fort Funston. Battery Davis is significant within the broader context of San Francisco Bay Area defense fortifications, as part of a pair of large gun batteries that flank the mouth of San Francisco Bay. Battery Davis and the Battery Davis Plotting and Switchboard Room will be assessed in the future as part of a National Historic Landmark nomination for the Seacoast Fortifications of San Francisco Bay" (NPS, 2006a).

GGNRA has prepared a draft National Landmark nomination, which includes Battery Davis and the Battery Davis Plotting and Switchboard Room as well as two additional fire control stations (FC Funston Group and B5S5 Const. 244). For purposes of the proposed undertaking, the GGNRA has requested that all of these structures should be treated as eligible for the National Register.

3.5.1.7 Native American Contact

ESA contacted the Native American Heritage Commission (NAHC) on November 6, 2012 to request a database search for sacred lands or other cultural properties of significance within or adjacent to the APE. ESA received a response on November 21, 2012. The NAHC database search of the sacred lands file failed to identify the presence of cultural resources in the vicinity of the APE. The NAHC provided a list of Native American contacts that might have further knowledge of cultural resources in the vicinity of the APE. On October 29, 2014, NPS sent letters to those on the NAHC list of contacts, supplemented by its own substantial list of Ohlone/Costanoan contacts, requesting information about resources in the APE to which they may attach cultural or religious significance. No substantive information from these contacts has been received as of the publication of this EIR/EIS. Copies of correspondence relating to Native American contact efforts are provided in Appendix A of the CRSR.

3.5.1.8 Cultural Survey Methods and Findings

Archaeological Resources

An ESA Registered Professional Archaeologist completed a pedestrian surface survey of the APE on November 2012 and August 2014. The APE along the west side of Lake Merced in the vicinity of the Vista Grande Canal Improvements and Diversion to Lake Merced was observed to be primarily covered in non-native ice plant along the edges of the existing canal, with disturbed mounds of artificial fill throughout. Soil was all sandy with artificial gravel inclusions. No archaeological resources were observed including shell, midden soils, or other evidence of past human use or occupation.

The APE at Fort Funston was observed primarily from the top of the bluff in the vicinity of the Fort Funston parking area. Observed soil was sandy and highly disturbed from construction of the military-related facilities, the existing tunnel, and the existing use area including parking, trails, benches, and other services.

The Avalon Canyon access road within the APE was observed to be on a very steep (45 degree) hillslope. Aerial imagery shows development of the area. The 1956 aerial shows a small trail extending down the steep slope and the railroad tracks of the Ocean Shore Railroad near to the base of the cliff adjacent to the beach. By 1968 the railroad tracks had been removed and the trail to the beach had been widened. The 1987 aerial shows a more developed access road. The access road was developed in 1993, and by 2002 the road had been reconfigured to its current alignment. The road has since partially collapsed near its terminus at the beach end of the alignment. No evidence of the railroad tracks or associated features were observed during the survey. The area has been highly terraced and modified from construction of the access road and earlier trail.

No prehistoric or historic-period archaeological resources were observed during the surface pedestrian survey. Prior to this effort, geotechnical coring completed for the proposed Project did not identify potential archaeological resources. The geotechnical study completed for the Project indicates that the Project APE is underlain by varying layers of artificial fill, Holocene-age Dune sand, and early period Merced and Colma formations. No indication of a paleosol associated with the upper feet of the Colma Formation was identified during the study.

While prehistoric and historic-era archaeological resources have been previously identified in the coastal bluff areas of the San Francisco peninsula in the Project vicinity, there is no evidence that archaeological resources are within the specific Project APE.

Architectural/Structural Resources

An ESA architectural historian and preservation planner completed an intensive-level survey and evaluation of all observable architectural and structural features within the APE in October 2012. The 1897 Vista Grande Canal and the early 1960s outlet structure were observed and recorded. A late 1950s-era former Nike Missile Defense System building at Fort Funston was also observed outside of, but adjacent to, the APE. Each of these features is described below.

The 1897 brick-lined canal, which is approximately 50 feet west of and parallel to John Muir Drive, extends about 3,600 feet from the intersection of Lake Merced and John Muir Drive on the south to Daly City's Lake Merced Pump Station on the north. From this area, water flows into a brick-lined tunnel, extending another 3,000 feet under the Olympic Club Golf Course and Fort Funston, to its terminus at an outlet structure at the Pacific Ocean. The canal is approximately 4 feet in width at the bottom with outwardly angled side walls approximately 6 feet high forming a trapezoidal section. The sides and bottom of the canal are primarily constructed of common-bond brick, although concrete patches over the brick lining were observed in about 4 locations, estimated to consist of no more than 5 percent of the total length of the canal. Other modifications to portions of the eastern wall of the canal were also observed, where it was widened for the installation of concrete ramps used to facilitate canal cleaning around 1997. These canal widenings occur in two places along the length of the canal, one toward the southern end and one near the middle of the canal, and are about 75 feet in length each. In these two locations, the canal becomes about 15 feet wide. It is estimated that the canal widenings comprise about 150 feet, or approximately 4 percent of the total 3,600-foot length of the canal. Only the east side of the canal contains these ramps; the bottom of the canal and its west side are unaltered. A steel security/trash grate is located at the mouth of the tunnel. A fenced concrete pad containing a concrete manhole providing access to the subterranean pump station is located immediately east of the tunnel entrance on the northern end of the canal. The trash grate and the manhole covers do not appear to be original to the canal, and were likely installed in the 1950s or 1960s, from outward appearances. The tunnel itself was not observable during the site visit, although a historic photo of the outlet end indicates that its exterior dimensions are about 6 feet wide and about 9 feet tall with an oval shape (see Figure 3.5-1).

The outlet structure, located at Ocean Beach at the base of the Fort Funston cliffs, was observed to be a concrete structure about 85 feet long measured from the base of the cliffs to the end of the outlet, and comprises two major components: a concrete pipe section about 55 feet long, about 10 feet wide and about 10 feet tall, leading to a concrete box-like structure about 30 feet long, about 20 feet wide, and about 12 feet tall. Constructed of poured concrete, the outlet box has a steel pipe railing around the perimeter of the flat roof, and two cast iron flap gates on the south elevation. The outlet structure was reconstructed and modified in the early 1960s.

At Fort Funston, the staging area for tunnel construction was observed to be an undeveloped area of sand dunes and vegetation, with no existing buildings or structures. One circa 1959 concrete masonry block building, which was identified as the Missile Assembly Building as part of the Nike Missile Defense System at Fort Funston, is located just southeast of the staging area and outside of the APE. This single-story utilitarian building is abandoned and is currently used for hang glider storage.

3.5.1.9 Cultural Evaluations and Recommendations for Historic Significance

To be eligible for listing in the National Register, a resource must be significant in American history, architecture, archaeology, engineering, or culture. Districts, sites, buildings, structures, and objects of potential significance must meet one or more of the following four established criteria:

A. Are associated with events that have made a significant contribution to the broad patterns of our history;

B. Are associated with the lives of persons significant in our past;

C. Embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded, or may be likely to yield, information important in prehistory or history.

Unless the property possesses exceptional significance, it must be at least fifty years old to be eligible for National Register listing (NPS, 1990).

An historic property must retain sufficient integrity to convey the reasons for its significance (NPS, 1990). The National Register lists seven types of integrity that must be sufficiently demonstrated by a resource. These are location, design, setting, materials, workmanship, feeling, and association.

The Vista Grande Canal and Tunnel was evaluated against these National Register criteria, including an assessment of integrity. The findings of the evaluation are provided below.

Recommendations for Eligibility for Listing in the National Register

The Vista Grande Canal and Tunnel is recommended eligible for listing in the National Register under Criterion A (events) and C (architecture/engineering). Each of these associations is described below.

Criterion A (Events)

In their overview of water conveyance systems throughout California prepared for the California Department of Transportation, JRP Historical (2000) identified six kinds of water conveyance systems that may be eligible for the National Register, including those associated with mining, hydroelectric systems, community water systems, reclamation systems, and multi-purpose systems. San Francisco’s Spring Valley Water Company is specifically noted as an example of a privately owned water service providing resources to a growing community (JRP, 2000, p. 70).

JRP (2000, p. 93) discuss the importance of community water systems to municipal communities, and note that development of such infrastructure is essential to the development of California history. Criterion A states that resources may be eligible for the National Register if they are associated with events that have made a significant contribution to the broad patterns of our history. For a community water system to meet this threshold, it must be well documented in archival and architectural resources, be associated with key communities and critical to the development of those communities. The City could not have grown and functioned without a reliable source of water.

In this case, the Vista Grande Canal and Tunnel are associated with the development of SVWC (predecessor to today's SFPUC), and with the critical infrastructure of San Francisco. The SVWC built the Vista Grande Canal and Tunnel in 1897 to prevent heavy runoff from contaminating Lake Merced water, which at the time constituted the primary water supply for San Francisco along with Crystal Springs Reservoir. The canal and tunnel now carry stormwater runoff from the Vista Grande Watershed in Daly City, and the tunnel also carries treated effluent from the Daly City wastewater treatment plant to the ocean outlet. The canal and tunnel appear to be the last physical remnants from the SVWC's water system around Lake Merced, built at a time when the lake was an important water source for San Francisco, prior to the development of the Hetch Hetchy water system in the 1930s. Although other portions of SVWC's system at Lake Merced, such as wooden box flumes, wharves, and other components are no longer extant, the surviving canal and tunnel features (as well as the two earthen dams at Lake Merced), retain sufficient integrity to convey the intent of the system as a whole. The other features that are no longer extant appear to have been in supportive of, or secondary features to, the canal and tunnel.

For these reasons, the Vista Grande Canal and Tunnel are associated with events that have made a significant contribution to the broad pattern of history; the event being the provision and protection of San Francisco's water supply during private SVWC ownership and prior to the public Hetch Hetchy development. The Vista Grande Canal and Tunnel contributed significantly to this event because without it, the waters of Lake Merced, and therefore San Francisco's water supply, would have been rendered unsafe due to contamination from runoff. Given this, ESA agrees with Shoup and Baker's earlier (1981) assessment, that is, the Vista Grande Canal and Tunnel are recommended eligible for the National Register under Criterion A because they are associated with events that have made a significant contribution to the broad patterns of our history. Further, the Canal and Tunnel retain sufficient integrity to convey that history, as discussed below.

Criterion B (Persons)

Research did not reveal any associations with the lives of persons significant in our past, as no single individual within the SVWC is credited with the design, construction, or operation of the Vista Grande Canal and Tunnel. Therefore, the structure does not appear eligible for the National Register under Criterion B.

Criterion C (Architecture)

As JRP (2000, p. 94) notes, there are requirements for meeting Criterion C: "To be considered a good representative . . . a water conveyance system must possess 'distinctive characteristics,' the common features or traits" of a type, period, or method of construction." The Vista Grande Canal and Tunnel were constructed using the simple tools of manual labor and were lined with hand-set, common-bond brick and mortar by local masons demonstrating a type, period, and construction techniques that is now exceedingly rare. Twentieth century mechanized construction methods and poured concrete materials replaced these earlier construction methods. The Vista Grande Canal and Tunnel is likely the only facility of its kind in Daly City, or in the general vicinity, built using these late nineteenth century construction techniques and materials, and demonstrate the skill of local masons, especially in the arched tunnel lining. The canal and tunnel may also have been designed by civil engineer Henry Dockweiler, who designed many of the SVWC's water projects in the Bay Area in the 1890s, and thus may represent the work of a master engineer, although this connection cannot be verified as no engineering plans or notes have been found. For these reasons, the canal and tunnel embody the distinctive characteristics of a type (brick-lined), period (1890s), and method (manual/non-mechanized) form of construction, and possibly represents the work of a master engineer. Based on these distinctive characteristics, the Vista Grande Canal and Tunnel are recommended eligible for the National Register under Criterion C.

Criterion D (Information Potential)

There is nothing to indicate that the Vista Grande Tunnel and Canal would yield, or are likely to yield, information important in prehistory or history. For these reasons, the facility is not recommended eligible for listing in the National Register under Criterion D. Project effects on prehistory, specifically, are provided below.

Period of Significance

The period of significance would be from 1877, when the SVWC began acquiring land around Lake Merced for the development of the city's water system, to 1934, when the Hetch Hetchy system became operational, rendering the Vista Grande Canal and Tunnel obsolete for the purposes of water supply/protection at Lake Merced. It was after this point that the waters of Lake Merced ceased being used as a primary source of city drinking water, and became used mostly for recreational purposes (and reservoir rebalancing).

Integrity

The following provides an evaluation of integrity; specifically, integrity of location, design, materials, workmanship, setting, feeling, and association.

- ***Location.*** The Vista Grande Canal and Tunnel remain in their original location.
- ***Design.*** The brick-lined, trapezoidal-shaped canal and the oval-shaped tunnel are essentially unchanged from their original design of the 1890s. The relatively minor alterations due to the two concrete maintenance ramps installed on the eastern side of the canal including concrete patches, estimated to represent about 4 to 5 percent of the total length of the canal, respectively, as well as the newer trash grate and concrete outlet structure on either end of the tunnel, have not substantially diminished its original design. It is estimated that approximately 95 percent of the canal's original design remains intact. Although inaccessible to the surveyor, there is no indication that the design of the tunnel has changed since its original construction, other than steel trash grate and concrete outflow

structures installed at either end. It is estimated that approximately 95 percent of the tunnel's original design remains intact. As such, the property retains its integrity of design.

- ***Materials.*** The Vista Grande Canal and Tunnel are constructed of brick materials, which are evident throughout the vast majority of the canal, and are assumed to exist within the tunnel, although the latter was not visible to the surveyor. Although approximately 4 to 5 percent of the brick canal has been replaced with concrete in the form or either patches or ramps, the vast majority of the property retains its original brick materials. Therefore, the property retains a sufficient amount of integrity of materials.

- ***Workmanship.*** The workmanship of hand-mortared brick set in a common-bond pattern by local masons is clearly apparent throughout the vast majority of the canal, and is assumed to exist within the tunnel, although the latter was not visible to the surveyor. As such, the property retains its integrity of materials.

- ***Setting.*** The setting of the Vista Grande Canal and Tunnel has been somewhat altered since its original construction in 1897 with the development of the Olympic Club Golf course in the 1920s immediately west of the canal, and the construction of John Muir Boulevard in the 1930s immediately east of the canal. However, these alterations occurred generally within the property's period of significance (1877 – 1934) and have not substantially affected the property's setting. These alterations also did not substantially change the canal's relationship with Lake Merced, or the tunnel's relationship with the ocean outfall. The property remains within a somewhat undeveloped portion of San Francisco, surrounded by open space and/or recreational uses, as it did in the 1890s. With the exception of the trash grate at the tunnel entrance, and the outlet structure at the end of the tunnel, the setting of the tunnel itself placed deep within the bluff is essentially unchanged. As such, the property retains its integrity of setting.

- ***Feeling.*** The Vista Grande Canal and Tunnel retain their aesthetic feeling as well as a communication of time and place, when these were important pieces of infrastructure used to protect San Francisco's water supply.

- ***Association.*** The connection between the Vista Grande Canal and Tunnel and the historic event it is associated with (the provision and protection of San Francisco's water supply during private SVWC ownership and prior to the public Hetch Hetchy development), remains evident despite the minor alterations to the facility itself.

Although the canal has lost minor amounts of integrity in terms of materials and design with the placement of some concrete patches and vehicular ramps, the trash rack at the entrance of the tunnel, and the utilitarian ocean outlet structure at the tunnel end, the vast majority (estimated to be approximately 95 percent) of the Vista Grande Canal and Tunnel system retains sufficient integrity of location, design, materials, workmanship, setting, feeling, and association to convey its historical significance under National Register Criteria A and C. Although the tunnel interior was inaccessible to the surveyor, water continues to flow through the system which indicates that it still operates as designed. In addition, research did not reveal any changes to the tunnel design, materials, or routing since its original construction. For these reasons, it is assumed that the tunnel, specifically, also retains sufficient integrity to convey its significance.

Outlet Structure. The Ocean Outlet structure, constructed in the 1960s as a later addition to the original outlet, is recommended ineligible for listing in the National Register. This utilitarian, concrete mass of box-like forms and pipes approximately 85 feet long measured from the base of the cliffs to the end of the structure lacks important association with historical events and displays a design and construction type typical of the era in which it was built.

Fort Funston. Fort Funston has been previously determined ineligible for listing in the National Register, although Battery Davis and other nearby seacoast defense structures are presumed eligible for listing in the National Register.

3.5.1.10 Designated Landmarks and Historic Districts

No designated City Landmarks, Historic Districts, or Conservation Districts are located within the APE for direct or indirect effects (San Francisco Planning Department, 2008, 2006).

3.5.2 Regulatory Setting

3.5.2.1 Federal Regulations

National Historic Preservation Act

Historic properties are protected through the National Historic Preservation Act (NHPA) of 1966, as amended (54 USC §306108), and it's implementing regulations. Under the NHPA, a historic property is considered significant if it meets the National Register criteria at 36 CFR 60.4, as stated below (see also Section 3.5.1.9):

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:
>
> a) That are associated with events that have made a significant contribution to the broad patterns of our history, or
>
> b) That are associated with the lives of persons significant in our past, or
>
> c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction, or
>
> d) That have yielded, or may be likely to yield, information important in prehistory or history.

Section 106 of the NHPA requires that a federal agency with direct or indirect jurisdiction over a proposed federal or federally assisted undertaking, or issuing licenses or permits, must consider the effect of the proposed undertaking on historic properties. A historic property may include a prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register maintained by the U.S. Secretary of the Interior. Federal agencies must also allow the Advisory Council on Historic Preservation (ACHP) to comment on the proposed undertaking and its potential effects on historic properties.

The implementing regulations for Section 106 of the NHPA (36 CFR 800) require consultation with the State Historic Preservation Officer (SHPO), the ACHP, federally recognized Indian tribes and other Native Americans, and interested members of the public throughout the compliance process. The four principal steps are:

- Initiate the Section 106 process (36 CFR 800.3);
- Identify historic properties, i.e., resources eligible for inclusion in the National Register (36 CFR 800.4);
- Assess the effects of the undertaking on historic properties within the area of potential effect (36 CFR 800.5); and
- Resolve adverse effects (36 CFR 800.6).

Adverse effects on historic properties are often resolved through preparation of a memorandum of agreement or programmatic agreement developed in consultation between the federal agency, the SHPO, Indian tribes, and interested members of the public. The ACHP is also invited to participate. The agreement describes stipulations to mitigate adverse effects on historic properties listed in or eligible for the National Register (36 CFR 60). The NPS will complete consultation under Section 106 of the NHPA for the proposed Project separately from, but concurrently with, the NEPA process.

National Park Service Management Policies

The 2006 edition of NPS Management Policies provides both general and specific policies related to management of different types of cultural resources, including the NPS' methodology for compliance with Section 106 of the NHPA and other applicable federal legislation (NPS, 2006b). In summary, "The National Park Service will protect, preserve, and foster appreciation of the cultural resources in its custody and demonstrate its respect for the peoples traditionally associated with those resources through appropriate programs of research, planning, and stewardship" (NPS, 2006b, p. 59). Specific policies that are most likely to be applicable to the proposed Project are summarized below.

> ***Policy 5.3.5: Treatment of Cultural Resources***. The Park Service will provide for the long-term preservation of, public access to, and appreciation of the features, materials, and qualities contributing to the significance of cultural resources. With some differences by type, cultural resources are subject to several basic treatments, including (1) preservation in their existing states; (2) rehabilitation to serve contemporary uses, consistent with their integrity and character; and (3) restoration to earlier appearances by the removal of later additions and replacement of missing elements.
>
> ***Policy 5.3.5.1: Archaeological Resources***. Archaeological resources will be managed in situ, unless the removal of artifacts or physical disturbance is justified by research, consultation, preservation, protection, or interpretive requirements. Preservation treatments

will include proactive measures that protect resources from vandalism and looting, and will maintain or improve their condition by limiting damage due to natural and human agents.

Policy 5.3.5.1.7: Submerged Cultural Resources. Historic shipwrecks and other submerged cultural resources will be protected, to the extent permitted by law, in the same manner as terrestrial archaeological resources. Protection activities involve inventory, evaluation, monitoring, interpretation, and establishing partnerships to provide for the management of historic shipwrecks and other submerged cultural resources in units of the National Park system.

Policy 5.3.5.2: Cultural Landscapes. Treatment decisions will be based on a cultural landscape's historic significance over time, existing conditions, and use. Treatment decisions will consider both the natural and built characteristics and features of a landscape, the dynamics inherent in natural processes and continued use, and the concerns of traditionally associated peoples. The treatment implemented will be based on sound preservation practices to enable long-term preservation of a resource's historic features, qualities, and materials. There are three types of treatment for extant cultural landscapes: preservation, rehabilitation, and restoration.

Policy 5.3.5.4: Historic and Prehistoric Structures. The treatment of historic and prehistoric structures will be based on sound preservation practice to enable the long-term preservation of a structure's historic features, materials, and qualities. There are three types of treatment for extant structures: preservation, rehabilitation, and restoration [as per the Secretary of the Interior's Standards for the Treatment of Historic Properties].

Policy 5.3.5.4.10: Historic and Prehistoric Ruins. The stabilization of historic and prehistoric ruins will be preceded by studies leading to the recovery of any data that would be affected by stabilization work. Ruins and related features on unexcavated archaeological sites will be stabilized only to the extent necessary to preserve research values or to arrest structural deterioration, recognizing that it is preferable to preserve archaeological sites in situ than to excavate them.

Secretary of the Interior's Standards for the Treatment of Historic Properties

The Secretary of the Interior's Standards for the Treatment of Historic Properties (Secretary's Standards, 36 CFR Part 68) are the criteria by which federal agencies and many local government bodies evaluate rehabilitative work on historic properties. The Secretary's Standards are a useful analytic tool for understanding and describing the potential adverse effects to historic properties. Compliance with the Secretary's Standards does not determine whether a project would cause a substantial adverse change to the significance of a historic property. Rather, projects that comply with the Secretary's Standards benefit from a regulatory presumption that they would have not have an adverse effect on a historic property. Projects that do not comply with the Secretary's Standards may or may not have an adverse effect on the significance of a historic property.

3.5.2.2 State Regulations

The State of California implements those aspects of the NHPA pertinent to state and local governments through its statewide comprehensive cultural resource surveys and preservation programs. The California OHP, as an office of the California Department of Parks and

Recreation, implements the policies of the NHPA on a statewide level. The OHP also maintains the California Historical Resources Inventory. The SHPO is an appointed official who implements historic preservation programs within the State's jurisdictions.

California Environmental Quality Act

Historical Resources

CEQA, as codified in California Public Resources Code Sections 21000 et seq., is the principal statute governing the environmental review of projects in the state. The CEQA Guidelines define a historical resource as: (1) a resource in, or determined to be eligible for listing in, the California Register of Historical Resources (California Register); (2) a resource included in a local register of historic resources, as defined in Public Resources Code Section 5020.1(k) or identified as significant in a historic resource survey meeting the requirements of Public Resources Code Section 5024.1(g); or (3) any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the lead agency's determination is supported by substantial evidence in light of the whole record. (CEQA Guidelines §15064.5 (a))

The California Register is "an authoritative guide in California to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change" (Pub. Res. Code §5024.1[a]). The criteria for eligibility for listing in the California Register are based on National Register criteria (Pub. Res. Code §5024.1[c]). Certain resources are determined by the statute to be automatically eligible for inclusion in the California Register, including California properties formally eligible for or listed in the National Register.

To be eligible for the California Register as a historical resource, a prehistoric or historic-period resource must be significant at the local, state, and/or federal level under one or more of the following evaluation criteria:

1) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

2) Is associated with the lives of persons important in our past;

3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

4) Has yielded, or may be likely to yield, information important in prehistory or history. [Pub. Res. Code §5024.1(c), based on 14 CFR 4852(b)]

For a resource to be eligible for the California Register, it must also retain enough integrity to be recognizable as a historical resource and to convey its significance. A resource that does not retain sufficient integrity to meet the National Register criteria may still be eligible for listing in the California Register.

CEQA Guidelines Section 15164.5(b)(3) notes that, "Generally, a project that follows the Secretary of the Interior's Standards for the Treatment of Historic Properties shall be considered as mitigated to a level of less than significant impact on the historical resource."

Archaeological Resources

CEQA considers archaeological resources as an intrinsic part of the physical environment and, thus, requires for any project that the potential of the project to adversely affect archaeological resources be analyzed (CEQA §21083.2). For a project that may have an adverse effect on a significant archaeological resource, CEQA requires preparation of an environmental impact report (CEQA §21083.2 and CEQA Guidelines §15065). CEQA recognizes two different categories of significant archaeological resources: "unique" archaeological resource (CEQA §21083.2) and an archaeological resource that qualifies as a "historical resource" under CEQA (CEQA §21084.1 and CEQA Guidelines §15064.5).

An archaeological resource can be significant as both or either a "unique" archaeological resource and as an "historical resource" but the process by which the resource is identified as either one or the other, under CEQA, is distinct (CEQA §21083.2(g), and CEQA Guidelines §15064.5(a)).

An archaeological resource is a "historical resource" under CEQA if it meets any of the above definitions of a historical resource (CEQA Guidelines §15064.5(a)). Generally, an archaeological resource is determined to be an "historical resource" due to its eligibility for listing in the California Register because of the potential scientific value of the resource, that is, "has yielded, or may be likely to yield, information important in prehistory or history" (i.e., Criterion 4) An archaeological resource may be California Register-eligible under other evaluation criteria, such as Criterion 1, association with events that have made a significant contribution to the broad patterns of history; Criterion 2, association with the lives of historically important persons; or Criterion 3, association with the distinctive characteristics of a type, period, region, or method of construction. Appropriate treatment for archaeological properties that are California Register-eligible under criteria other than Criterion 4 may be different than that for a resource that is significant exclusively for its scientific value.

The fact that an archaeological resource is not listed in any historical inventories is not sufficient to conclude that the archaeological resource is not a historical resource. When the lead agency believes there may be grounds for a determination that an archaeological resource is a historical resource, then the lead agency should evaluate the resource for eligibility for listing to the California Register (CEQA Guidelines §15064.5(a)(4)).

A "unique archaeological resource" is a category of archaeological resources created by the CEQA statutes (§21083.2(g)). An archaeological resource is a unique archaeological resource if it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of one of three criteria:

1) Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;

2) Has a special and particular quality such as being the oldest of its type or the best available example of its type; or

3) Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Under CEQA, evaluation and protection of an archaeological resource as a historical resource is prioritized over the evaluation and protection of the resource as a unique archaeological resource, in that CEQA requires that "when a project will impact an archaeological site, a lead agency shall first determine whether the site is an historical resource," and if the lead agency determines that the archaeological site is a historical resource, the limitations on the cost of mitigation provided for unique archaeological resources in Public Resources Code Section 21084.1 do not apply (CEQA Guidelines §15064.5(c)).

Evaluation of an Archaeological Resource as Scientifically Significant

In requiring that a potentially affected archaeological resource be evaluated as a historical resource, that is, as an archaeological site of sufficient scientific value to be California Register-eligible, CEQA presupposes that the published guidance of the California OHP for CEQA providers is to serve as the methodological standard by which the scientific, and thus, the California Register eligibility, of an archaeological resource is to be evaluated. As guidance for the evaluation of the scientific value of an archaeological resource, the OHP has issued two guidelines: Archaeological Resource Management Reports (1989) and the Guidelines for Archaeological Research Designs (1991).

Integrity of an Archaeological Resource

Integrity is an essential criterion in determining if a potential resource, including an archaeological resource, is a historical resource. In terms of CEQA "integrity" can, in part, be expressed in the requirement that a historical resource must retain the physical characteristics that convey its historical significance (CEQA Guidelines §15064.5(b)).

For an archaeological resource that is evaluated for California Register eligibility under Criterion 4, "has yielded or may be likely to yield information important to prehistory or history," integrity is conceptually different than how it is usually applied to the built environment. For a historic building, possessing integrity means that the building retains the defining characteristics from the period of significance of the building. In archaeology, an archaeological deposit or feature may have undergone substantial physical change from the time of its deposition but it may yet have sufficient integrity to qualify as a historical resource. The integrity test for an archaeological resource is whether the resource can yield sufficient data (in type, quantity, quality, diagnosticity) to address significant research questions. Thus, in archaeology "integrity" is often closely associated with the development of a research design that identifies the types of physical characteristics ("data needs") that must be present in the archaeological resource and its physical context to adequately address research questions appropriate to the archaeological resource.

Significant Adverse Effect on an Archaeological Resource

The determination of whether an effect on an archaeological resource is significant depends on the effect of the project on those characteristics of the archaeological resource that make the archaeological resource significant. For an archaeological resource that is a historical resource because of its prehistoric or historic information value, that is, its scientific data, a significant effect is impairment of the potential information value of the resource.

The depositional context of an archaeological resource, especially soils stratigraphy can be informationally important to the resource in terms of data and reconstructing characteristics of the resource at time of deposition and interpreting the impacts of later deposition events on the resource. Thus, for an archaeological resource eligible to the California Register under Criterion 4, a significant adverse effect to its significance may not be limited to impacts on the artifactual material but may include effects on the soils matrix in which the artifactual matrix is situated.

Mitigation of an Adverse Effect to an Archaeological Resource

Preservation in place is the preferred treatment of an archaeological resource (CEQA §21083.2(b); CEQA Guidelines §15126.4 (b)(3)(a)). When preservation in place of an archaeological resource is not feasible, data recovery, in accord with a data recovery plan prepared and adopted by the lead agency prior to any soils disturbance, is the appropriate mitigation (CEQA Guidelines Section 15126.4 (b)(3)(C)). In addition to data recovery, under CEQA, the mitigation of effects to an archaeological resource that is significant for its scientific value, requires curation of the recovered scientifically significant data in an appropriate curation facility (CEQA Guidelines §15126.4(b)(3)(C)), that is a curation facility compliant with the Guidelines for the Curation of Archaeological Collections (California Office of Historic Preservation, 1993). Final studies reporting the interpretation, results, and analysis of data recovered from the archaeological site are to be deposited in the California Historical Resources Regional Information Center (CEQA Guidelines §15126.4(b)(3)(C)).

California Public Resources Code

Effects on Human Remains

Under State law, human remains and associated burial items may be significant resources in two ways: they may be significant to descendent communities for patrimonial, cultural, lineage, and religious reasons and human remains may also be important to the scientific community, such as prehistorians, epidemiologists, and physical anthropologists. The specific stake of some descendent groups in ancestral burials is a matter of law for some groups, such as Native Americans (CEQA Guidelines §15064.5(d), Pub. Res. Code §5097.98). In other cases, the concerns of the associated descendent group regarding appropriate treatment and disposition of discovered human burials may become known only through outreach. Beliefs concerning appropriate treatment, study, and disposition of human remains and associated burial items may be inconsistent and even conflictual between descendent and scientific communities. CEQA and other State regulations concerning Native American human remains provide the following procedural requirements to assist in avoiding potential adverse effects to human remains within the contexts of their value to both descendents communities and the scientific community:

- When an initial study identifies the existence or probable likelihood that a project would impact Native American human remains, the lead agency is to contact and work with the appropriate Native American representatives identified through the Native American Heritage Commission (NAHC) to develop an agreement for the treatment and disposal of the human remains and any associated burial items (CEQA Guidelines §15064.5(d), Pub. Res. Code §5097.98).

- If human remains are accidentally discovered, the county coroner must be contacted. If the county coroner determines that the human remains are Native American, the coroner must contact the NAHC within 24 hours. The NAHC must identify the most likely descendant (MLD) to provide for the opportunity to make recommendations for the treatment and disposal of the human remains and associated burial items. If the MLD fails to make recommendations within 48 hours of notification or the project applicant rejects the recommendations of the MLD, the Native American human remains and associated burial items must be reburied in a location not subject to future disturbance within the project site (Pub. Res. Code §5097.98).

- If potentially affected human remains/burial may have scientific significance, whether or not having significance to Native Americans or other descendent communities, then under CEQA, the appropriate mitigation of effect may require the recovery of the scientific information of the remains/burial through identification, evaluation, data recovery, analysis, and interpretation (CEQA Guidelines §15064.5(c)(2)).

Assembly Bill 52

In September of 2014, the California Legislature passed Assembly Bill (AB) 52, which added provisions to the Public Resources Code concerning the evaluation of impacts on tribal cultural resources under CEQA, and consultation requirements with California Native American tribes. In particular, AB 52 now requires lead agencies to analyze a project's impacts on "tribal cultural resources," separately from paleontological resources (Pub. Res. Code §§21074, 21083.09). The Bill defines "tribal cultural resources" in a new section of the Public Resources Code, Section 21074. The Bill also requires lead agencies to engage in additional consultation procedures with respect to California Native American tribes (Pub. Res. Code §§21080.3.1, 21080.3.2, 21082.3). Finally, AB 52 requires the Office of Planning and Research to update Appendix G of the CEQA Guidelines by July 1, 2016 to provide sample questions regarding impacts to tribal cultural resources (Pub. Res. Code §21083.09).

AB 52's provisions only apply to projects that have a notice of preparation filed on or after July 1, 2015, and thus the Bill's requirements are not applicable to the proposed Project (which published the NOI/NOP on March 1, 2013). While AB 52's requirements do not apply, this EIR/EIS has evaluated the proposed Project's potential impacts on tribal cultural resources, as defined by Section 21074 of the Public Resources Code (added by AB 52). In addition, as provided in greater detail in Section 3.5.1.6, Previously Identified Cultural Resources in the APE, Daly City and NPS have consulted with California Native American Tribes that are traditionally or culturally affiliated with the geographic area of the Project.

3.5.2.3 Local Regulations

San Francisco Historic Preservation Commission and Planning Code Articles 10 and 11

The OHP has included San Francisco on its list of Certified Local Governments, which means that San Francisco has an approved historic preservation ordinance, Historic Preservation Commission, and other formal processes related to historic preservation and cultural resources management.

San Francisco Planning Department CEQA Review Procedures for Historical Resources

San Francisco Preservation Bulletin No. 16 provides guidance for the CEQA review process for historical resources. As a certified local government under the NHPA, and the lead agency in CEQA determinations, San Francisco has instituted guidelines and a system for initiating CEQA review of historical resources. The San Francisco Planning Department's "CEQA Review Procedures for Historical Resources" incorporates the State's CEQA guidelines into the City's existing regulatory framework. To facilitate the review process, the Planning Department has established categories to determine the significance of historic properties based on their inclusion within cultural resources surveys and/or historic districts. These categories include:

- *Category A.1* – Resources listed on or formally determined to be eligible for the CALIFORNIA REGISTER;
- *Category A.2* – Adopted local registers, and properties that have been determined to appear or may become eligible for the CALIFORNIA REGISTER;
- *Category B* – Properties requiring further consultation and review; and
- *Category C* – Properties determined not to be historical resources or properties for which the City has no information indicating that the property is a historical resource.

3.5.3 CEQA Significance Criteria and NEPA/NHPA Impact Thresholds

3.5.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section V, a project would cause adverse impacts on cultural resources if it would:

a) Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5;

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to CEQA Guidelines Section 15064.5;

c) Disturb any human remains, including those interred outside of formal cemeteries.

3.5.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook Environmental Screening Form (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have measurable impacts on cultural resources, with impact intensity based on the impact descriptions in the following table.

Historic Architectural Resources

Impact Intensity	Impact Description
Negligible:	The undertaking would cause no alteration, either directly or indirectly, to any of the characteristics of a district, building, structure, object, or site that is listed or eligible for listing on the National Register of Historic Places, or alterations would be so minor as to be imperceptible and would not diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.
Minor Adverse:	The undertaking would result in a modification to an eligible or listed district, building, structure, object, or site, but would not modify or alter any of the characteristics that qualify the property for National Register eligibility and would not diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.
Moderate Adverse:	The undertaking would alter, directly or indirectly, one or more character-defining features of a district, building, structure, object, or site that is listed or eligible for listing on the National Register, in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. However, this impact would not diminish the integrity of the resource such that its eligibility for the National Register would be jeopardized.
Major Adverse:	The undertaking would have a substantial, noticeable, and permanent impact to a district, building, structure, object, or site listed or eligible for listing in the National Register. The undertaking would result in the alteration, modification, destruction, or damage of one or more characteristics that qualify the resource's eligibility for the National Register, diminishing the integrity of the property's location, design, setting, materials, workmanship, feeling, or association to such an extent that it is no longer eligible for listing in the National Register.

Archaeological Resources

Impact Intensity	Impact Description
Negligible:	The undertaking would not modify or alter archaeological districts or sites listed or eligible for listing in the National Register.
Minor Adverse:	The undertaking would result in a slight modification or alteration of an archaeological district or site eligible for listing or listed in the National Register, but would not affect any of the characteristics that qualify the resource for National Register eligibility. The integrity of the resource would not be compromised.
Moderate Adverse:	The undertaking would result in the modification or alteration of one or more of the characteristics that qualify the archaeological district or site for inclusion in the National Register. The resource's integrity would be diminished, but not to the extent that the National Register eligibility of the resource would be jeopardized.
Major Adverse:	The undertaking would have a substantial, noticeable, and permanent impact to a district or site listed or eligible for listing in the National Register. The undertaking would result in the alteration or modification of one or more characteristics that qualify the resource for inclusion in the National Register, diminishing the integrity of the resource to such an extent that it is no longer eligible for listing in the National Register.

Cultural Landscapes

Impact Intensity	Impact Description
Negligible:	The undertaking would not alter (or alterations would be imperceptible) cultural landscapes listed or eligible for listing in the National Register.
Minor Adverse:	The undertaking would slightly alter the cultural landscape, but would not affect any of the characteristics that qualify the landscape for inclusion in the National Register.
Moderate Adverse:	The undertaking would result in the alteration or modification of one or more of the characteristics that qualify the cultural landscape for inclusion in the National Register. The cultural landscape's integrity would be diminished, but not to the extent that the National Register eligibility of the cultural landscape would be jeopardized.
Major Adverse:	The undertaking would have a substantial, noticeable, and permanent impact to a cultural landscape listed or eligible for listing in the National Register. The undertaking would result in the alteration or modification of one or more characteristics that qualify the cultural landscape for inclusion in the National Register, diminishing the integrity of the cultural landscape to such an extent that it is no longer eligible for listing in the National Register.

NHPA Criteria of Adverse Effect

The ACHP has issued regulations for the implementation of Section 106, entitled *Protection of Historic Properties* (36 CFR 800). ACHP regulations discuss the following types of effect:

- ***No Historic Properties Affected:*** When there are no historic properties present, or the action would have no effect on historic properties, the action is said to have *no effect* on historic properties.

- ***No Adverse Effect:*** Occurs when there would be an effect on a historic property, but the action would not alter characteristics that make the property eligible for inclusion in the National Register of Historic Places in a way that would diminish the integrity of the property.

- ***Adverse Effect:*** Occurs when an action would alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the National Register of Historic Places in a way that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative.

Negligible or minor adverse effects described above under the NEPA impact thresholds above correspond to a "No Adverse Effect" under NHPA parlance, while moderate and major adverse effects under NEPA correspond to an "Adverse Effect" under the NHPA.

3.5.4 Methodology and Assumptions

3.5.4.1 Architectural/Structural Resources

Potential impacts on architectural resources are assessed by identifying any project activities such as new construction, demolition, or substantial alteration within identified historic districts that could affect resources that have been identified as historical resources for the purposes of CEQA.

Properties identified as historical resources under CEQA include those that are significant because of their association with important events, people, or architectural styles or master architects, or for their informational value (National Register and California Register Criteria A/1, B/2, C/3, and D/4) and that retain sufficient historic integrity to convey their significance. However, Criterion D/4 is typically applied to the evaluation of historic-period archaeological resources and not to architectural resources, as described below. Once a resource has been identified as significant, it must be determined whether the impacts of the project would “cause a substantial adverse change in the significance” of the resource (CEQA Guidelines §15064.5[b]). A substantial adverse change in the significance of a historical resource means “physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the historical resource would be materially impaired” (CEQA Guidelines §15064[b][1]). A historical resource is materially impaired through the demolition or alteration of the resource’s physical characteristics that convey its historical significance and that justify its inclusion in the California Register (CEQA Guidelines §15064.5[b][2][A]).

Any prehistoric or historic building, structure, object, site, landscape, or district that is included in, or is eligible for inclusion in, the National Register is termed a *historic property* and is managed for protection under the NHPA. Types of historic properties include archaeological sites, historic built-environment resources, archaeological and historic districts, cultural landscapes, and traditional cultural properties. These resources may also be considered under the Archaeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and EO 13007 (Indian Sacred Sites).

Section 106 of the NHPA requires the federal agency to consider the effects of its undertakings on historic properties and to provide the ACHP a reasonable opportunity to comment. The agency must also identify the appropriate SHPO/Tribal Historic Preservation Officers to consult with during the process. It should also plan to involve the public, and identify other potential consulting parties. Section 106 also applies to properties not formally determined eligible, but which meet eligibility requirements for the National Register and are therefore treated as eligible until a formal determination can be made.

3.5.4.2 Archaeological Resources

Under CEQA, the significance of most prehistoric and historic-period archaeological sites is usually assessed under California Register Criterion 4. This criterion stresses the importance of the information potential contained within the site, rather than its significance as a surviving example of a type or its association with an important person or event. Archaeological resources may also be assessed under CEQA as unique archaeological resources, defined as archaeological artifacts, objects, or sites that contain information needed to answer important scientific research questions.

Under the NHPA and NEPA, archaeological resources are typically considered eligible for inclusion in the National Register because of their cultural value to traditionally associated peoples (Criteria A and/or B), and the information they have or may be likely to yield (Criterion D). In certain instances archaeological resources can also be assessed as eligible for the National Register under Criterion C (exemplifying a type, construction method, or style). Intensity of impacts on archaeological resources relates, additionally, to the importance of the information they contain and the extent of disturbance or degradation. Even the disturbance of a small portion of a rare or unstudied site type (impacts to less than 10 percent of the total site area) can be considered an adverse effect, while impacts to 25 percent or more of the site area of a well-known and common site type may be considered not adverse.

Characteristics that qualify a property for inclusion in the National Register include the seven integrity factors listed above (location, design, setting, materials, workmanship, feeling, and association). Undertakings are designed to avoid adverse effects to the maximum extent possible. If complete avoidance of adverse effects is not possible, steps are taken to minimize those effects, including the implementation of mitigation measures. Data recovery does not constitute mitigation of adverse effects under the current NHPA regulations (36 CFR 800). Finally, if complete mitigation is not possible, memoranda of agreement are developed with the SHPO to resolve adverse effects. Resolving and/or mitigating adverse effects in this manner does not necessarily mean that there would be no remaining adverse effects; in many cases, mitigation can result in reduced impacts.

3.5.4.3 Human Remains

Human remains, including those buried outside of formal cemeteries, are protected under several state laws, including Public Resources Code Section 5097.98 and Health and Safety Code Section 7050.5. These laws are identified above in Section 3.5.2.2, State Regulations. This analysis considers impacts including intentional disturbance, mutilation, or removal of interred human remains.

3.5.5 Impact Analysis

3.5.5.1 Proposed Project

CEQA Analysis

a) **Impact CUL-1: The Project would cause a substantial adverse change in the significance of a historical resource because it would demolish the majority of the historic Vista Grande Canal and Tunnel. (Significant and Unavoidable)**

The temporary construction shaft and the replacement of the Ocean Outlet would have no direct or indirect impacts to historical resources at Fort Funston, which include Battery Davis and two fire control stations, as these resources are at a distance of 300 to 1,000 feet away from the APE. These features would remain eligible for listing in the National Register after completion of the Project. Replacement of the Ocean Outlet, specifically, would have no impact on historical resources, as this structure is not considered a historical resource.

The Vista Grande Canal and Tunnel is recommended eligible for listing in the National Register of Historic Places under Criterion A (events) and C (architecture/engineering). As such, the property meets the definition of a historical resource a defined under CEQA Guidelines Section 15064.5. The proposed Project would replace approximately 1,350 feet of the upstream portion of the Canal with a concrete collection box, box culvert, debris screening device, and diversion structure. Replacement of the Canal with a box culvert would support development of a constructed treatment wetland in an area between John Muir Drive and the southern edge of the Canal. The Project also would demolish and later replace 150 feet of the downstream portion of the Canal to accommodate a temporary access ramp for construction of the rehabilitated Lake Merced Portal. The total length of Canal replacement would be approximately 1,500 feet, or approximately 42 percent of its 3,600-foot length.

The proposed Project also would replace the Vista Grande Tunnel in its entirety to increase its flow capacity. The existing brick-lined tunnel would be excavated and a new tunnel with a larger-diameter concrete lining would be constructed in its place. Tunneling would begin from a temporary 30-foot-diameter construction shaft located at Fort Funston. Once completed, two new 24-inch wastewater pipelines would be installed within the tunnel to replace the existing force main. At Fort Funston, the existing Ocean Outlet would also be demolished and replaced with a new outlet structure.

Although approximately 58 percent or about 2,100 feet of the Canal would remain intact after completion of the Project, the Project would demolish the remaining 1,500 feet of the Canal and all of the 3,000-foot-long Tunnel, thereby substantially affecting of the vast majority (68 percent) of the Vista Grande Canal and Tunnel as an entire drainage system. As the proposed Project would result in the physical demolition of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a *significant* impact.

This impact could be reduced with implementation of **Mitigation Measure 3.5-1** (HABS/HAER Recordation) and **3.5-2** (Public Interpretation). However, even with implementation of **Mitigation Measures 3.5-1** and **3.5-2,** the impact would remain *significant and unavoidable*, as there are no measures available that would avoid the loss of the structure to a *less-than-significant* level.

Mitigation Measure 3.5-1: HABS/HAER Recordation.

Prior to initiation of Project construction or demolition, the City of Daly City, in consultation with the NPS, shall record the Vista Grande Canal and Tunnel in accordance with the NPS Historic American Building Survey/Historic American Engineering Record (HABS/HAER) program. This program entails: 1) documentation of the canal and tunnel through large-format black and white photographs (including the interior of the length of the tunnel), 2) preparation of a historic resources report, 3) preparation of measured drawings (or copies of original plans), and 4) archiving of the documentation package at the U.S. Library of Congress, the City of Daly City, Golden Gate park archives, and other local repositories such as public libraries. The specific HABS/HAER requirements of the

Vista Canal and Tunnel will be further detailed in consultation with the NPS Pacific Western Region's HABS/HAER coordinator.

Mitigation Measure 3.5-2: Public Interpretation.

Prior to the completion of the Project, the City of Daly City, in coordination with the NPS, shall prepare a public interpretation package that may entail interpretive materials, including but not limited to signage, brochures, videos, historical narrative, or other printed or web-based methods of explaining the historical and engineering significance of the Vista Grande Canal and Tunnel to the general public.

Significance after Mitigation: Significant and Unavoidable.

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b) Impact CUL-2: The Project would cause a substantial adverse change in the significance of an archaeological resource, including shipwrecks. (Less than Significant with Mitigation)

The Project would have an impact on archaeological resources if it caused substantial adverse change in the significance of an archaeological resource including those that qualify as historical resources according to CEQA Guidelines Section 15064.5, unique archaeological resources as defined in CEQA Section 21083.2(g), and historic properties that meet the National Register listing criteria at 36 CFR 60.4.

No prehistoric or historic-period archaeological resources or shipwrecks have been previously identified in the APE or were observed during the surface pedestrian survey for the Project. Geotechnical coring completed for the Project did not identify potential archaeological resources or indication of a paleosol associated with the upper feet of the Colma Formation along the proposed tunnel and canal Project components (Treadwell & Rollo, 2013). While prehistoric and historic-era archaeological resources have been identified previously in the coastal bluff areas of the San Francisco peninsula in the Project vicinity, there is no evidence that archaeological resources are within the specific Project APE, or would be impacted by the proposed Project.

While unlikely, ground-disturbing activities (including those associated with potential Lake Management Plan actions) could expose and cause impacts on unknown archaeological resources or shipwrecks, which would be a potentially *significant* impact. This impact could be reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.5-3** (Inadvertent Discovery of Archaeological Resources). This measure would require construction activities to halt if archaeological resources are identified so that a qualified archaeologist, and NPS archaeological resources staff if located on federally administered lands, can inspect the find and provide additional recommendations as necessary, with the goal of avoiding, minimizing, or mitigating adverse effects.

Mitigation Measure 3.5-3: Inadvertent Discovery of Archaeological Resources or Shipwrecks.

The following measures shall be implemented should construction activities result in the inadvertent discovery of an archaeological resource:

a) Prior to construction, a training session on the recognition of the types of archaeological resources that could be encountered and the procedures to be followed if they are found shall be presented to Project construction personnel by a qualified professional archaeologist. If prehistoric or historic-period archaeological resources or shipwrecks are encountered, all construction activities within 50 feet shall halt. If the resource is located within San Francisco, the San Francisco Planning Department also shall be notified.

b) If the resource is located on federally administered lands, NPS also shall be notified. Abandoned shipwrecks, archaeological sites, and historic resources in submerged lands of California are under the jurisdiction of the California State Lands Commission (CSLC). In the case of an inadvertent discovery of a submerged archaeological site, shipwreck, or related artifacts, the applicable jurisdictional agency shall also contact and initiate consultation with the CSLC staff within two business days of such discovery.

c) The qualified archaeologist shall inspect the find within 24 hours of discovery and consult with the applicable jurisdictional agency and the culturally affiliated Native American group or groups.

d) If the find is determined to be a historical resource according to CEQA Guidelines or a historic property that meets the National Register listing criteria at 36 CFR 60.4, the archaeologist, in consultation with the applicable jurisdictional agency and the culturally affiliated Native American group shall determine whether preservation in place is feasible. This may be accomplished through planning construction to avoid the resource; incorporating the resource within open space; capping and covering the resource; or deeding the site into a permanent conservation easement.

e) If preservation in place is not feasible, Daly City and the qualified archaeologist shall prepare and implement an Archaeological Research Design and Treatment Plan (ARDTP). Daly City, the qualified archaeologist, agencies with jurisdiction in the location(s) of the discovered resource(s), and the culturally affiliated Native American group(s, if applicable) shall meet to determine the scope of the ARDTP. The ARDTP shall identify a program for the treatment and recovery of important scientific data contained within the portions of the archaeological resources located within the Project Area of Potential Effects (APE); preserve any significant historical information obtained; and identify the scientific/historic research questions applicable to the resources, the data classes the resource is expected to possess, and how the expected data classes shall address the applicable research questions.

f) Treatment for most archaeological resources shall consist of (but is not limited to) sample excavation, artifact collection, site documentation, and historical research, with the aim to target the recovery of important scientific data contained in the portion(s) of the significant resource(s) to be impacted by the Project. The treatment plan shall include provisions for analysis of data in a regional context, reporting of results within a timely manner, curation of artifacts and data at an approved facility, and dissemination of reports to local and state repositories, libraries, and interested professionals. The results of the investigation shall be documented in a technical report that provides a full artifact catalog, analysis of items collected, results of any special studies conducted, and interpretations of the resource(s) within a regional and local context. All technical documents shall be placed on file at the Northwest Information Center of the California Historical Resources Information System.

Significance after Mitigation: Less than Significant.

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d) Impact CUL-3: Project construction would disturb human remains. (Less than Significant with Mitigation)

No known human burial locations have been identified in the Project area; however, the possibility cannot be entirely discounted. Project construction could result in direct impacts to previously undiscovered human remains during earthmoving activities. Impacts on human remains would be potentially *significant*, but could be reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.5-4** (Inadvertent Discovery of Human Remains), which requires all work halt in the vicinity of the find and the County Coroner be contacted.

Mitigation Measure 3.5-4: Inadvertent Discovery of Human Remains.

The following measure shall be implemented should construction activities result in the inadvertent discovery of human remains:

The treatment of any human remains and associated or unassociated funerary objects discovered during soil-disturbing activities shall comply with applicable state laws. Such treatment shall include stopping work within 50 feet of the discovery and immediate notification of the County Coroner. In the event of the coroner's determination that the human remains are Native American, the coroner shall notify the Native American Heritage Commission, which shall appoint a Most Likely Descendant (MLD) (Pub. Res. Code §5097.98). The qualified archaeologist, Daly City, the landowner of the property on which the discovery is made, and the MLD shall make all reasonable efforts to develop an agreement for the treatment, with appropriate dignity, of any human remains and associated or unassociated funerary objects (CEQA Guidelines §15064.5[d]). The agreement shall take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. Public Resources Code Section 5097.98 allows 48 hours to reach agreement on these matters. If the MLD and the other parties do not agree on the reburial method, the landowner of the property on which the discovery is made shall follow Public Resources Code Section 5097.98(b), which states that "the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance."

Significance after Mitigation: Less than Significant.

NEPA/NHPA Analysis

Under NEPA and the NHPA, the Project would have a major adverse impact on a historic property (the Vista Grande Canal and Tunnel), because it would have a substantial, noticeable, and permanent impact on a structure eligible for listing in the National Register. The Project would result in the destruction of all, or nearly all, of the characteristics that qualify the resource's eligibility for the National Register, diminishing the integrity of the property to such an extent that it is no longer eligible for listing in the National Register.

Impacts to historic properties could be reduced with implementation of Mitigation Measures 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). Even with implementation of Mitigation Measures 3.5-1 and 3.5-2**.** However**,** the Project would result in a major adverse impact because it would not avoid removal of a historic property.

The temporary construction shaft and the replacement of the Ocean Outlet would have no direct or indirect impacts to historic properties at Fort Funston, such as Battery Davis and the two fire control stations, as these resources are located between 300 to 1,000 feet away from the APE. These features would remain eligible for listing in the National Register after completion of the Project. Replacement of the Ocean Outlet, specifically, would have no impact on a historic property, as this structure is not considered a historic property.

The Project would not modify or alter archaeological districts or sites listed or eligible for listing in the National Register. Therefore, the Project is expected to result in negligible effects to archaeological resources. However, in the event that inadvertent discovery of archaeological resources occurs, the modification or alteration of a previously unknown archaeological resource could result in a minor to major impact, depending on the intensity of the alteration that would occur as a result of Project-related disturbance and the effect the alteration would have on the resource's eligibility for listing in the National Register. Implementation of Mitigation Measure 3.5-3 (Inadvertent Discovery of Archaeological Resources or Shipwrecks), which outlines procedures in the event that resources are inadvertently uncovered during construction, would reduce potential impacts associated with inadvertent discovery.

The Project would result in negligible effects to cultural landscapes as it would not alter cultural landscapes listed or eligible for listing in the National Register.

Section 106 Process

The NPS is in the process of completing its requirements under Section 106 of the NHPA (36 CFR 800) separately from, but concurrently in coordination with, the NEPA process. As described in Section 3.5.2.1, Federal Regulations, the implementing regulations for Section 106 require consultation with the SHPO, the ACHP, federally recognized Indian tribes and other Native Americans, and interested members of the public throughout the compliance process.

To date, the Section 106 process has been initiated between the NPS and SHPO, and historical properties eligible for inclusion in the National Register have been identified and evaluated (OHP, December 15, 2014) The SHPO has preliminarily concurred that the Vista Grande Canal and Tunnel is eligible for listing in the National Register under Criteria A and C (OHP, January 28, 2015) and intends to consider official concurrence after additional requested information is provided by NPS. In the interim, this analysis is based upon the assumption that the system is eligible. Immediately following publication of the Draft EIR/EIS, the NPS and SHPO intend to assess the effects of the Project preferred alternative (or “undertaking”) on historic properties within the APE, and will resolve adverse effects in accordance with 36 CFR 800.6. As described above, a major adverse impact under NEPA criteria correspond to an adverse effect under NHPA criteria. Therefore, the NPS and SHPO would likely find that the proposed undertaking would have an adverse effect on a historic property through Section 106 of the NHPA. Adverse effects on historic properties are often resolved through preparation of a memorandum of agreement or programmatic agreement developed in consultation between the federal agency, the SHPO, Indian tribes, and interested members of the public. The ACHP also is invited to participate. The agreement describes stipulations to mitigate adverse effects on historic properties eligible for the National Register (36 CFR 60), and may include the mitigations listed in Section 3.5.5.1, and potentially others that may be negotiated during the consultation process.

3.5.5.2 Tunnel Alignment Alternative

The following describes the cultural resources effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.5.5.1, Proposed Project, or Section 3.5.5.3, Canal Configuration Alternative, depending on the option selected. Thus, cultural resources effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative would construct a new tunnel to the south of the existing tunnel. Although the existing tunnel would be left in place, it would no longer function as it has historically, because water would no longer flow through this portion of the drainage system. Additionally, for safety purposes, the existing tunnel would be filled with concrete to prevent collapse. Filling the historic tunnel with concrete would substantially alter the character-defining features which justify its eligibility for listing in the CRHR and NRHP, namely its dimensions (length, width, height) and its brick construction.

Although the location of the connection of this new tunnel to the Canal is not yet determined, it is expected that, similar to the proposed Project, approximately 150 feet of the Canal would need to be demolished and later replaced to accommodate a temporary construction access ramp for portal construction.

The Tunnel Alignment Alternative could be paired with either the Canal improvements under the proposed Project or with the Canal Configuration Alternative. Paired with the Canal improvements under the proposed Project, the Tunnel Alignment Alternative would not avoid the *significant* impacts to the Vista Grande Canal and Tunnel as a historical resource, as the combination of these options would demolish and replace approximately 1,500 feet or 42 percent of the existing Canal and would fill the entire length of the tunnel with concrete, adversely affecting 4,570 feet or approximately 69 percent of the Vista Grande Canal and Tunnel system as a whole. As this combination of alternatives would result in the physical demolition of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a *significant* impact.

Paired with the Canal Configuration Alternative as described in more detail in Section 3.5.5.3, below, the Tunnel Alignment Alternative would demolish only about 500 feet of the existing Canal (150 for the temporary portal construction access ramp and 350 for the alternative debris screening device and diversion structure), and would fill the entire length of the tunnel with concrete, adversely affecting 4,070 feet or approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. Although this combination would result in a more limited extent of physical demolition and permanent alteration, it would not substantially reduce the likelihood that the significance of the historical resource would be materially impaired compared to the Tunnel Alignment Alternative paired with the proposed Canal improvements. As this combination of alternatives would result in the physical demolition and alteration of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a *significant* impact.

In either case, the impact could be reduced with implementation of Mitigation Measure 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). Even with implementation of Mitigation Measures 3.5-1 and 3.5-2, the impact of the Tunnel Alignment Alternative combined with either the proposed Canal improvements or the Canal Configuration Alternative would remain *significant and unavoidable*, as there are no measures available which would fully mitigate the loss of the Tunnel and partial loss of the Canal structure to a *less-than-significant* level. The lead agencies considered whether additional feasible mitigation could be implemented to further reduce the impact associated with filling the existing Tunnel with concrete. One option considered was to retain approximately 10 feet of the eastern or western portal of the Tunnel unfilled to allow it to be viewed by the public and/or used for future study. This measure would reduce the impact, but would not reduce it to a *less-than-significant* level, as the vast majority of the Tunnel would be substantially altered. Retaining a portion of the eastern portal unfilled was determined to be infeasible for the same safety reasons described above because in this location, the tunnel is closest to the ground surface, and collapse of the retained and abandoned portion could result in a collapse of the ground surface. Additionally, retaining a portion of the western portal unfilled would only be effective temporarily; as described in Section 2.6.5, Project Maintenance, as the bluff continues to recede after completion of construction, portions of the Tunnel would again become exposed on the beach, and Daly City would need to periodically demolish and remove the exposed portions of its infrastructure. Therefore, within approximately 25 years, the retained portion would be expected to be demolished. Additionally, retention of a portion of the Tunnel for the purposes of public or research-related access could create a safety hazard.

Similar to the proposed Project, no impacts to other historical resources located within Fort Funston are anticipated with the Tunnel Alignment Alternative.

Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown archaeological resources and human remains. Implementation of Mitigation Measures 3.5-3 and 3.5-4 would ensure that procedures are in place to reduce potential impacts to a *less-than-significant* level.

The Ocean Outlet structure associated with the Tunnel Alignment Alternative could be as close as 200 feet from the 1882 schooner *Neptune* that wrecked in 1900. The existing outlet is approximately 900 feet north of the shipwreck remains. Impacts to shipwreck remains could be potentially *significant*. This impact could be reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.5-5** (Establish Cultural Resources Sensitivity Area), which would ensure that shipwreck remains are avoided during ground disturbing activities in the vicinity of the shipwreck.

Mitigation Measure 3.5-5: Establish Cultural Resources Sensitivity Zone.

In the event that construction activities other than vehicle movement occurs within 200 feet of the remains of the 1882 schooner *Neptune* (CA-SFR-107H), as determined by the qualified archaeologist retained pursuant to Mitigation Measure 3.5-3, the qualified archaeologist shall prepare and implement a Cultural Resources Sensitivity Zone to protect the resource and develop an Archaeological Monitoring Plan for this zone. The Cultural Resources Sensitivity Zone shall be established prior to ground disturbing activity at the beach below Fort Funston and shall include temporary fencing or other means of delineating a buffer around the known site to prohibit work or access to that location during construction. The Cultural Resources Sensitivity Zone Archaeological Monitoring Plan shall include:

- A cultural resources training program that shall be completed by all construction and field workers involved in ground disturbance at the beach below Fort Funston;
- The name and contact information for the person(s) responsible for conducting monitoring activities;
- Monitoring protocols to ensure monitoring is conducted in accordance with current professional standards provided by the California Office of Historic Preservation;
- A template and content requirements for monitoring reports;
- A schedule for submittal of monitoring reports and person(s) responsible for review and approval of monitoring reports; and
- Methods to ensure security of the Cultural Resources Sensitivity Zone and associated cultural resources sites.

During the course of the monitoring, the archaeologist may adjust the frequency of the monitoring —from continuous to intermittent—based on the conditions and professional judgment regarding the potential to encounter resources.

Significance after Mitigation: Less than Significant.

NEPA Analysis

The Tunnel Alignment Alternative would avoid the major adverse impact associated with the Tunnel portion of the proposed Project because it would leave the existing Tunnel intact. However, as stated above, the Tunnel Alignment Alternative could be paired with either the Canal improvements under the proposed Project or with the Canal Configuration Alternative. Impacts associated with Canal improvements under the proposed Project are described in more detail in Section 3.5.5.1, Proposed Project, and Section 3.5.5.3, Canal Configuration Alternative.

Paired with the Canal improvements under the proposed Project, the Tunnel Alignment Alternative would have a noticeable and permanent impact to a structure eligible for listing in the National Register, as the combination of these options would demolish and replace approximately 1,500 feet or 42 percent of the existing Canal and would fill the entire length of the tunnel with concrete, adversely affecting 4,570 feet or approximately 69 percent of the Vista Grande Canal and Tunnel system as a whole. This combination of options would result in the destruction of many of the characteristics of the Canal and Tunnel system that qualify the property's eligibility for the National Register, diminishing the integrity of the property as an entire drainage system to such an extent that it would no longer be eligible for listing in the National Register.

Should this alternative be paired with the Canal Configuration Alternative as described in more detail in Section 3.5.5.3 below, the Tunnel Alignment Alternative would demolish only about 500 feet of the existing Canal, and would fill the entire length of the tunnel with concrete, adversely affecting 4,070 feet or approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. Although this combination would result in a more limited extent of physical demolition and permanent alteration, it would not avoid the destruction of many of the characteristics of the Canal and Tunnel that qualify the resource's eligibility for the National Register, diminishing the integrity of the property as an entire drainage system to such an extent that it would no longer be eligible for listing in the National Register.

In either case, the major adverse effects to historic properties could be reduced with implementation of Mitigation Measures 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). However, even with implementation of these measures, the Tunnel Alignment Alternative paired with either the proposed Canal improvements or the Canal Configuration Alternative would continue to have a major adverse impact on a historic property.

The Tunnel Alignment Alternative would not modify or alter known archaeological districts or sites listed or eligible for listing in the National Register because none have been identified within the APE. Therefore, this alternative is expected to result in negligible effects to archaeological resources. However, in the event that inadvertent discovery of archaeological resources occurs, the modification or alteration of a previously unknown archaeological resource could result in a minor to major impact, depending on the intensity of the alteration that would occur as a result of disturbance and the effect the alteration would have on the resource's eligibility for listing in the National Register. Implementation of Mitigation Measure 3.5-3, which outlines procedures in the event that resources are inadvertently uncovered during construction, would reduce impacts that could occur in the event of an inadvertent discovery of an archaeological resource.

Due to its proximity to the shipwreck remains, the Tunnel Alignment Alternative could adversely affect remains of the wrecked 1882 schooner *Neptune*. Although it is expected that construction activities associated with the Tunnel Alignment Alternative would have negligible effects on this resource because no work is proposed near the remains and no alteration is anticipated, inadvertent alteration of the shipwreck remains could result in a minor to moderate impact depending on the effect on the resource's integrity. Implementation of Mitigation Measure 3.5-5 would ensure that the resource is avoided during construction activities and that the impact to archaeological resources (including shipwrecks) would be negligible.

The Tunnel Alignment Alternative would result in negligible effects to cultural landscapes as the undertaking would not alter cultural landscapes listed or eligible for listing in the National Register.

3.5.5.3 Canal Configuration Alternative

The following describes the cultural resources effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.5.5.1, Proposed Project, or Section 3.5.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, cultural resources effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative would reduce the significant impacts to the Vista Grande Canal by eliminating the majority of the demolition compared to the Canal improvements under the proposed Project. This alternative would replace approximately 350 feet or about 10 percent of the southern end of the existing Canal (compared with 1,350 feet removed from the southern end of the Canal under the proposed Project).

As described above the Canal Configuration Alternative could be paired with either the Tunnel improvements under the proposed Project or the Tunnel Alignment Alternative. As also described therein, if paired with the Tunnel improvements under the proposed Project, the Canal Configuration Alternative would have an adverse material impact on the Vista Grande Canal and Tunnel as a historical resource, as the combination of these options would demolish and replace the entire Tunnel and approximately 500 feet of the Canal (including the 150 feet at the upstream end of the Canal for the temporary portal construction access ramp), or approximately 53 percent of the Vista Grange Canal and Tunnel system as a whole. As this combination of alternatives would result in the physical demolition of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a *significant* impact. This impact could be reduced with implementation of Mitigation Measure 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). However, even with implementation of Mitigation Measures 3.5-1 and 3.5-2, the impact of the Canal Configuration Alternative combined with the Tunnel improvements under the proposed Project would remain *significant and unavoidable*, as there are no measures available which would fully mitigate the total loss of the Tunnel and partial loss of the Canal structure to a *less-than-significant* level.

If paired with the Tunnel Alignment Alternative as described in more detail in Section 3.5.5.2, above, the Canal Configuration Alternative would demolish only about 500 feet of the existing Canal (150 for the temporary portal construction access ramp and 350 for the alternative debris screening device and diversion structure), and would fill the entire length of the tunnel with concrete, adversely affecting 4,070 feet or approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. Although this combination would result in a more limited extent of physical demolition and permanent alteration, it would not substantially reduce the likelihood that the significance of the historical resource would be materially impaired. As this combination of alternatives would result in the physical demolition and alteration of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a *significant* impact. This impact could be reduced with implementation of Mitigation Measure 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). However, even with implementation of Mitigation Measures 3.5-1 and 3.5-2, the impact of the Canal Configuration Alternative combined with the Tunnel Alignment Alternative would remain *significant and unavoidable*, as there are no measures available which would fully mitigate the total loss of the Tunnel and partial loss of the Canal structure to a *less-than-significant* level.

Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown archaeological resources and human remains. Implementation of Mitigation Measures 3.5-3 and 3.5-4 would ensure that procedures are in place to reduce potential impacts to a *less-than-significant* level.

NEPA Analysis

The Canal Configuration Alternative would avoid the major adverse impact associated with the Canal portion of the proposed Project because it would leave 90 percent of the existing Canal intact. However, the Canal Configuration Alternative could be paired with either the Tunnel improvements under the proposed Project or with the Tunnel Alignment Alternative. Impacts associated with Tunnel improvements under the proposed Project are described in more detail in Section 3.5.5.1, Proposed Project, and Section 3.5.5.2, Tunnel Alignment Alternative.

Paired with the Tunnel improvements under the proposed Project, the Canal Configuration Alternative would have a noticeable and permanent impact to a structure eligible for listing in the National Register, as the combination of these options would demolish and replace the entire tunnel, approximately 4 percent of the northern end of the existing Canal, and approximately 10 percent of the southern end of the existing Canal, or approximately 53 percent of the Vista Grande Canal and Tunnel system as a whole. Although this combination of options would minimize impacts to the historic Canal, specifically, it would continue to result in the destruction of characteristics of the Tunnel that qualify the resource’s eligibility for the National Register, diminishing the integrity of the property as an entire drainage system to such an extent that it would no longer be eligible for listing in the National Register.

If paired with the Tunnel Alignment Alternative, as described in more detail in Section 3.5.5.2, above, the Canal Configuration Alternative would demolish only about 500 feet of the existing

Canal, and would fill the entire length of the tunnel with concrete, adversely affecting 4,070 feet or approximately 61 percent of the Vista Grande Canal and Tunnel as a whole. T Although this combination would result in a more limited extent of physical demolition and permanent alteration, it would not avoid the destruction of many of the characteristics of the Canal and Tunnel that qualify the resource's eligibility for the National Register, diminishing the integrity of the property as an entire drainage system to such an extent that it would no longer be eligible for listing in the National Register.

In either case, the major adverse effects to historic properties could be reduced with implementation of Mitigation Measures 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). However, even with implementation of these measures, the Canal Configuration Alternative paired with either the proposed Tunnel improvements or the Tunnel Alignment Alternative would continue to have a major adverse impact on a historic property.

Thus, the impact of this combination of options would be moderate because although at least one character-defining feature of the property would be altered, the property's eligibility for the National Register would not be jeopardized. Implementation of Mitigation Measures 3.5-1 and 3.5-2 would further reduce the impact of the Tunnel Alignment Alternative combined with the Canal Configuration Alternative.

The Canal Configuration Alternative would not modify or alter known archaeological districts or sites listed or eligible for listing in the National Register because none have been identified within the APE. Therefore, this alternative is expected to result in negligible effects to archaeological resources. However, in the event that inadvertent discovery of archaeological resources occurs, the modification or alteration of a previously unknown archaeological resource could result in a minor to major impact, depending on the intensity of the alteration that would occur as a result of disturbance and the effect the alteration would have on the resource's eligibility for listing in the National Register. Implementation of Mitigation Measure 3.5-3, which outlines procedures in the event that resources are inadvertently uncovered during construction, would reduce impacts that could occur in the event of an inadvertent discovery of an archaeological resource.

The Canal Configuration Alternative would result in negligible effects to cultural landscapes as the undertaking would not alter cultural landscapes listed or eligible for listing in the National Register.

3.5.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. There would be no impact on historical resources.

Because no new construction or ground-disturbing activities would occur under the No Project/No Action Alternative, undiscovered archaeological resources and human remains would not be encountered, therefore there would be no impact.

No impact to cultural resources would occur as a result of ongoing operation and maintenance of the existing and proposed infrastructure.

3.5.6 Cumulative Effects

3.5.6.1 Geographic Extent/Context

The geographic scope for the analysis of potential cumulative cultural resources impacts is limited to the immediate Project vicinity because impacts related to cultural resources are generally site-specific and depend on the specific localized resources and resource potential. As a result, they are not typically additive or cumulative in nature.

Past, Present, and Reasonably Foreseeable Projects

There are no past projects that have substantially changed the geographic setting for cultural resources. Nearly all of the facilities in the immediate Project area, such as Lake Merced and associated recreational areas, Lake Merced Boulevard, and the Olympic Club golf course, are substantially similar to the conditions that were present in 1934, which is the end of the period of significance of the Vista Grande Canal and Tunnel. Minor alterations to the area since this time include construction of the apartment complex near the Lake Merced Portal on John Muir Drive, and the current roadway materials of Lake Merced Boulevard. Thus, existing conditions reflect the contributions of past projects.

There are several proposed projects including groundwater and recycled water projects and commercial and residential developments in the Project vicinity. These current and reasonably foreseeable projects' long- and short-term cumulative environmental impacts are not anticipated to combine with the impacts of the proposed Project or alternatives in a manner that is cumulatively considerable, because impacts related to cultural resources are generally site-specific and depend on and are limited to the localized resources and resource potential.

3.5.6.2 Construction

None of the current and reasonably foreseeable future projects including groundwater and recycled water projects, as well as commercial and residential developments, are within the immediate project area nor anticipated to significantly affect historical resources in manner that could combine with the impacts of the proposed Project or alternatives to create a significant cumulative impact. None of these current or future projects would demolish historic water conveyance systems similar to the Vista Grande Canal and Tunnel. Even if significant impacts to historical resources were identified as part of CEQA or NEPA review for the current and reasonably foreseeable future projects, these impacts would not be additive in nature.

All of the identified current and reasonably foreseeable future projects that involve ground disturbance have the potential to combine with the impacts of the proposed Project or an alternative to result in a cumulative impact to unknown/unrecorded buried archaeological resources. All of these above-listed projects as well as the proposed Project and alternatives have been, or would be, required to adhere to the body of laws and regulations pertaining to the protection of cultural resources, including the NHPA and CEQA. In addition, the cumulative projects identified on NPS-managed lands, in particular, would be required to adhere to strict federal resource protection measures developed specifically for these management areas, such as those described in the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR Part 68) and the NPS Management Policies (NPS, 2006b). Therefore, no *significant* cumulative impact to archaeological resources or human remains is anticipated.

3.5.6.3 Operation and Maintenance

The proposed Project and alternatives would have no operation or maintenance-related impacts related to CEQA criteria or NEPA thresholds for cultural resources, and therefore, operation and maintenance would not contribute to a cumulative impact.

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3.6 Geology and Soils

This section describes the existing geology, soil conditions, and seismicity in the vicinity of the Project site, including geologic and seismic hazards. The regulatory setting describes the laws, regulations, plans, and policies related to geologic and seismic considerations relevant to the Project. The impact analysis presents the significance criteria used to evaluate the significance of potential impacts on identified resources as a consequence of implementing the Project or alternatives, the methods used in evaluating these impacts, and the results of the impact assessment based on the applied significance criteria. Geologic features are considered as a resource in Section 3.12, Geologic and Paleontological Resources.

3.6.1 Affected Environment

The study area relevant to geology, soils, and geologic hazards comprises the Project site, which consists of the physical footprint of Project construction, operation and maintenance activities. The study area relevant to faulting and seismic hazards is the broader Coast Range Geomorphic Province,[1] because the Project site could be affected by ground shaking and secondary seismic hazards associated with faults within that province.

3.6.1.1 Topography

The geologically complex Coast Ranges Geomorphic Province lies between the Pacific Ocean and the Great Valley province (Sacramento and San Joaquin Valleys) and stretches from the California-Oregon border to the Santa Ynez Mountains near Santa Barbara. The tectonics of the San Andreas and other major faults in the western part of California have played a major role in the geologic history of the area. Much of the Coast Ranges Geomorphic Province is composed of marine sedimentary deposits, metamorphic rocks, and volcanic rocks that form northwest-trending mountain ridges and valleys running generally parallel to the San Andreas Fault Zone. The Project area is located within the central portion of the Coast Ranges, just north and east of the San Andreas Fault Zone. Topography in the Project area is dominated by a northwest-southeast trending ridgeline, with gently sloping to moderately steep, northeast-facing slopes to the east and near vertical coastal bluffs to the west (Treadwell and Rollo, 2013).

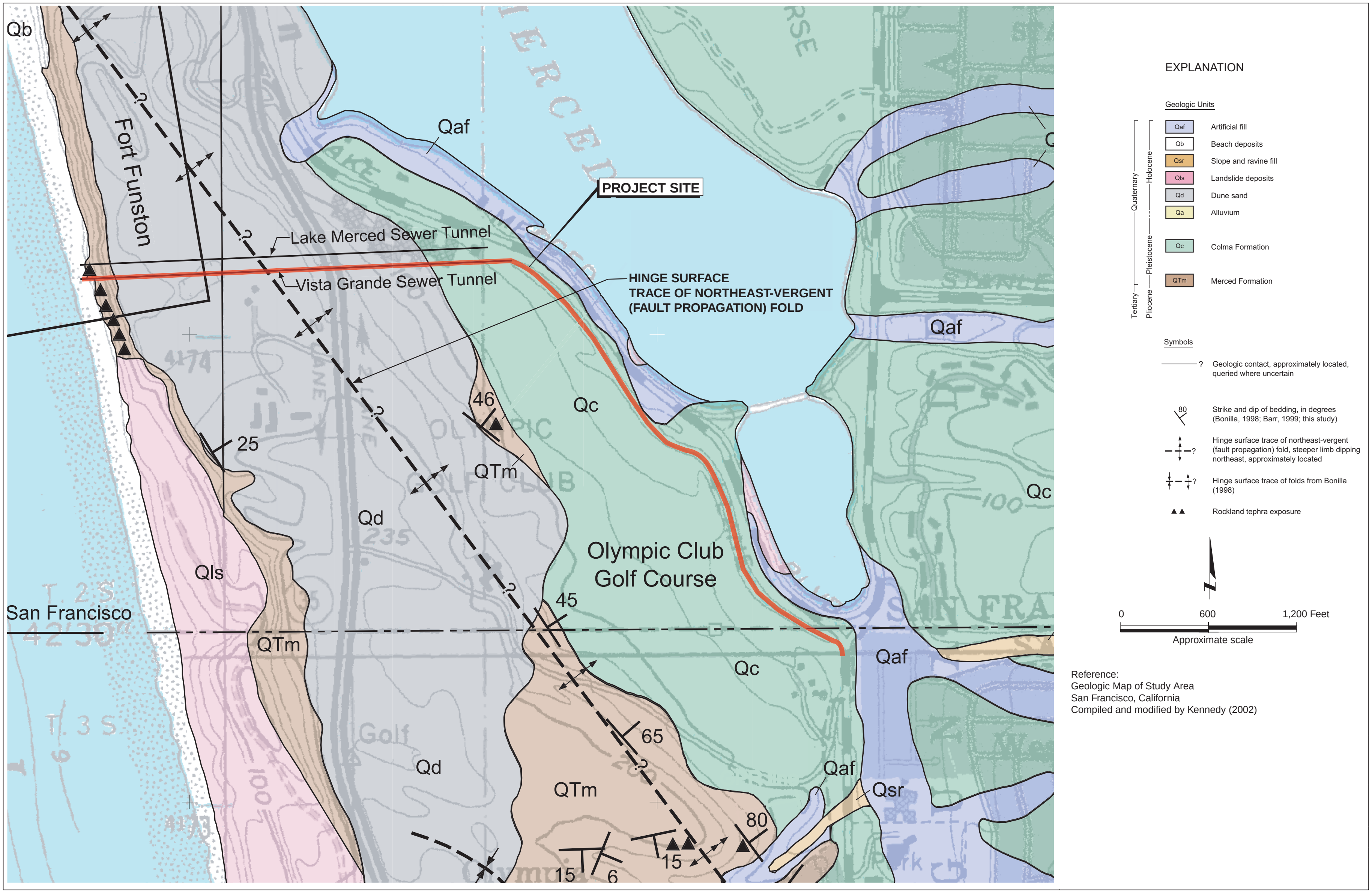
3.6.1.2 Geology

Information on geologic conditions is based on regional geologic mapping and geotechnical investigations at Project site and in the vicinity.

Geologic Setting

The discussion of geologic units is based on the geotechnical and geological investigations conducted by Treadwell and Rollo (2013), unless otherwise cited. **Figure 3.6-1** shows the local geology of the Project area. The Project area is predominantly underlain by the Plio-Pleistocene

[1] A geomorphic province is an area that possesses similar bedrock, structure, history, and age. California has 11 geomorphic provinces (CGS, 2002).



SOURCE: Treadwell & Rollo, 2013

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Figure 3.6-1

Local Geologic Map

age (approximately 5 million to 10,000 years ago) Merced Formation and late Pleistocene age (up to approximately 125,000 years ago) Colma Formation.

The Merced Formation is well exposed on the face of the bluffs at the western edge of Fort Funston.

In the Lake Merced area, the Merced Formation is unconformably overlain by nearly horizontal beds of the Colma Formation (Treadwell and Rollo, 2013). The Merced Formation is characterized as medium- to very fine-grained, poorly indurated to friable sandstone, siltstone, and claystone, with some conglomerate lenses and a few friable beds of white volcanic ash. The Colma Formation is described as poorly consolidated beach, estuarine, eolian, stream, and colluvial deposits that are distributed discontinuously throughout the northern part of the San Francisco Peninsula (Schlocker, 1974).

Throughout most of the Project area, Colma Formation deposits are blanketed by Holocene age (11,000 years to present) eolian sand dune deposits. These deposits are transported from prevailing onshore winds and are composed mainly of very fine-to fine-grained, well-sorted sand with occasional organic-rich interbeds. Other identified Holocene deposits throughout the Project area include artificial fill, landslide deposits, and slope debris observed on the steep bluffs at Fort Funston, artificial fill along the western shores of South Lake and Impound Lake, and wave-deposited beach sand at the base of the bluffs. More information about landsliding is provided below in Section 3.6.1.3, Seismic and Geologic Hazards.

Site-Specific Geotechnical Conditions

A geotechnical investigation performed at the Project site provides site-specific information regarding subsurface materials. This information summarized below is from Treadwell and Rollo (2013) unless otherwise cited.

Diversion Structure, Box Culvert, and Lake Merced Discharge Structure

The geotechnical investigation indicates that this portion of the Project area is underlain by about 1 foot of loose sandy fill with occasional gravel over approximately 8 feet of medium dense sand with silt (Dune Sand) overlying dense and very dense Colma Formation sand. Colma deposits in this area are uncemented to moderately cemented, and are characterized as olive, yellow-brown, red-brown, or olive-brown, very dense sand and sand with silt, with scattered gravel, discernable bedding, and magnetite laminations. Data collected indicates that groundwater elevations are at approximately 21 feet below ground surface (bgs), corresponding to North American Vertical Datum of 1988 (NAVD88)[2] Elevation 15 feet. Recent datum (December 2012) indicate Lake Merced water levels at approximately 17 feet NAVD88 or approximately 5.6 feet City Datum.

[2] NAVD88 is the vertical control datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988 (Treadwell and Rollo, 2013).

Lake Merced Tunnel Portal

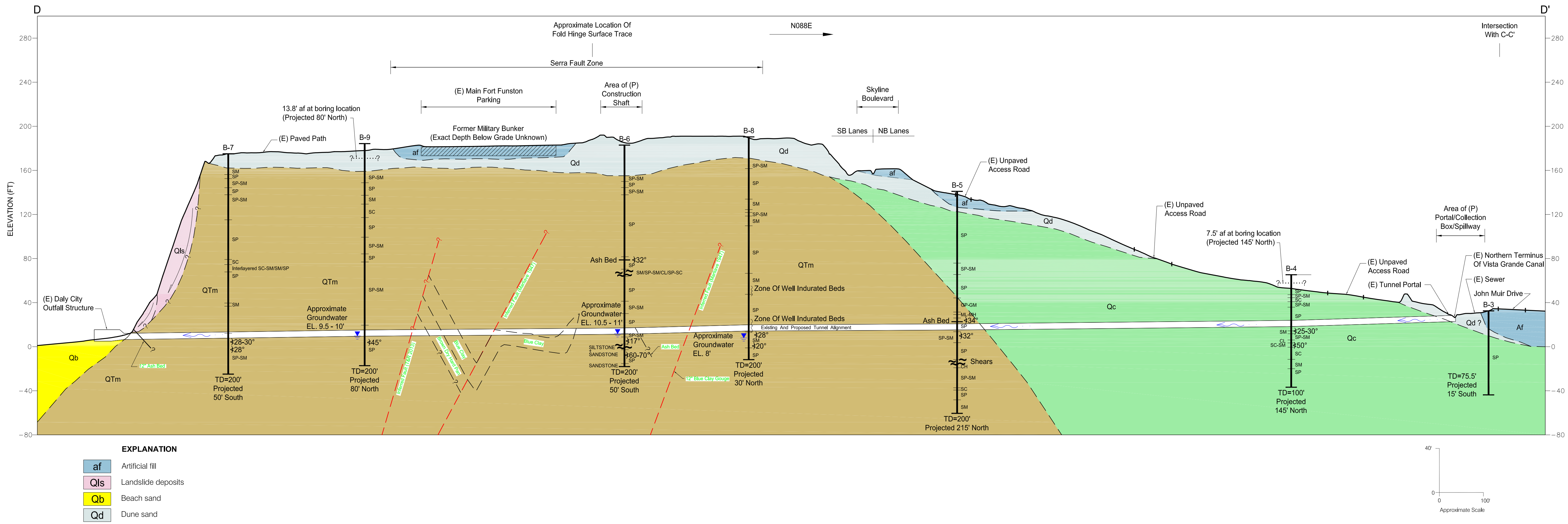
The geotechnical investigation describes the tunnel portal area as underlain by approximately 18 feet of fill, consisting of loose to medium dense sand. The fill is underlain by approximately 5 feet of Dune Sand, characterized by yellow-brown, medium dense sand and sand with silt. Based on geomorphic expressions related to changes in slope gradient, this Dune Sand appears to extend up to about 15 feet bgs in the area of the tunnel portal. Below the Dune Sand, deposits of the Colma Formation were encountered, characterized by very dense sand with abundant magnetite laminations, occasional gravel interbeds, and cross-bedding. Groundwater levels are estimated to be present at approximately 15 to 20 feet NAVD88 or 3.6 to 8.6 feet City Datum, based on piezometric groundwater data collected from the piezometer installed during geotechnical investigations and water levels in Lake Merced.

Tunnel Alignment

The existing underground Vista Grande tunnel system is approximately 3,000 feet long; its alignment spans beneath The Olympic Club, Skyline Boulevard, and Fort Funston (east to west). The east tunnel portal (Lake Merced Portal) daylights just west of John Muir Drive, approximately 200 feet southeast of the Lakewood Apartments. The west portal of the tunnel daylights below the coastal bluffs of Fort Funston at the Daly City outlet structure. Drainage in the tunnel enters the east portal via the Vista Grande canal and discharges west to the Pacific Ocean.

The geotechnical investigation describes the alignment as consisting of Colma Formation, Dune Sand, and Merced Formation. Dune Sand overlies the Merced Formation along the alignment and a portion of the Colma Formation. In addition, small amounts of Artificial Fill overlie intermittent portions of the alignment. Near the outlet structure, the deposits consist of Landslide Deposits and Beach Sand. **Figure 3.6-2** shows a cross section of the alignment and the locations of the deposits described above and borings performed for the geotechnical analysis. West of Boring B-5 (shown in Figure 3.6-2), the Holocene deposits along the alignment directly overlie the Merced Formation.

According to the geotechnical investigation, the only information available related to the original construction of the tunnel is a “pencil profile over the tunnel showing scattered geologic information of a rather general character together with a record of progress during driving of the tunnel” obtained from the Spring Valley Water Company (Treadwell and Rollo, 2013). This pencil profile shows a bed of blue clay and areas of brown “hard pan” sand encountered at different intervals throughout the tunnel alignment during construction of the existing Vista Grande Tunnel. At least two “probable” fault traces were documented during construction of the tunnel, with the presence of one fault indicated by a 12-inch layer of clay gouge. Some of these geologic features have been added to Geologic Cross-Section on **Figures 3.6-2** and **3.6-3** to facilitate interpretation of subsurface conditions at the tunnel elevation. The presence of the fault traces at different elevations, perched groundwater, and random zones of blue clay and hard pan led the geotechnical investigations to conclude there was significant folding within the Merced Formation to the west of Skyline Boulevard. As noted in the geotechnical report, investigator Chester Marliave hypothesized in a report on the Vista Grande Tunnel in 1947 that synclinal folding in the Merced Formation may serve as groundwater traps, that created variable construction conditions throughout this portion of the tunnel alignment (Treadwell and Rollo, 2013).



EXPLANATION

af	Artificial fill
Qls	Landslide deposits
Qb	Beach sand
Qd	Dune sand
Qc	Colma Formation
QTm	Merced Formation
— · · · ?	Geologic contact; dashed where inferred, dotted where concealed, queried where uncertain
— — — ?	Fault; dashed where inferred, queried where uncertain
℄	Center line
60-70°	Bedding dip
≈~	Shear zone
	Direction of water flow in tunnel
N04W	Orientation of cross-section
(E)	Existing
(P)	Proposed
I	Treadwell & Rollo Exploratory Boring Locations
SP	Unified Soils Classification System designator; see Figure A-10 for explanation

Notes:
1. Text in green font indicates notes from 1947 field sketch and Marliave report.
2. Geology adapted and modified from Marliave (1947), Bonilla (1998), Kennedy (2002), Gilpin Geosciences (2007), McGuire (2009) and Treadwell & Rollo Subsurface data (2013).
3. Treadwell & Rollo Exploratory Borings located using a hand-held global positioning system (GPS) unit.
4. Elevation Datum NAVD 88.

SOURCE: Treadwell & Rollo, 2013

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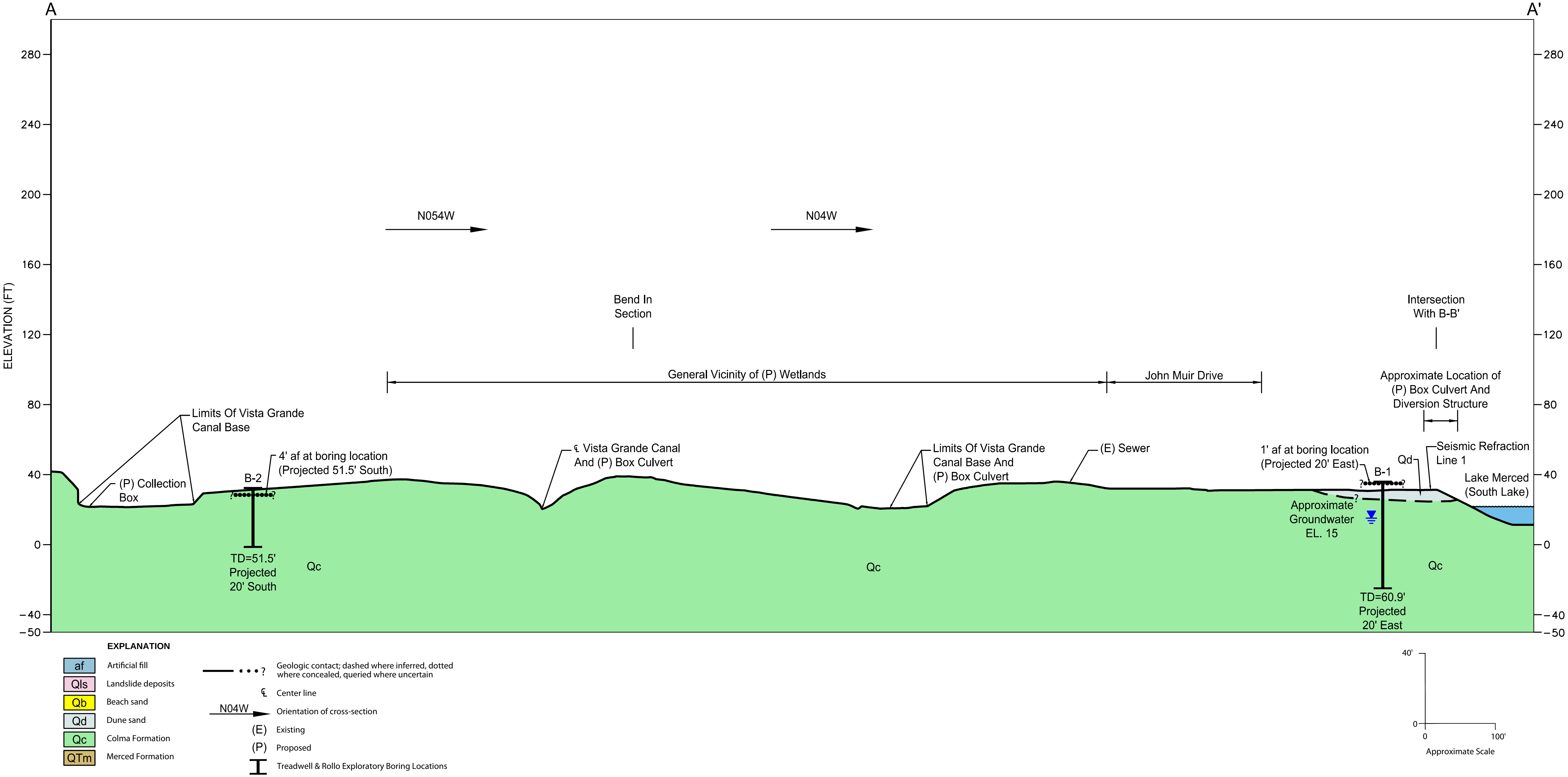
Figure 3.6-2
Geologic Cross-Section D-D'



Notes:
1. Geology adapted and modified from Marliave (1947), Bonilla (1998), Kennedy (2002), Gilpin Geosciences (2007), McGuire (2009) and Treadwell & Rollo subsurface data (2013).
2. Treadwell & Rollo Exploratory Borings located using a hand-held global positioning system (GPS) unit.
3. Elevation Datum NAVD 88.

SOURCE: Treadwell & Rollo, 2013

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Figure 3.6-3
Geologic Cross-Section A-A'

Temporary Construction Shaft

The geotechnical investigation describes the area as having approximately 28 feet of medium dense to dense Dune Sand overlying Merced Formation deposits. The Merced Formation in this location primarily consists of very dense sand and sand with silt beds with scattered deposits of gravel, clay, and sand with clay. Approximately 1 foot of clay was encountered at 116.5 feet bgs; the clay was observed to be highly oxidized with a chaotic structure and abundant discontinuous "cornflake" shears, which are likely associated with episodes of shrink/swell at time of deposition, and not tectonically related.

Coring recovery at the depths of the tunnel (165 to 174 bgs) was generally poor; however, samples taken above and below this interval encountered very dense sand and sand with silt; and it is anticipated that similar conditions exist within the tunnel elevations.

A 2-foot-thick bed of siltstone was encountered at 179 feet bgs. The siltstone is characterized as dark gray to black, thinly bedded with low hardness and low strength. A well-developed shear plane, characterized as a continuous, through-going shear with a polished surface, was observed within the siltstone. The shear plane was measured as having a shallow angle dip of approximately 17 degrees. Slickensides[3] were observed on fracture surfaces within the siltstone. Geotechnical investigations interpreted the shears to be related to local tectonic folding, possibly associated with the Serra Fault Zone, on the basis of review of the referenced published data on the structural folding within the Merced Formation and the proximity to the mapped fault trace.

According to piezometric data collected during geotechnical investigations, the groundwater level is about 172 feet bgs, or 11 feet NAVD88 (-0.6 City Datum).

Ocean Outlet Structure

The geotechnical investigation describes this area as having medium dense Dune Sand overlying very dense Merced Formation deposits. The Merced Formation in this location is characterized primarily by very dense sand and silty sand with occasional deposits of sand with gravel and clayey sand. Bedding structures were observed at various depths and abundant magnetite was observed in deposits throughout the borehole. Bedding attitudes were measured at between 20 and 30 degrees, which correlate with attitudes taken by others on Merced bedding exposures on the cliff face.

3.6.1.3 Seismic and Geologic Hazards

Seismicity

The Project area can be expected to experience periodic minor earthquakes and possibly a major earthquake on one of the nearby active faults during the lifespan of the proposed facilities. The seismicity in the site vicinity is primarily related to activity on the San Andreas Fault system. The faults in this system are characterized by right-lateral, predominantly strike-slip movement. The other major active faults in the area are the San Gregorio, Hayward, and Calaveras faults. These

[3] Slickensides are polished and striated rock surfaces that result from friction along a fault or bedding plane.

and other faults of the region are shown on **Figure 3.6-4**. For each of the active faults, the distance from the site and estimated mean characteristic Moment magnitude[4] are summarized in **Table 3.6-1**.

**TABLE 3.6-1
REGIONAL FAULTS AND SEISMICITY**

Fault Segment	Approx. Distance from fault (Miles)	Direction from Site	Mean Characteristic Moment Magnitude
N. San Andreas – Peninsula	0.7	West	7.23
N. San Andreas (1906 event)	0.7	West	8.05
San Gregorio Connected	5.0	West	7.50
N. San Andreas – North Coast	6.2	Northwest	7.51
Total Hayward	17	Northeast	7.00
Total Hayward-Rodgers Creek	17	Northeast	7.33
Monte Vista-Shannon	23	Southeast	6.50
Point Reyes	24	Northwest	6.90
Rodgers Creek	26	North	7.07
Mount Diablo Thrust	27	East	6.70
Total Calaveras	28	East	7.03
Green Valley Connected	30	East	6.80
West Napa	34	Northeast	6.70
Greenville Connected	39	East	7.00

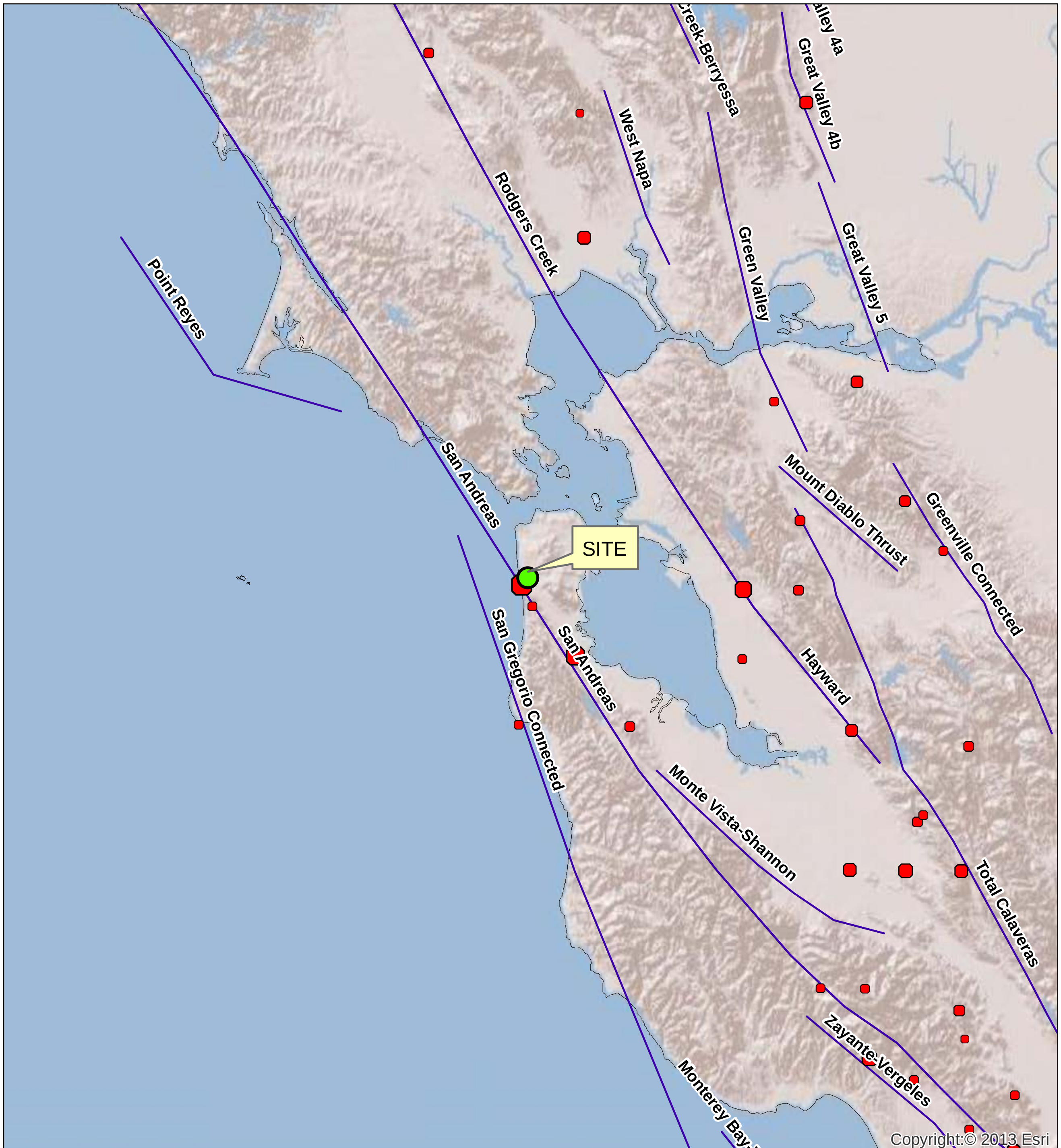
San Andreas Fault

The San Andreas Fault Zone, located about 2.5 miles southwest of the Lake Merced portion of the Project area, is a major structural feature that forms at the boundary between the North American and Pacific tectonic plates. It is a right-lateral strike-slip[5] fault, extending from the Salton Sea in Southern California near the border with Mexico to north of Point Arena, where the fault trace continues out into the Pacific Ocean. The main trace of the San Andreas Fault through the Bay Area trends northwest from the Santa Cruz Mountains to the eastern side of the San Francisco Peninsula.

Since 1800, four major earthquakes have been recorded on the San Andreas Fault in Northern California and/or the greater Bay Area. In 1836, an earthquake with an estimated maximum intensity of VII on the Modified Mercalli Intensity (MMI) scale occurred east of Monterey Bay on the San Andreas Fault. The estimated moment magnitude, Mw, for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a Mw of about 7.5. 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 292 miles in length. It had a maximum intensity of XI (MM), a

[4] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

[5] Refers to relative motion on either side of a fault that is primarily horizontal (as opposed to vertical).



Legend

- Earthquake Epicenter - Magnitude 5
- Earthquake Epicenter - Magnitude 6
- Earthquake Epicenter - Magnitude 7
- Earthquake Epicenter - Magnitude 8

NOTES:

1. Digitized data for fault coordinates and earthquake catalog was developed by the California Geological Survey. The historic earthquake catalog includes events from January 1800 to December 2000.

0 10 20
Kilometers

N
W E
S

SOURCE: Treadwell & Rollo, 2013

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Figure 3.6-4
Regional Faults

Mw of about 7.9, and was felt 348 miles away in Oregon, Nevada, and Los Angeles. The most recent major earthquake to affect the Bay Area was the Loma Prieta Earthquake of October 17, 1989, in the Santa Cruz Mountains with a Mw of 6.9, approximately 58 miles from the site.

A smaller, yet noteworthy, earthquake occurred in Daly City on March 22, 1957. The epicenter of this 5.4 Mw earthquake was near Mussel Rock, approximately 3 miles south of the Project site. This earthquake produced seismically induced lateral spreading[6] of liquefied[7] soil along the banks of Lake Merced and slope instability along the bluffs bounding the west side of Highway 1 in Daly City.

Serra Fault

The Serra Fault Zone crosses the Project site beneath Fort Funston. The Serra Fault Zone is considered to be the northernmost extension of the Foothills thrust fault system. The fault was originally zoned as "potentially active." A "potentially active" fault is a fault that has not exhibited surface rupture within Holocene time (the past 11,000 years), but is judged to have the potential for surface rupture in the present geologic regime. Since the fault has not exhibited surface rupture during Holocene time, it is not considered an "active fault," and consequently is not zoned within an Alquist-Priolo Special Studies zone, defined in Section 3.6.2 Regulatory Setting.

Hayward and Calaveras Faults

The Hayward Fault Zone, located approximately 26 miles northeast of the Project area, extends for 60 miles from San Pablo Bay in Richmond south to the San Jose area. In 1868, an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated Mw for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably a Mw of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake (Mw of 6.2).

Earthquake Probabilities

The 2007 WGCEP at the U.S. Geologic Survey (USGS) predicted a 63 percent chance of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area in 30 years (Treadwell and Rollo, 2013). More specific estimates of the probabilities for different faults in the Bay Area are presented in **Table 3.6-2**.

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6 Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

7 Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

TABLE 3.6-2
ESTIMATES OF 30-YEAR PROBABILITY OF A MAGNITUDE 6.7 OR GREATER EARTHQUAKE

Fault	Probability (percent)
Hayward-Rodgers Creek	31
N. San Andreas	21
Calaveras	7
San Gregorio	6
Concord-Green Valley	3
Greenville	3
Mount Diablo Thrust	1

SOURCE: WGCEP (2008)

Fault Rupture

The Serra Fault has ruptured during the Holocene era based on folding of Holocene beds; however, no direct evidence of Holocene surface rupture has been documented. The Serra Fault is not believed to be seismogenic (capable of generating earthquakes) and the fault is not zoned as an active Alquist-Priolo Earthquake Fault (Treadwell and Rollo, 2013). However, because of its blind thrust designation (a blind thrust earthquake occurs along a thrust fault that does not show signs on the Earth's surface), fault offset could occur within the subsurface that would not manifest itself as surface rupture.

Previous geotechnical investigations indicate that two fault traces were encountered within the Vista Grande Tunnel alignment with up to 40 feet of documented offset of a blue clay layer. On the basis of the discontinuous, folded strata mapped within the tunnel alignment, a possible third ancillary fault was inferred to the west of the two fault traces previously identified. Therefore, the geotechnical investigations characterize an area of inferred fault traces as the Serra Fault Zone, which could experience sympathetic rupture (Treadwell and Rollo, 2013).

The geotechnical investigations also concluded that during the lifespan of the existing and proposed tunnels, there is a high potential for rupture as a result of faulting (Treadwell and Rollo, 2013). On the basis of evidence of Holocene slip observed in trench exposures of the Serra Fault, the slip component on the fault is anticipated to be right-lateral oblique slip.

Considering the “reported” behavior of the Tunnel during the 1906 earthquake and the results of a video survey, the geotechnical investigations concluded that the deformation should be less than 12 inches in the entire fault zone (approximately 850 feet). Deformations are expected to be cumulative within the secondary fault rupture zone; such deformations are not expected to be more than 2 inches over any 50-foot segment of the tunnel within the zone.

In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed or were known. However, based on the blind thrust mechanism of the Serra Fault, the geotechnical investigation concluded the risk of fault rupture at the ground surface is low (Treadwell and Rollo, 2013). Localized earthquake-induced surface cracking from fault rupture or intense shaking at the top of the bluffs is possible.

Groundshaking

During a major earthquake on one of the nearby active faults in the general region, the site would likely experience very strong to violent ground shaking. The intensity of the earthquake ground motion at the site depends upon the characteristics of the generating fault, distance to the earthquake epicenter, magnitude and duration of the earthquake, and specific site geologic conditions. During its history, the site has been subjected to very strong to violent ground shaking from moderate to large earthquakes on the San Andreas, Hayward, and Calaveras faults, and future strong ground shaking should be anticipated.

Strong ground shaking during an earthquake can result in ground failure such as that associated with earthquake-induced landsliding, soil liquefaction, lateral spreading, and cyclic densification.[8] The geotechnical investigations evaluated the potential of these phenomena occurring at the Project site under an earthquake with a Mw of 8.1 and a peak ground acceleration of 0.6g, which are discussed below (Treadwell and Rollo, 2013).[9]

Liquefaction

When a saturated, cohesionless sediment liquefies during a major earthquake, it experiences a temporary loss of shear strength due to a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction. According to the Seismic Hazard Zones map for the San Francisco 7.5 minute Quadrangle and presented as **Figure 3.6-5**, a narrow area susceptible to liquefaction has been mapped underlying a significant portion of John Muir Drive and adjacent to the Lake Merced shoreline (Treadwell and Rollo, 2013). The liquefaction hazard area is mapped as underlying the roadway from its intersection with Lake Merced Boulevard to just south of the Lakewood Apartments. The proposed diversion structure area and adjacent section of John Muir Drive are not mapped within a liquefaction zone despite their location within the shoreline margin. However, the mapped liquefaction zone is located adjacent to and potentially encroaching on existing and proposed improvements to the west. Liquefaction was well documented along the western shoreline of Lake Merced and John Muir Drive during the 1957 Daly City earthquake.

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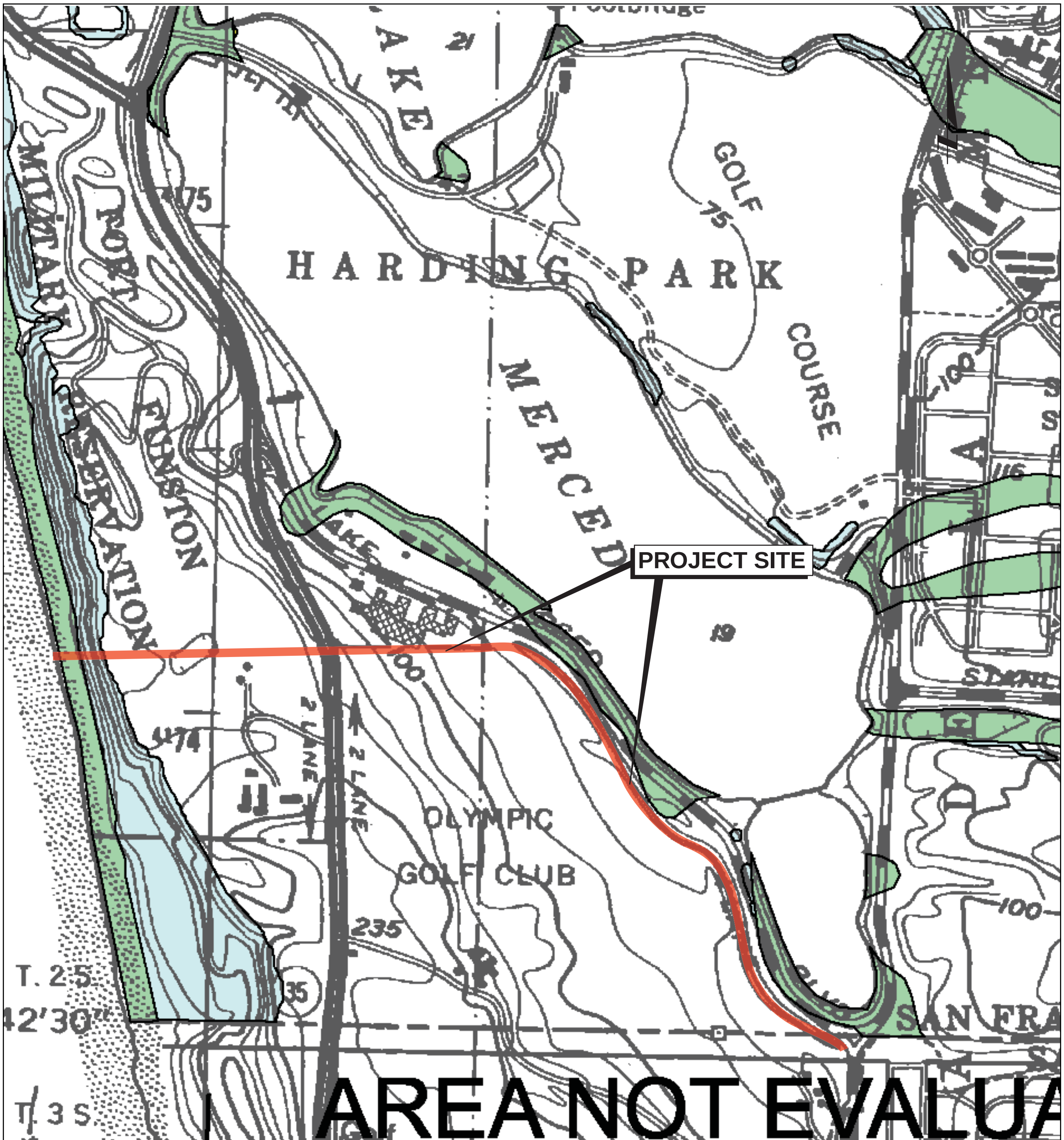
8 Cyclic densification (also referred to as differential compaction) is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground surface settlement.

9 Ground motion, or ground shaking, during an earthquake is commonly expressed with the motion parameters of acceleration, velocity, and the duration of the shaking. A common measure of ground motion is the peak ground acceleration (PGA). The PGA for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. PGA is expressed as the percentage of the acceleration due to gravity (g), which is approximately 980 centimeters per second squared.



EXPLANATION

Liquefaction; Areas where historic occurence of liquefaction, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

Earthquake-Induced Landslides; Areas where previous occurence of landslide movement, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

0 500 1,000 Feet

Approximate scale

Reference:
State of California "Seismic Hazard Zones"
City and County of San Francisco
Released on November 17, 2001

SOURCE: Treadwell & Rollo, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.6-5
Regional Seismic Hazards Map

The geotechnical investigation used the results from borings to evaluate the potential for liquefaction and subsequent settlement (Treadwell and Rollo, 2013). Potentially liquefiable deposits were encountered in Boring B-3 (see Figure 3.6-2), along the alignment near John Muir Drive the eastern end of the existing tunnel, between depths of about 12 to 18 feet bgs. The proposed tunnel portal is located just outside the margins of the liquefaction zone. Based on results of liquefaction analysis, the geotechnical investigations concluded that the potential for liquefaction in this area is high and estimated the associated liquefaction-induced ground settlement in this area could be on the order of 3 inches. The geotechnical investigations did not encounter potentially liquefiable soil below the groundwater table in any of the other borings drilled.

Lateral Spreading

Lateral spreading occurs as surficial soil displaces along a shear zone that has formed within an underlying continuous liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a channel, by earthquake and gravitational forces. The geotechnical investigations did not encounter potentially liquefiable soil in Boring B-1 (Figure 3.6-3), which was drilled adjacent to Lake Merced; however, lateral spreading along the Lake Merced shoreline was observed as a result of liquefaction during the 1957 earthquake (Treadwell and Rollo, 2013). Therefore, because of this historical data and as a result of the steep inclination (locally between about 2:1 to 4:1, vertical to horizontal) of the slopes along the Lake Merced shoreline, the geotechnical investigations concluded that the potential for lateral spreading and/or slumping ground in this area is moderate to high.

Cyclic Densification

Cyclic densification can occur in non-saturated sand (sand above the groundwater table) caused by earthquake vibrations, resulting in settlement of the ground surface. The geotechnical investigation encountered loose to medium-dense non-saturated sand in all of the borings drilled during investigations (Treadwell and Rollo, 2013). For most of the borings, it is estimated the seismically induced settlement in these layers could be on the order of 0.25 to 0.5 inch; except in the vicinity of Boring B-5 (see Figure 3.6-2), which is in an undeveloped area of the Olympic Club. At this location, the upper 18 feet of soil consists of very loose to medium-dense, relatively clean sand that could cyclically densify. It is estimated up to a foot of settlement could occur during a large earthquake. In the vicinity of Boring B-9, which is in an undeveloped area at Fort Funston, it is estimated seismically induced settlement on the order of 4 inches could occur.

Landsliding

The geotechnical investigations did not include a quantitative slope stability evaluation or analyses related to the potential for deep-seated slope stability at the coastal bluff; however, the coastal bluffs at Fort Funston are mapped within a California Geological Survey (CGS) zone subject to seismically induced instability and appear to have experienced sloughing and shallow landsliding (Treadwell and Rollo, 2013). During the 1989 Loma Prieta earthquake, three landslides occurred above the existing Daly City and SFPUC ocean outlet structures, depositing a total of about 3,700 cubic yards of earth materials onto the beach below. Additionally, bluff failures under static conditions have been well documented along this stretch of coast resulting from erosion or wave action. Historically, bluff failures have occurred as shallow failures related to saturation from rainfall, or as “wedge” failures from wave action eroding the toe of the bluff.

Gilpin Geosciences (2007) mapped numerous shallow landslides and slumps including the failures mentioned above that occurred during the Loma Prieta Earthquake. The northern lateral margin of a well-documented and very large, deep-seated landslide is located approximately 600 feet to the south of the ocean outlet structure.

During field investigations, large-scale erosional features on the cliff face were observed above the two existing outlet structures within the limits of the 1989 landslides (Treadwell and Rollo, 2013). The geotechnical investigations took into consideration the current understanding of the historic bluff performance in the vicinity, site observations, and the results of field investigations, and concluded the potential for deep-seated landsliding during static conditions along the bluff is low. However, the potential for shallow or wedge failures up to about 10 to 15 feet thick under static conditions is moderate to high. The geotechnical investigation concluded that the potential for relatively large-scale landsliding is high during large seismic events.

A small area along the southern boundary of the proposed diversion area above Lake Merced is also mapped within the zone of potential earthquake-induced landsliding. On the basis of the results of geotechnical investigations, Treadwell and Rollo concluded that there is a moderate potential for surficial erosion and instability, but that the potential for large-scale or deep-seated failures of the lake banks in this area appears to be low.

The Daly City 2030 General Plan notes the landslide potential in the coastal zone which includes Avalon Canyon. This area has experienced several landslides over the last few decades which resulted in a number of existing homes having to be removed due to risks posed by landslides (Daly City, 2013).

Expansive Soils

Expansive soils are characterized by their potential “shrink-swell” behavior. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in certain fine-grained clay sediments from the process of wetting and drying. The higher the percentage of expansive minerals present in near surface soils, the higher the potential for significant expansion. The greatest effects occur when there are significant or repeated moisture content changes. Expansions of 10 percent or more in volume are not uncommon. This change in volume can exert enough force on a building or other structure to cause cracked foundations, floors, and basement walls. Structural damage typically occurs over a long period of time, usually the result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. The geotechnical investigation revealed the soils in the Project area are generally comprised mixtures of urban land, artificial fill, sand, gravel and soils that form on alluvial materials (Treadwell and Rollo, 2013). These soils have a low shrink-swell potential and tend not to swell when water is absorbed. Smaller areas of clay were found throughout the Project area but not in large concentrations.

Corrosive Soils

Corrosive soils can damage underground utilities including pipelines and cables, and can weaken roadway structures. Rates of steel corrosion of uncoated steel are related to soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. The geotechnical investigation concluded that soils within the Project area have a mild to moderate potential for corrosion (Treadwell and Rollo, 2013).

3.6.2 Regulatory Setting

3.6.2.1 Federal

There are no federal regulations regarding geology and soils that are relevant to the Project.

3.6.2.2 State Regulations

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was passed in 1990 following the Loma Prieta earthquake to reduce threats to public health and safety and to minimize property damage caused by earthquakes. The act directs the Department of Conservation to identify and map areas prone to the earthquake hazards of liquefaction, earthquake-induced landslides, and amplified groundshaking. For structures intended for human occupancy, the act requires site-specific geotechnical investigations to identify potential seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy within the Zones of Required Investigations. As mentioned in Section 3.6.1.3, Seismic and Geologic Hazards (Landsliding), the CGS has mapped seismic hazards throughout portions of the Project area that are susceptible to liquefaction. However, because the proposed Project would not involve the construction of any structures for human occupancy, the provisions of this act related to requirements for structures intended for human occupancy do not apply.

California Building Code

The California Building Code (CBC), which is codified in Title 24 of the California Code of Regulations, Part 2, was promulgated to safeguard the public health, safety, and general welfare by establishing minimum standards related to structural strength, egress facilities, and general building stability. The purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all building and structures within its jurisdiction. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under State law, all building standards must be centralized in Title 24 or they are not enforceable. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The 2013 edition of the CBC is based on the 2012 International Building Code (IBC) published by the International Code Council. The 2013 edition of the CBC was published by the California Building Standards Commission in July, 2013, and took effect starting January 1, 2014. The 2013 CBC contains California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standard 7. ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (such as wind loads) for inclusion into building codes. The provisions of the CBC apply to the construction, alteration, use and occupancy, location, maintenance, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California. Seismic design provisions of the building code generally prescribe minimum lateral forces applied statically to the structure, combined with the gravity forces of dead and live loads. The prescribed lateral forces are generally considered to be substantially smaller than the actual peak forces that would be associated with a major earthquake. Consequently structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse, but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake. However, it is reasonable to expect that a structure designed in-accordance with the seismic requirements of the CBC should not collapse in a major earthquake.

The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients, all of which are used to determine a seismic design category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site; SDC ranges from A (very small seismic vulnerability) to E/F (very high seismic vulnerability and near a major fault). Seismic design specifications are determined according to the SDC in accordance with Chapter 16 of the CBC. Chapter 16, Section 1613 provides earthquake loading specifications for every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, which shall be designed and constructed to resist the effects of earthquake motions in accordance with American Society of Civil Engineers (ASCE) Minimum Design Standards 7-10. Chapter 18 of the CBC covers the requirements of geotechnical investigations (Section 1803), excavation, grading, and fills (Section 1804), load-bearing of soils (1805), as well as foundations (Section 1808), shallow foundations (Section 1809), and deep foundations (Section 1810). Chapter 18 also describes analysis of expansive soils and the determination of the depth to groundwater table. For SDCs D, E, and F, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading, plus an evaluation of lateral pressures on basement and retaining walls, liquefaction and soil strength loss, and lateral movement or reduction in foundation soil-bearing capacity. It also addresses measures to be considered in structural design, which may include ground stabilization, selecting appropriate foundation type and depths, selecting appropriate structural systems to accommodate anticipated displacements, or any combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak ground acceleration magnitudes and source characteristics consistent with the design earthquake ground motions.

In addition, the updated CBC no longer cites the 1997 UBC Table 18-1-B for identifying expansive soils. The significance criterion in Appendix G of the CEQA Guidelines still refers to this out-of-date table. This EIR/EIS uses the updated CBC section as provided below.

- ***1803.5.3 Expansive Soil.*** In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1,2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

    1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318
    2. More than 10 percent of the soil particles pass a No. 200 sieve (75 micrometers), determined in accordance with ASTM D 422
    3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422
    4. Expansion index greater than 20, determined in accordance with ASTM D 4829

NPDES Construction General Permit

For stormwater discharges associated with construction activity within California, the SWRCB has adopted the General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ (Construction General Stormwater Permit; CGP) to avoid and minimize water quality impacts attributable to such activities. The permit applies to all projects where construction activity disturbs one or more acres of soil. Construction activities subject to this permit includes clearing, grading, and disturbances to the ground, such as stockpiling or excavation. The Construction General Stormwater Permit requires the development and implementation of a stormwater pollution prevention plan (SWPPP); the plan must specify best management practices (BMPs) designed to prevent pollutants from contacting stormwater and to keep all products of erosion from migrating offsite into receiving waters. Examples of typical construction BMPs include scheduling or limiting activities to certain times of year, installing sediment barriers such as silt fence and fiber rolls, maintaining equipment and vehicles used for construction, tracking controls such as stabilizing entrances to the construction site, and developing and implementing a spill prevention and cleanup plan. Non-stormwater management measures include installing specific discharge controls during certain activities, such as paving operations, and vehicle and equipment washing and fueling. The SWPPP must be prepared before the construction begins. The CGP is discussed in more detail in Section 3.9, Hydrology and Water Quality.

California Occupational Safety and Health Administration

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the work place. In California, the California Division of

Occupational Safety and Health (Cal/OSHA) and the federal OSHA are the agencies responsible for ensuring worker safety in the workplace.

The OSHA Excavation and Trenching standard (29 CFR 1926.650) covers requirements for excavation and trenching operations, which are among the most hazardous construction activities. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. Cal/OSHA is the implementing agency for both state and federal OSHA standards.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this Act, the state geologist established regulatory zones, called earthquake fault zones, around the surface traces of active faults and has published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace because many active faults are complex and consist of more than one branch that may experience ground surface rupture. This Act does not apply to the Project because no active faults cross the Project site.

3.6.2.3 Local Regulations

There are no local regulations regarding geology and soils that are relevant to the analysis of Project impacts.

3.6.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.6.3.1 CEQA Significance Criteria

The Project would have significant impacts related to geology and soils if it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the state geologist for the area or based on other substantial evidence of a known fault (refer to CDMG Special Publication 42 [2007]),
    - Strong seismic groundshaking,
    - Seismic-related ground failure, including liquefaction,
    - Landslides;

b) Result in substantial soil erosion or the loss of topsoil;

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse;

d) Be located on expansive soil, as defined in the California Building Code (CBC) Section 18.5.3 (updates the former Table 18-1-B of the Uniform Building Code, 1994), creating substantial risks to life or property; or

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

3.6.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook, the Project and alternatives are evaluated to determine whether they would have material adverse effects on geological resources or from geohazards (NPS, 2001).

Impact Intensity	Impact Description
Negligible:	Risks to the public and the environment from soil erosion and seismic or landslide events would remain unchanged, or the change in risk would be at such low levels of detection that it would not have a discernible effect on resources or public safety.
Minor:	The change in risks to the public and the environment from soil erosion and seismic or landslide events would be detectable but would not be appreciable.
Moderate:	The change in risks to the public and the environment from soil erosion and seismic or landslide events would be readily apparent and long-term, with substantial, noticeable changes in risks to the public and the environment locally within the study area.
Major:	The change in risks to the public and the environment from soil erosion and seismic or landslide events would be readily apparent, long-term, and would result in substantial, changes in risks to the public and the environment throughout the study area.

3.6.3.3 Criteria and Thresholds with No Impact or Not Applicable

The following topic is not discussed further in this section because the issue is not applicable to the Project and there would be no impact:

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater. No septic systems (which treat wastewater through ground percolation) or alternative wastewater disposal systems are proposed for this Project. The proposed Project would alleviate flooding potential and protect the ocean outlet from ongoing coastal erosion, while reconnecting a significant portion of the Lake Merced Watershed to Lake Merced and does not include septic systems. Therefore, the criterion related to soils supporting the use of septic tanks or alternative wastewater disposal systems is not applicable to the Project and is not discussed further.

3.6.4 Methodology and Assumptions

The impact assessment provides a qualitative analysis to address soil resources, geologic hazards and primary and secondary effects of earthquakes. Impacts related to geologic and seismic hazards would be considered significant if they would cause injury, structural collapse, unrepairable facility or utility damage, or severe service disruption. This analysis assumes that construction and design of proposed facilities would utilize standard site preparation practices, engineering designs, and seismic safety techniques that are required under the CBC and other state and local geologic hazard regulations (see Section 3.6.2, Regulatory Setting). As stated in Section 3.6.2.2, State Regulations, this EIR/EIS uses the updated CBC section as the significance criterion for identification of expansive soils.

3.6.5 Impact Analysis

3.6.5.1 Proposed Project

CEQA Analysis

a) Impact GEO-1: Construction, operation, and maintenance of the Project could expose people or structures to potential substantial adverse effects involving strong seismic ground shaking and/or seismic-related ground failure. (Less than Significant with Mitigation)

Impact GEO-3 discusses possible impacts related to the Project being located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project (landsliding).

Fault Rupture

As discussed in Section 3.6.2.2, State Regulations, the Project is not within an Alquist-Priolo Fault Zone; however, Holocene slip was observed in trench exposures of the Serra Fault and the geotechnical investigation concluded there is a high potential for rupture as a result of faulting within the proposed tunnels alignment (Treadwell and Rollo, 2013). It is expected that such deformations would not be more than 2 inches over any 50-foot segment of the tunnel within the zone. Therefore, the geotechnical investigation concluded the Project may be constructed as planned from geological and geotechnical engineering perspectives provided the recommendations presented in the geotechnical report are incorporated into the foundation design and Project plans and implemented during construction. Without implementation of these recommendations, *significant* fault rupture effects could occur. Therefore, the recommendations are included in **Mitigation Measures 3.6-1a** and **3.6-1b**. With implementation of Mitigation Measures 3.6-1a and 3.6-1b, potential seismic impacts related to fault rupture would be *less than significant.*

Groundshaking

Groundshaking is the most widespread effect of earthquakes, and poses a greater overall seismic threat than local ground rupture. Depending on the level of groundshaking, distance to the epicenter, and composition of underlying materials, an earthquake could damage the tunnel and channel structures, resulting in a disruption of the intended operations. Such damage could require short-term temporary service interruptions for inspections and repairs, as well as long-term repairs.

As discussed in Section 3.6.1.3, Seismic and Geologic Hazards, groundshaking during an earthquake in the Project area has the potential to be strong, with peak ground acceleration around 0.6 g, which could result in *significant* groundshaking effects on the proposed facilities. However, the proposed pipeline and facilities would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations as part of Mitigation Measures 3.6-1a and 3.6-1b that were provided in the geotechnical investigations report (Treadwell and Rollo, 2013), thereby ensuring that Project facilities are appropriately designed to withstand seismic damage due to groundshaking. Therefore, given compliance with the CBC and the implementation of Mitigation Measures 3.6-1a and 3.6-1b, potential seismic impacts related to groundshaking would be *less than significant.*

Seismic-Related Ground Failure

Damage from liquefaction and lateral spreading is generally most severe from liquefaction of materials located within 15 to 20 feet of the ground surface. In addition, where pipelines are buried in soil overlying deeper liquefiable soil layers, liquefaction of the deeper layers can result in substantial lateral spreading of the upper competent soil layer. Lateral spreading can extend several hundred feet from a slope, and displacements of tens of feet can occur if soil conditions are especially favorable for liquefaction and if earthquake shaking is of sufficient duration.

During an earthquake, underground utilities tend to fail at the interface between a softer unit and a stiffer unit due to the settlement that occurs within the softer unit, a phenomenon known as differential settlement. Differential settlement is a concern because it can cause uneven movement of pipelines and building foundations, resulting in substantial damage, including cracks and breakage.

As discussed in Section 3.6.1.3, Seismic and Geologic Hazards, liquefaction zones were not identified in the Project area. However, a mapped liquefaction zone is located adjacent to and potentially encroaching on existing and proposed improvements to the west. The geotechnical investigation confirmed a high potential for liquefaction, densification, and lateral spreading in the area of the proposed tunnel portal (Treadwell & Rollo, 2013). Estimated associated liquefaction-induced ground settlement in this area could be on the order of three inches. No potentially liquefiable soil was encountered in Boring B-1 (Figure 3.6-3), which was drilled adjacent to Lake Merced. However, lateral spreading along Lake Merced's western shoreline, north of Boring B-1 was observed as a result of liquefaction during the 1957 earthquake (USGS, 1957). Therefore, the geotechnical investigations concluded that the potential for lateral spreading and/or slumping ground in this area is moderate to high (Treadwell & Rollo, 2013).

Seismically induced settlement could also occur as a result of cyclic densification. As discussed earlier, all of the borings drilled during geotechnical investigations encountered loose to medium dense non-saturated sand, which is a key component of settlement of the ground surface as a result of earthquake vibrations. Estimated seismically induced settlement primarily ranges from 0.25 inches to 0.5 inches, but is higher at the Project area near the Olympic Club (up to 12 inches) and near Fort Funston (4 inches) (Treadwell & Rollo, 2013).

The geotechnical investigation concluded that the majority of the proposed structures and improvements can be supported on shallow spread-type foundations, consisting of isolated or continuous footings or mats, except in the vicinity of Boring B-3 (see Figure 3.6-2), where the new tunnel portal and Lake Merced overflow inlet are planned in an area of potentially liquefiable soil (Treadwell and Rollo, 2013). Unless the potentially liquefiable soil is removed and recompacted (overexcavated) or improved to mitigate liquefaction, structures in this area should be supported on a deep foundation system that gains its support below the potentially liquefiable layer. The deep foundation system could consist of cast-in-place drilled piers, micropiles, or another acceptable deep foundation system such as auger-cast or displacement piles or a torqued-in piling system. Ground improvement or overexcavation should extend to a depth of at least 18 bgs, corresponding to 2.63 feet City Datum. If liquefaction potential is addressed in this area, the structures may be supported on shallow foundations. For shallow foundations designed in accordance with the recommendations presented in the geotechnical investigations (Treadwell and Rollo, 2013), it was estimated that total and differential settlements due to static dead plus live loads would be less than 1 and 0.5 inch, respectively. For properly constructed deep foundations, designed in accordance with the recommendations of the geotechnical investigations (Treadwell and Rollo, 2013), it was estimated total and differential settlements due to static dead plus live loads would be less than 0.75 and 0.5 inch, respectively.

As discussed above, all Project facilities would be designed to meet current seismic standards in accordance with the CBC and the and the geotechnical recommendations that were provided in the geotechnical investigations report as part of Mitigation Measures 3.6-1a and 3.6-1b, thereby improving the ability of the pipeline and a majority of the other facilities to withstand seismic damage due to liquefaction and related phenomena.

The geotechnical investigation concluded the majority of the proposed structures can be supported on shallow spread-type foundations, consisting of isolated or continuous footings or mats, except in the vicinity of Boring B-3, where the new tunnel portal and Lake Merced overflow inlet are planned in an area of potentially liquefiable soil (Treadwell & Rollo, 2013). For the structures in the vicinity of Boring B-3, this would be a *significant* impact. Implementation of **Mitigation Measure 3.6-1c** would reduce impacts from potentially liquefiable soil in the vicinity of Boring B-3 to *less than significant* because the proposed Project would be designed, engineered, and constructed in conformance with engineering practices and geotechnical recommendations to minimize potential structural damage during a seismic event.

> **Mitigation Measure 3.6-1a:** Prior to final Project design, a qualified engineer and/or geologist shall perform an inspection to map the size, location, orientation, and patterns of cracks and any crack offsets to provide additional insight into possible tunnel deformation related to faulting, and to help better assess the potential impact of the Serra Fault Zone during future seismic events on the San Andreas Fault, as recommended in the geotechnical investigation conducted by Treadwell & Rollo (2013).

Mitigation Measure 3.6-1b: Daly City and/or its contractor(s) shall retain inspectors working under the auspices of a California-licensed geotechnical engineer to be present on the Project site during excavation, grading, and general site preparation activities to monitor the implementation of the recommendations specified in this measure.

- Project construction shall be in conformance with CBC seismic design requirements and the OSHA Excavation and Trenching standard (29 CFR 1926.650) for the Project area.
- When and if needed, the geotechnical engineer shall provide structure-specific geologic and geotechnical recommendations prior to and during construction that shall be documented in a report to be appended to the Project's previous geotechnical reports and approved by the City of San Francisco Department of Building Inspection.

Mitigation Measure 3.6-1c: Project foundations in the vicinity of Boring B-3 shall be constructed using cast-in-place drilled piers, micropiles, or another equivalent deep foundation system such as auger-cast or displacement piles or a torqued-in piling system for deep foundations.

Significance after Mitigation: Less than Significant.

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b) Impact GEO-2: The Project could result in substantial soil erosion or the loss of topsoil. (Less than Significant with Mitigation)

Construction activities such as excavating, trenching, and grading (including activities required for potential Lake Management components) can remove stabilizing vegetation and expose areas of loose soil that, if not properly stabilized during construction, can be subject to erosion by wind and stormwater runoff, potentially resulting in a *significant* impact with respect to soils.

The Project construction activities are subject to the requirements of the NPDES Construction General Permit because the proposed construction would disturb more than one acre. As a condition of construction, the applicant would be required to obtain coverage under the Construction General Permit, regulated by the RWQCB. Among other things, the conditions of the Permit include mandatory implementation of BMPs concerning erosion control. Compliance with the Construction General Permit, including the implementation of a SWPPP and associated BMPs, would ensure that the potential impact of soil erosion or the loss of topsoil during construction is *less than significant*. The plan must include the following information:

- Location and perimeter of the site
- Location of nearby storm drains and/or catch basins
- Existing and proposed roadways and drainage pattern within the site
- Drawing or diagram of the sediment and erosion control devices to be used on site
- A visual monitoring program

- A chemical monitoring program for nonvisible pollutants

The plan would specify minimum BMPs related to housekeeping (storage of construction materials, waste management, vehicle storage and maintenance, landscape materials, pollutant control); non-stormwater management; erosion control; sediment control; and run-on and runoff control. Implementation of these standard BMP measures in accordance with the Erosion and Sediment Control Plan would ensure that the potential impact of soil erosion or the loss of topsoil during construction is *less than significant.*

The geotechnical investigation also included a recommendation for annual maintenance of retaining wall backdrain systems during the operation of the Project, to ensure proper water flow and detect possible erosion (Treadwell and Rollo, 2013). These hazards, without incorporating Project-specific recommendations, would be *significant*. Implementation of **Mitigation Measure 3.6-2** would reduce the impact to a *less-than-significant* level by ensuring that maintenance includes inspection and flushing.

> **Mitigation Measure 3.6-2:** Annual maintenance shall include the following: inspection and flushing to make sure that subdrain pipes are free of debris and are in good working order; and inspection of subdrain outfall locations to verify that introduced water flows freely through the discharge pipes and that no excessive erosion has occurred.
>
> **Significance after Mitigation:** Less than Significant.

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c) Impact GEO-3: The Project may be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project. (Less than Significant with Mitigation)

Natural or constructed slopes could become destabilized during construction-related excavation and/or grading operations if located on problematic soils. Excavations for the Project components could result in slope instability, potentially triggering slope failures that could result in landslides, slumps, soil creep, or debris flows. Potential impacts related to subsidence and liquefaction are discussed above under Impact GEO-1.

Slope failures are more likely to occur in areas with a history of previous failure and in weak geologic units exposed on unfavorable slopes. As described in Section 3.6.1.3, Seismic and Geologic Hazards, the outlet structure is in an area where the potential for deep-seated landsliding during static conditions along the bluff is low; however, the potential for shallow or wedge failures up to about 10 to 15 feet thick under static conditions is moderate to high. During large seismic events, the potential for relatively large-scale landsliding is high. In addition, there is landslide potential at Avalon Canyon which would provide beach access during construction of the outlet structure.

The geotechnical investigation provided construction considerations and specifications to ensure the safety of workers and provide protection of surrounding improvements, including roadways, utilities and adjacent structures from slope instability, landsliding, and lateral earth pressure (Treadwell & Rollo, 2013). These hazards, without incorporating Project-specific recommendations, would be *significant*. With implementation of **Mitigation Measures 3.6-3a** and **3.6-3b**, impacts associated with landsliding would be *less than significant* because the measures would include adherence to the construction specifications of the geotechnical report which were defined in that report as measures required to reduce effects related to from slope instability, landsliding, and lateral earth pressure, as well as additional slope studies prior to final Project design.

Mitigation Measure 3.6-3a: The following recommendations regarding site preparation, foundations, retaining walls, seismic design, and other geotechnical aspects provided in the geotechnical report shall be incorporated into this Project.

- Areas that will include improvements, including new below-grade structures, concrete flatwork and slabs-on-grade, shall be cleared and grubbed of all vegetation, and the site shall be stripped of organic topsoil containing over three percent organic matter. Stripped materials shall be removed from the site or stockpiled for later use in landscaped areas, if approved by the architect.
- After stripping the existing soil subgrade, areas to receive fill or other improvements shall be scarified, moisture-conditioned, and compacted. The subgrade shall provide a firm, non-yielding surface. The soil subgrade shall be kept moist until it is covered by improvements. If soft or loose soil is encountered after stripping, the unsuitable material shall be excavated and replaced with suitable fill material.
- All materials to be used as general engineered fill or backfill, including on-site soil, shall be free of organic material, be non-hazardous and non-corrosive, contain no large rocks or lumps, and have low expansion potential, and be approved by the geotechnical engineer.
- Fill shall be placed in horizontal lifts, moisture-conditioned to above the optimum moisture content and compacted.
- Fill placed beneath exterior slabs-on-grade/flatwork and other below-grade structures shall also be moisture-conditioned. From a geotechnical standpoint, concrete flatwork/exterior slabs and other below-grade structures can be cast directly on soil subgrade. If Class 2 aggregate base is used beneath flatwork/slabs or structures it shall be compacted as necessary.
- Backfill for utility trenches and other excavations is also considered fill, and shall be compacted according to the recommendations previously presented. Jetting of trench backfill shall not be permitted. Special care shall be taken when backfilling utility trenches in pavement areas.
- Temporary slopes in loose to medium dense sand shall not be steeper than 2:1 (horizontal to vertical) for slopes up to 15 feet in height. Slopes higher than 15 feet shall be analyzed for stability. Temporary slopes in dense sand shall not be steeper than 1.5:1. If the sides of proposed excavations cannot be sloped back, then shoring shall be provided.
- A flexible shoring system shall be designed to resist lateral earth pressures and other pressures as described in the geotechnical investigations. Traffic or surcharge loads shall be added to the active pressures.

- The contractor shall be responsible for determining the actual length of tiebacks required to resist the lateral earth and water pressures imposed on the temporary retaining systems.
- The geotechnical engineer shall observe tieback testing.
- The geotechnical engineer shall evaluate the tieback test results and determine whether the tiebacks are acceptable.
- The shoring designer shall evaluate the required penetration depth of the soldier piles. The soldier piles shall have sufficient axial capacity to support the vertical load acting on the piles, if any.
- The geotechnical investigation anticipates an internally braced soil-cement shoring wall may be used for shoring in some areas where tiebacks aren't needed. The shoring designer shall determine the appropriate factor of safety to use.
- During excavation, the groundwater shall be lowered and maintained at that level until sufficient structural weight or a foundation system is available to resist the hydrostatic uplift forces on the bottom of the foundation and/or slab-on-grade. The selection and design of the dewatering system shall be the responsibility of the contractor. The geotechnical engineer shall check the design of the proposed dewatering system prior to installation.
- Adjacent improvements shall be monitored by the contractor for signs of subsidence including vertical movement and groundwater levels outside the excavation shall be monitored while dewatering is in progress.

Mitigation Measure 3.6-3b: Prior to final Project design, additional slope stability studies, including updated geologic mapping and slope stability analysis, shall be performed by a California-licensed geotechnical engineer to evaluate potential for weakened blocks that could become loose during outlet construction or tunneling. Also, stability analyses shall be completed to evaluate the potential impacts of bluff failure on the new outlet structure to be constructed at the base of the cliff. If potential for weakened blocks to become loose or for bluff failure to occur during construction, the study shall include design specifications and construction methods, such as use of temporary structural supports, to avoid such effects. Recommendations from the studies shall be incorporated into the final Project design and construction methods, and implemented by Daly City and/or its contractors.

Significance after Mitigation: Less than Significant.

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d) Impact GEO-4: The proposed Project would not create substantial risks to life or property due to expansive or corrosive soils. (Less than Significant with Mitigation)

Expansive Soils

As described in Section 3.6.1.3, Seismic and Geologic Hazards, the proposed Project would be located on soils with a low shrink-swell potential; therefore, potential impacts related to expansive soils would be *less than significant*.

Corrosive Soils

As described in Section 3.6.1.3, Seismic and Geologic Hazards, the geotechnical investigation conducted for the proposed Project concluded that Project area soils have a mild to moderate corrosion potential which could corrode the micropiles. Micropiles may be used to resist seismic and static compression and uplift loads. Micropiles consist of small-diameter (typically 6- to 14-inch-diameter), drilled, concrete- or grout-filled shafts with steel bars or pipes embedded in the concrete or grout. These hazards, without incorporating Project-specific recommendations, would be *significant*. **Mitigation Measure 3.6-4**, which would require double-corrosion protected micropiles be incorporated into project design, would reduce this impact to *less than significant*.

> **Mitigation Measure 3.6-4:** Daly City and/or its contractors shall ensure that all micropiles used for the Project are double-corrosion protected.
>
> **Significance after Mitigation:** Less than Significant.

NEPA Analysis

As described in the CEQA analysis, the proposed Project would result in changes to the risks to the public from soil erosion, seismic events, and landslides. Construction activities would result in exposing areas of loose soil that could be subject to erosion by wind and stormwater runoff. However, adherence to the NPDES Construction General Permit, which includes implementation of BMPs and a SWPPP, and the implementation of Mitigation Measure 3.6-2 would ensure that the Project would result in minor adverse effects on soil erosion.

The Project would result in the construction of facilities in an area with a potential for seismic events. As previously described, the Project would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations that were provided in the geotechnical investigation report, and are included as part of Mitigation Measures 3.6-1a and 3.6-1b.

The CEQA analysis above also described the potential for liquefaction and lateral spreading. Implementation of Mitigation Measure 3.6-1a and Mitigation Measure 3.6-1b, which would ensure the Project incorporates recommendations provided in the geotechnical report and completes additional slope stability studies. In addition, in the vicinity of Boring B-3 (Figure 3.6-2), implementation of Mitigation Measure 3.6-1c is recommended. Implementation of these mitigation measures, as well as conformance with the CBC would minimize potential structural damage during a seismic event, and ensure the Project would result in minor adverse effects from seismic events.

The CEQA analysis also includes a discussion on landslide events. As described in greater detail therein, Project construction could result in slope instability, potentially triggering slope failures that could result in landslides, slumps, soil creep, or debris flows. In addition, the Project is in an area where the potential for relatively large-scale landsliding is high. Mitigation Measure 3.6-3a and Mitigation Measure 3.6-3b are recommended to implement recommendations regarding site preparation, foundations, retaining walls, seismic design, and other geotechnical aspects provided in the geotechnical report. This would reduce the potential for landslide events and result in minor adverse effects from landslides.

3.6.5.2 Tunnel Alignment Alternative

The following describes the geology and soils effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.6.5.1, Proposed Project, or Section 3.6.5.3, Canal Configuration Alternative, depending on the option selected. Thus, geology and soils effects for the canal portion would be as described in those sections.

The proximity of the Tunnel Alignment Alternative to the existing Vista Grande Tunnel and proposed tunnel alignment (proposed Project) would result in the Tunnel Alignment Alternative encountering approximately the same geologic and seismic conditions as to those discussed in Section 3.6.5.1, Proposed Project. Therefore, the construction and operation impacts associated with the Tunnel Alignment Alternative would be similar to the Tunnel portion of the Project.

CEQA Analysis

As with the Project, structural damage to facilities could occur as a result of strong seismic groundshaking. As with the Project, the Tunnel Alignment Alternative would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations that were provided in the geotechnical investigations report, and are included as part of Mitigation Measures 3.6-1a and 3.6-1b. Therefore, given compliance with the CBC and Mitigation Measures 3.6-1a and 3.6-1b, potential seismic impacts related to groundshaking would be *less than significant.*

As with the Project, the Tunnel Alignment Alternative also has the potential for seismic-related ground failure resulting from liquefaction and lateral spreading. Implementation of Mitigation Measure 3.6-1a and Mitigation Measure 3.6-1b would ensure that the Tunnel Alignment Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies. In addition, in the vicinity of Boring B-3, implementation of Mitigation Measure 3.6-1c would be required. Implementation of these mitigation measures, as well and conformance with the CBC, would minimize potential structural damage during a seismic event, and ensure that the potential seismic-related impacts of the Tunnel Alignment Alternative would be reduced to a *less-than-significant* level.

As with the Project, the Tunnel Alignment Alternative construction could result in erosion from wind and stormwater runoff. Adherence to the NPDES Construction General Permit and implementation of Mitigation Measure 3.6-2, which would require annual maintenance of retaining wall backdrain systems during the operation of the Tunnel Alignment Alternative, would reduce potential erosion impacts to a *less-than-significant* level.

As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. The use of a shielded tunnel boring machine or digger shield to excavate the new tunnel under this alternative would provide immediate support during the excavation cycle, and initial support then would be installed along the tunnel drive, stabilizing the excavation. Implementation of Mitigation Measure 3.6-3a and Mitigation Measure 3.6-3b would ensure that the Tunnel Alignment Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies, reducing potential impacts related to slope failure to a *less-than-significant* level.

Like with the Project, the area soils have a mild to moderate corrosion potential. Implementation of Mitigation Measure 3.6-4 would incorporate corrosion protection measures into the Tunnel Alignment Alternative and reduce potential impacts to a *less-than-significant* level.

NEPA Analysis

As described above in the CEQA analysis, the Tunnel Alignment Alternative would result in changes to the risks to the public from soil erosion, seismic, and landslide events. Construction activities would result in exposing areas of loose soil that could be subject to erosion by wind and stormwater runoff. However, adherence to the NPDES Construction General Permit, which includes implementation of BMPs and a SWPPP, and the implementation of recommended Mitigation Measure 3.6-2, which would require annual maintenance of retaining wall backdrain systems during the operation of the Tunnel Alignment Alternative, would ensure that the adverse effects on soil erosion would be minor.

The Tunnel Alignment Alternative would result in the construction of facilities in an area with a potential for seismic events. As previously described, the Tunnel Alignment Alternative would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations provided in the geotechnical investigation report (Treadwell and Rollo, 2013). The CEQA analysis above also describes the potential for liquefaction and lateral spreading. Implementation of Mitigation Measure 3.6-1a and Mitigation Measure 3.6-1b would ensure the Tunnel Alignment Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies. In addition, in the vicinity of Boring B-3 implementation of Mitigation Measure 3.6-1c is recommended. Implementation of these mitigation measures, as well as conformance with the CBC would minimize potential structural damage during a seismic event, and ensure the Tunnel Alignment Alternative would result in minor adverse effects from seismic events.

As also described above, the construction of the Tunnel Alignment Alternative could result in slope instability, potentially triggering slope failures that could result in landslides, slumps, soil creep, or debris flows. In addition, the Tunnel Alignment Alternative is in an area where the potential for relatively large-scale landsliding is high. Implementation of Mitigation Measure 3.6-3a and Mitigation Measure 3.6-3b would ensure that recommendations regarding site preparation, foundations, retaining walls, seismic design, and other geotechnical aspects provided in the geotechnical report are implemented. This would reduce the potential for landslide events and result in minor adverse effects from landslides.

3.6.5.3 Canal Configuration Alternative

The following describes the geology and soils effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.6.5.1, Proposed Project, or Section 3.6.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, geology and soils effects for the tunnel portion would be as described in those sections.

The Canal Configuration Alternative would entail less construction than the proposed Canal improvements, as it would leave a larger portion of the existing Canal in place and would not construct the proposed box culvert in place of the upstream portion of the Canal. The constructed treatment wetland also would be reduced in size compared to the proposed Project wetland. The methods and duration to construct this alternative would not change appreciably compared to the canal portion of the proposed Project.

CEQA Analysis

Impacts of the Canal Configuration Alternative would be similar to those described for the canal portion of the proposed Project. Structural damage to facilities could occur as a result of strong seismic groundshaking and/or seismic-related ground failure. The Canal Configuration Alternative would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations that were provided in the geotechnical investigation report, and are included as part of Mitigation Measures 3.6-1a and 3.6-1b.

As with the Project, the Canal Configuration Alternative has the potential to encounter liquefaction and lateral spreading. Implementation of Mitigation Measure 3.6-1a and Mitigation Measure 3.6-1b, which would ensure that the Canal Configuration Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies. Implementation of these mitigation measures as well as conformance with the CBC, would minimize potential structural damage during a seismic event, and ensure that the potential impacts of the Canal Configuration Alternative would be reduced to a *less-than-significant* level.

As with the Project, the Canal Configuration Alternative construction could result in erosion from wind and stormwater runoff. Adherence to the NPDES Construction General Permit and implementation of Mitigation Measure 3.6-2, which would require annual maintenance of retaining wall backdrain systems during the operation of the Canal Configuration Alternative, would ensure that the effects on soil erosion would be *less than significant*.

As with the Project, excavations could trigger slope failures that could result in landslides, slumps, soil creep, or debris flows. Implementation of Mitigation Measure 3.6-3a and Mitigation Measure 3.6-3b would ensure that the Canal Configuration Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies, reducing potential impacts related to slope failure to a *less-than-significant* level.

As with the Project, the area soils have a mild to moderate corrosion potential. Implementation of Mitigation Measure 3.6-4 would incorporate corrosion protection measures into the Canal Configuration Alternative and reduce potential impacts to a *less-than-significant* level.

NEPA Analysis

As described above in the CEQA analysis, the Canal Configuration Alternative would result in changes to the risks to the public from soil erosion, seismic, and landslide events. Construction activities would result in exposing areas of loose soil that could be subject to erosion by wind and stormwater runoff. However, adherence to the NPDES Construction General Permit, which includes implementation of BMPs and a SWPPP, and the implementation of Mitigation Measure 3.6-2, which would require annual maintenance of retaining wall backdrain systems during the operation of the Canal Configuration Alternative would result in minor adverse effects on soil erosion.

The Canal Configuration Alternative would result in the construction of facilities in an area with the potential for seismic events. As previously described, the Canal Configuration Alternative would be designed to meet current seismic standards in accordance with the CBC and the geotechnical recommendations that were provided in the geotechnical investigations report, and are included as part of Mitigation Measures 3.6-1a and 3.6-1b. The CEQA analysis above also described the potential for liquefaction and lateral spreading. Implementation of Mitigation Measure 3.6-1a and Mitigation Measure 3.6-1b, which would ensure the Canal Configuration Alternative incorporates recommendations provided in the geotechnical report and completes additional slope stability studies, as well as conformance with the CBC, would minimize potential structural damage during a seismic event, and ensure the Canal Configuration Alternative would result in minor adverse effects from seismic events.

As also described above, the construction of the Canal Configuration Alternative could result in slope instability, potentially triggering slope failures that could result in landslides, slumps, soil creep, or debris flows. In addition, the Canal Configuration Alternative is in an area where the potential for relatively large-scale landsliding is high. Implementation of Mitigation Measure 3.6-3a and Mitigation Measure 3.6-3b would require the inclusion of recommendations regarding site preparation, foundations, retaining walls, seismic design, and other geotechnical aspects provided in the geotechnical report. This would reduce the potential for landslide events and result in minor adverse effects from landslides.

3.6.5.4 No Project/No Action Alternative

Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Vista Grande Drainage Basin would continue to flood during storm events, resulting in flooding of residential areas along John Muir Drive. The stormwater from the Lake Merced Watershed area would continue to be disconnected from Lake Merced. In addition, Daly City would continue to use the existing ocean outlet structure at Fort Funston which would continue to contribute to erosion of the cliff face where it is located. The Project site would continue to experience existing levels of geologic and seismic hazards.

3.6.6 Cumulative Effects

3.6.6.1 Geographic Extent/Context

The geographic scope for the analysis of potential cumulative geologic and soils impacts is limited to the immediate vicinity around the Project sites. Impacts related to geologic and seismic hazards are generally site-specific and depend on the localized geology and soil conditions. As a result, they are not typically additive or cumulative in nature.

3.6.6.2 Past, Present, and Reasonably Foreseeable Projects

In the vicinity of the Project, there are several projects proposed including groundwater and recycled water projects, and commercial and residential developments. These present and reasonably foreseeable projects' long- and short-term cumulative environmental impacts are not anticipated to impact the Project or cause geologic or seismic-related impacts because impacts related to geologic and seismic hazards generally are site-specific and depend on and are limited to the localized geology and soil conditions. Existing conditions reflect the contributions of past projects.

3.6.6.3 Construction

Impacts caused by the cumulative projects, combined with the Project, would not result in a *significant* cumulative impact even if all of the projects were to be constructed simultaneously because the Project and all cumulative projects would be required to adhere to the robust body of regulations that govern geologic and seismic hazards, worker safety, building standards, and water quality best management practices. The regulations include conducting geotechnical investigations and the implementation of the recommendations provided within each geotechnical report. Together, these measures along with recommendations provided in the geotechnical investigations would ensure that impacts related to exposure to geologic or seismic would be minimized and/or avoided. Therefore, the Project's incremental contribution to any geologic and seismic-related cumulative impact would not be cumulatively considerable.

3.6.6.4 Operation and Maintenance

The Project and alternatives would have negligible, and site-specific contributions to cumulative geologic and seismic-related conditions during operation and maintenance and therefore, impacts from the operation and maintenance phase would not be cumulatively considerable.

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3.7 Greenhouse Gas Emissions and Climate Change

This section provides a description of global climate change, greenhouse gas (GHG) emissions, the existing regulatory framework governing GHG emissions, and an analysis of the impacts related to GHGs associated with development of the Project.

3.7.1 Affected Environment

3.7.1.1 Climate Change

"Global warming" and "global climate change" are the terms used to describe the increase in the average temperature of the earth's near-surface air and oceans since the mid-20th century and its projected continuation. Warming of the climate system is now considered to be unequivocal (International Panel on Climate Change [IPCC], 2007), with global surface temperature increasing approximately 1.33 degrees Fahrenheit (°F) over the last 100 years. Continued warming is projected to increase global average temperature between 2 and 11°F over the next 100 years.

Natural processes and human actions have been identified as the causes of this warming. The IPCC concludes that variations in natural phenomena such as solar radiation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward. After 1950, however, increasing GHG concentrations resulting from human activity such as fossil fuel burning and deforestation have been responsible for most of the observed temperature increase. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries. Since 2007, no scientific body of national or international standing has maintained a dissenting opinion.

Potential global warming impacts in California may include, but are not limited to, loss in snow pack, sea level rise, more extreme heat days per year, more high ozone days, more large forest fires, and more drought years. Secondary effects are likely to include the displacement of thousands of coastal businesses and residences, impacts on agriculture, changes in disease vectors, and changes in habitat and biodiversity. As the CARB *Climate Change Scoping Plan* noted, the legislature in enacting Assembly Bill (AB) 32 found that global warming would cause detrimental effects to some of the state's largest industries, including agriculture, winemaking, tourism, skiing, commercial and recreational fishing, forestry, and the adequacy of electrical power generation. The *Climate Change Scoping Plan* states as follows (CARB, 2008a): "The impacts of global warming are already being felt in California. The Sierra snowpack, an important source of water supply for the state, has shrunk 10 percent in the last 100 years. It is expected to continue to decrease by as much as 25 percent by 2050. World-wide changes are causing sea levels to rise – about 8 inches of increase has been recorded at the Golden Gate Bridge over the past 100 years – threatening low coastal areas with inundation and serious damage from storms."

Ecosystem and Biodiversity Impacts

Climate change is expected to have effects on diverse types of ecosystems, from alpine to deep-sea habitat (USEPA, 2014). As temperatures and precipitation change, seasonal shifts in vegetation would occur; this could affect the distribution of associated flora and fauna species. As the range of species shifts, habitat fragmentation could occur, with acute impacts on the distribution of certain sensitive species. The IPCC states that "20 percent to 30 percent of species assessed may be at risk of extinction from climate change impacts within this century if global mean temperatures exceed 2 to 3°C (3.6 to 5.4°F) relative to pre-industrial levels" (IPCC, 2007). Shifts in existing biomes could also make ecosystems vulnerable to encroachment by invasive species. Wildfires, which are an important control mechanism in many ecosystems, may become more severe and more frequent, making it difficult for native plant species to repeatedly re-germinate. In general terms, climate change is expected to put a number of stressors on ecosystems, with potentially catastrophic effects on biodiversity.

Human Health Impacts

Climate change may increase the risk of vector-borne infectious diseases, particularly those found in tropical areas and spread by insects, such as malaria, dengue fever, yellow fever, and encephalitis (USEPA, 2013a). Cholera, which is associated with algal blooms, could also increase. While these health impacts would largely affect tropical areas in other parts of the world, effects would also be felt in California. Warming of the atmosphere would be expected to increase smog and particulate pollution, which could adversely affect individuals with heart and respiratory problems, such as asthma. Extreme heat events would also be expected to occur with more frequency and could adversely affect the elderly, children, and the homeless. Finally, the water supply impacts and seasonal temperature variations expected as a result of climate change could affect the viability of existing agricultural operations, making the food supply more vulnerable.

3.7.1.2 Greenhouse Gases

The generation of electricity can produce GHGs in addition to the criteria air pollutants that traditionally have been regulated under the federal and state CAAs. For traditional sources of electricity, such as fossil fuel-fired power plants, GHG emissions include primarily carbon dioxide (CO_2), with much smaller amounts of nitrous oxide (N_2O), and methane (CH_4) primarily from unburned natural gas). Other sources of GHG emissions include sulfur hexafluoride (SF_6) from high voltage power equipment and hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) from refrigeration/chiller equipment. Because these different GHGs have different warming potential (i.e., the amount of heat trapped by a certain mass of a GHG), and CO_2 is the most common reference gas for climate change, GHG emissions often are quantified and reported as CO_2 equivalents (CO_2e). For example, SF_6, while representing a small fraction of the total GHGs emitted annually worldwide, is a very potent GHG with 23,900 times the global warming potential of the same mass of CO_2. Therefore, an emission of one metric ton of SF_6 would be reported as an emission of 23,900 metric tons CO_2e. Large emission sources are reported in million metric tons[1] of CO_2e.

1 A metric ton is 1,000 kilograms; it is equal to approximately 1.1 U.S. tons and approximately 2,204.6 pounds.

GHG emissions from the electricity sector are dominated by CO_2 emissions from carbon-based fuels. Other sources of GHG emissions are small and also are more likely to be easily controlled or reused or recycled, but are nevertheless documented here as some of the compounds that have very high global warming potentials.

Fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles, has led to substantial increases in CO_2 emissions and atmospheric concentrations. In 1994, atmospheric CO_2 concentrations were found to have increased by nearly 30 percent above pre-industrial (c. 1860) concentrations.

In California, the transportation sector is the largest emitter of GHGs, accounting for 36 percent of total GHG emissions in the state in 2012, followed by electricity generation at 21 percent and the industrial sector at 19 percent (CARB, 2014b, 2014a). California produced approximately 459 million gross metric tons of CO_2e in 2012 (CARB, 2014a).

In the Bay Area, the transportation sector and industrial/commercial sector represent the largest sources of GHG emissions, each accounting for 36.4 percent of the Bay Area's 95.8 million tons of CO_2e in 2007. Electricity/co-generation sources account for about 15.9 percent of the Bay Area's GHG emissions, followed by residential fuel usage at about 7.1 percent. Off-road equipment and agricultural/farming sources currently account for approximately 3 percent and 1.2 percent of the total Bay Area GHG emissions, respectively (BAAQMD, 2010).

3.7.2 Regulatory Setting

3.7.2.1 Federal

U.S. Environmental Protection Agency (USEPA)

On April 2, 2007, in *Massachusetts v. USEPA*, 549 US 497, the Supreme Court found that GHGs are air pollutants covered by the CAA. The Court held that the USEPA must determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the USEPA is required to follow the language of Section 202(a) of the CAA.

On April 17, 2009, the USEPA Administrator signed proposed "endangerment" and "cause or contribute" findings for GHGs under Section 202(a) of the CAA. The USEPA held a 60-day public comment period, considered public comments, and issued final findings. The USEPA found that six GHGs taken in combination endanger both the public health and the public welfare of current and future generations. The USEPA also found that the combined emissions of these GHGs from new motor vehicles and new motor vehicle engines contribute to the greenhouse effect as air pollution that endangers public health and welfare under CAA Section 202(a) (USEPA, 2010).

Specific GHG regulations that the USEPA has adopted to date are as follows:

> ***40 CFR Part 98. Mandatory Reporting of Greenhouse Gases Rule*.** This rule requires mandatory reporting of GHG emissions for facilities that emit more than 25,000 metric tons of CO_2e emissions per year (USEPA, 2013b). The Project would not trigger GHG reporting as required by this regulation.

> ***40 CFR Part 52. Proposed Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule*.** USEPA has mandated that Prevention of Significant Deterioration (PSD) and Title V requirements applies to facilities whose stationary source CO_2e emissions exceed 100,000 tons per year (USEPA, 2011). The Project would not trigger PSD or Title V permitting under this regulation.

Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, the U.S. EPA released its final Greenhouse Gas Reporting Rule (Reporting Rule). The Reporting Rule is a response to the fiscal year (FY) 2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110-161), that required the U.S. EPA to develop "…mandatory reporting of GHGs above appropriate thresholds in all sectors of the economy…." The Reporting Rule will apply to most entities that emit 25,000 metric tons of CO_2e or more per year. Starting in 2010, facility owners are required to submit an annual GHG emissions report with detailed calculations of facility GHG emissions. The Reporting Rule also mandates recordkeeping and administrative requirements in order for the U.S. EPA to verify annual GHG emissions reports.

3.7.2.2 State

The legal framework for GHG emission reduction has come about through Executive Orders, legislation, and regulation. The major components of California's climate change initiative are reviewed below.

Senate Bill 97

Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is a prominent environmental issue requiring analysis under CEQA. This bill directed the Governor's Office of Planning and Research (OPR) to prepare, develop, and transmit to the California Natural Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by CEQA, no later than July 1, 2009. The California Natural Resources Agency was required to certify or adopt those guidelines by January 1, 2010. On December 30, 2009, the Natural Resources Agency adopted the state CEQA Guidelines amendments, as required by SB 97. These state CEQA Guidelines amendments provide guidance to public agencies regarding the analysis and mitigation of the effects of GHG emissions in draft CEQA documents. The amendments became effective March 18, 2010.

CEQA Guidelines

CEQA Guidelines Section 15064.4 specifically addresses the significance of GHG emissions. Section 15064.4 calls for a lead agency to make a "good-faith effort" to "describe, calculate or estimate" GHG emissions in CEQA environmental documents. Section 15064.4 further states that the analysis of GHG impacts should include consideration of (1) the extent to which the project may increase or reduce GHG emissions, (2) whether the project emissions would exceed a locally applicable threshold of significance, and (3) the extent to which the project would comply with "regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions." The guidelines also state that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements in a previously approved plan or mitigation program (including plans or regulations for the reduction of greenhouse gas emissions) that provides specific requirements that will avoid or substantially lessen the cumulative problem within the geographic area in which the project is located (CEQA Guidelines Section 15064(h)(3).) The CEQA Guidelines revisions do not, however, set a numerical threshold of significance for GHG emissions.

The revisions also include the following guidance on measures to mitigate GHG emissions, when such emissions are found to be significant:

> Consistent with Section 15126.4(a), lead agencies shall consider feasible means, supported by substantial evidence and subject to monitoring or reporting, of mitigating the significant effects of greenhouse gas emissions. Measures to mitigate the significant effects of greenhouse gas emissions may include, among others:
>
> (1) Measures in an existing plan or mitigation program for the reduction of emissions that are required as part of the lead agency's decision;
>
> (2) Reductions in emissions resulting from a project through implementation of project features, project design, or other measures;
>
> (3) Off-site measures, including offsets that are not otherwise required, to mitigate a project's emissions;
>
> (4) Measures that sequester greenhouse gases; and
>
> (5) In the case of the adoption of a plan, such as a general plan, long range development plan, or plans for the reduction of greenhouse gas emissions, mitigation may include the identification of specific measures that may be implemented on a project-by-project basis. Mitigation may also include the incorporation of specific measures or policies found in an adopted ordinance or regulation that reduces the cumulative effect of emissions.

Assembly Bill 1493

AB 1493 required CARB to develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty trucks and other vehicles determined by CARB to be vehicles whose primary use is noncommercial personal transportation in the state."

To meet the requirements of AB 1493, CARB approved amendments to the California Code of Regulations in 2004, adding GHG emissions standards to California's existing standards for motor vehicle emissions. Amendments to the California Code of Regulations Title 13, Sections 1900 and 1961, and adoption of Section 1961.1 require automobile manufacturers to meet fleet-average GHG emissions limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes, beginning with model year 2009. Because the AB 1493 standards would impose stricter standards than those under the CAA, California applied to the USEPA for a waiver under the CAA; this waiver was initially denied in 2008. In 2009, however, the USEPA granted the waiver.

Executive Order S-3-05

In 2005, in recognition of California's vulnerability to the effects of climate change, then-Governor Arnold Schwarzenegger established Executive Order S-3-05, which sets forth the following target dates by which statewide GHG emissions would be progressively reduced: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; and by 2050, reduce GHG emissions to 80 percent below 1990 levels.

Assembly Bill 32

In 2006, the California legislature passed AB 32 (California Health and Safety Code Division 25.5, Sections 38500, et seq.), also known as the Global Warming Solutions Act. AB 32 requires the CARB to design and implement feasible and cost-effective emissions limits, regulations, and other measures, such that statewide GHG emissions are reduced to 1990 levels by 2020 (representing a 25-percent reduction in emissions). AB 32 anticipates that the GHG reduction goals will be met, in part, through local government actions. The CARB has identified a GHG reduction target of 15 percent from current levels for local governments (municipal and community-wide) and notes that successful implementation of the plan relies on local governments' land use planning and urban growth decisions because local governments have primary authority to plan, zone, approve, and permit land development to accommodate population growth and the changing needs of their jurisdictions.

Scoping Plan Provisions

Pursuant to AB 32, the CARB adopted a *Climate Change Scoping Plan* in December 2008 (CARB, 2008a) outlining measures to meet the 2020 GHG reduction goal. In order to meet this goal, California must reduce its GHG emissions by 30 percent below projected 2020 business-as-usual emissions levels. The 2008 Scoping Plan recommends measures that California may implement, such as new fuel regulations, and estimates that a reduction of 174 million metric tons of CO_2e (about 191 million U.S. tons) from the transportation, energy, agriculture, forestry, and other sources could be achieved if California implements all of the measures. An update to the Scoping Plan, published in 2014, lays out a set of new actions, including specific recommended actions with lead agency assignments and anticipated due dates. Some of the actions are near-term, while others are focused on longer-term efforts (CARB, 2014b). The measures relevant to the Project are listed in **Table 3.7-1**.

Green Building Standards Code

In January 2010, the State of California adopted the California Green Building Standards Code (CALGreen) that establishes mandatory green building standards for all buildings in California. The code covers five categories: planning and design, energy efficiency, water efficiency and

TABLE 3.7-1
RELEVANT RECOMMENDED ACTIONS OF CLIMATE CHANGE SCOPING PLAN

Source	Strategy Name and Description
2008 Scoping Plan	***W-3 Water System Energy Efficiency*.** This measure seeks to reduce the magnitude and intensity of energy use in California's water systems through further implementation of energy efficiency measures such as more efficient pumps and wastewater treatment.
2008 Scoping Plan	***W-4 Reuse Urban Runoff*.** This measure proposes that LID be required to maximize the infiltration and/or capture of stormwater to increase local water supplies. Where favorable soil and geologic conditions exist, stormwater would be infiltrated to increase groundwater supplies. In locations where potential infiltration is either limited or not recommended, capture and storage would be required to preserve stormwater for nonpotable applications. In addition to LID techniques, this measure promotes development of regional infiltration facilities and neighborhood facilities to augment local water supplies.
2014 Update	SWRCB and RWQCB by 2016 to implement green infrastructure permits to treat and capture urban runoff for local use.
2014 Update	SWRCB and RWQCBs by 2016 to modify state and regional water board policies and permits to achieve conservation, water recycling, stormwater reuse, and wastewater-to-energy goals.

SOURCE: CARB, 2008b, 2014b

conservation, material conservation and resource efficiency, and indoor environmental quality. These standards include a mandatory set of minimum guidelines, as well as more rigorous voluntary measures, for new construction projects to achieve specific green building performance levels. This code went into effect as part of local jurisdictions' building codes on January 1, 2011.

3.7.2.3 Regional and Local

Bay Area Air Quality Management District Climate Protection Program

The Bay Area Air Quality Management District (BAAQMD) is the primary agency responsible for air quality regulation in the San Francisco Bay Area Air Basin (SFBAAB). BAAQMD established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the SFBAAB (BAAQMD, 2012a). The program includes measures that promote energy efficiency, reduce vehicle miles traveled, and develop alternative sources of energy, all of which assist in reducing GHGs and other air pollutants that affect the health of residents. BAAQMD also seeks to support current climate protection programs in the region and to stimulate additional efforts through public education and outreach, technical assistance to local governments and other interested parties, and promotion of collaborative efforts among stakeholders. The BAAQMD recommends that local agencies adopt a Greenhouse Gas Reduction Strategy consistent with AB 32 goals and that subsequent projects determine the significance of their GHG emissions based on the degree to which that project complies with a Greenhouse Gas Reduction Strategy (BAAQMD, 2012b). This recommendation is consistent with the approach to analyzing GHG emissions outlined in OPR's CEQA Guidelines, as amended by SB 97.

Daly City Green Vision: Climate Action Plan (2011)

The Daly City Green Vision: Climate Action Plan (CAP) seeks to reduce the City operation's overall carbon footprint through a series of ten goals by the year 2020. The goals cover topics such as reducing solid waste, recycling and reuse of wastewater, preservation of urban forests, adoption of a master pedestrian and bicycle plan, reuse of biosolids, and use of green buildings standards, and community education. A relevant GHG reduction goal includes Goal 3 (Recycle and Beneficially Reuse Wastewater).

San Francisco Construction and Demolition Debris Recovery Ordinance

In 2006, San Francisco adopted Ordinance No. 27-06, requiring all construction and demolition debris to be transported to a registered facility that can divert a minimum of 65 percent of these materials from landfills. This ordinance applies to all construction, demolition, and remodeling projects within the City of San Francisco.

3.7.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.7.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section VII, a project would cause adverse impacts related to GHG emissions if it would:

a) Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or

b) Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.

3.7.3.2 NEPA Impact Thresholds

In February 2010, the Council on Environmental Quality (CEQ) provided a draft guidance memorandum on consideration of the effects of climate change and GHG emissions in NEPA documentation (CEQ, 2010). This guidance indicates that NEPA analyses should consider climate change issues that arise in relation to the consideration of the GHG emissions effects of a proposed action and alternative actions as well as the relationship of climate change effects to a proposed action or alternatives, including the relationship to proposal design, environmental impacts, and mitigation and adaptation measures.

This document identifies the CAA reporting requirement of 25,000 metric tons or more of CO_2e as an indication that GHG emissions could be considered a potential adverse impact of a federal action, but specifies that the reporting requirement should not necessarily be used as a threshold. In lieu of other federal guidance, Project GHG emissions were calculated and compared to the federal reporting threshold for the purposes of assessing impacts under NEPA. The impact intensity with respect to GHG emissions is described in the table below.

Impact Intensity	Impact Description
Negligible:	Alternative would generate a negligible amount of GHG emissions (assumed to be 1 percent or less of the USEPA reporting threshold).
Minor:	Alternative would generate a minor amount of GHG emissions (up to 50 percent of the USEPA reporting threshold).
Moderate:	Alternative would generate a moderate amount of GHG emissions (greater than 50 percent but less than the USEPA reporting threshold).
Major:	Alternative would generate a major amount of GHG emissions (exceed the USEPA reporting threshold) generated.

The CEQ guidelines indicate that climate change can affect the environment of a proposed action in a variety of ways. For instance, climate change can affect the integrity of a development or structure by exposing it to a greater risk of floods, storm surges, or higher temperatures. Climate change can increase the vulnerability of a resource, ecosystem, or human community, causing a proposed action to result in consequences that are more damaging than prior experience with environmental impacts analysis might indicate (CEQ, 2010). Because such effects are resource-specific, no impact intensity thresholds are provided in this section for climate change-related impacts. Rather, such impacts and their expected level of intensity are addressed in Section 3.9, Hydrology and Water Quality, which is the applicable resource section.

3.7.3.3 Criteria and Thresholds with No Impact or Not Applicable

The Project and alternatives would not result in impacts related to the following CEQA significance criterion; this criterion is not discussed in the impact analysis for the following reasons:

b) ***Conflict with an applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.*** The Project and alternatives would not conflict with any applicable adopted GHG-related plans, policies, or regulations, including the BAAQMD Climate Protection Program or the Daly City Climate Action Plan, which generally do not address temporary construction-related GHG emissions. Additionally, the Project and alternatives would support the goals of CARB's Climate Change Scoping Plan by complying with the relevant measures described in Table 3.7-1. For example, the Project and alternatives would increase the energy efficiency of the wastewater system thereby supporting Scoping Plan Measure W-3 by discontinuing the use of the force main in favor of a gravity-only effluent discharge, and therefore would no longer require that the effluent be pumped during wet weather. The Project and alternatives also are designed to reuse urban runoff thereby supporting Scoping Plan Measure W-4 by contributing stormwater from the Basin to Lake Merced, and reduce the effect of nearby groundwater pumping projects on Lake Merced. Several upstream Low Impact Development (LID) measures also are included in the Lake Management Plan (LMP) (Appendix A). Additionally, contractors would be required to comply with the requirements of San Francisco's Construction and Demolition Ordinance (Chapter 14 of the Environment Code), which requires that construction debris materials are recycled or reused and not transported to a landfill. The diversion of construction and demolition wastes within San Francisco is expected to reduce GHG emissions by 57,000 short tons per year (San Francisco, 2010). Therefore, no impact would occur with respect to applicable plans and policies to reduce emissions of GHGs.

3.7.4 Methodology and Assumptions

This GHG impact analysis considers short-term Project construction impacts and was developed using a custom excel-based calculation worksheet, provided in **Appendix C**. Emission factors for CO_2 associated with off-road vehicle construction activities were provided by the Roadway Construction Emissions Model [Sacramento Metropolitan Air Quality Management District (SMAQMD), 2013] which is based on factors within CARB's Offroad 2011 Emissions Inventory.

During Project construction, construction equipment, trucks, worker vehicles, and ground-disturbing activities would generate GHG emissions directly. The construction equipment inventory and use assumptions input to estimate construction emissions were developed based on the assumed weekly construction schedule for the Project combined with equipment types and duration of use information provided by Daly City. Construction of the Canal is expected to occur for almost the full 28 months of total Project construction. Tunnel construction would occur for 21 months and would occur concurrently with construction of the Ocean Outlet, which is expected to last 5.5 months. Construction activities would include site demolition, tree and vegetation removal, excavation, tunneling, grading, pile driving, drilling, backfilling, and material loading.

Truck trips would be required for construction and would include concrete hauling, other material hauling, and worker vehicle trips. Expected construction vehicle trip data were obtained from Daly City, and CO_2 vehicle emission factors were obtained from EMFAC 2011, using context-specific parameters (see Appendix C for more details). Additional vehicle emission factors (CH_4 and N_2O) were provided by the California Climate Action Registry's (CCAR) General Reporting Protocol (CCAR, 2009). Trip length information was provided by CalEEMod default factors for San Mateo County, which are 24.8, 40, and 14.6 miles for round trips for light-duty, heavy-duty haul, and heavy-duty vendor vehicles, respectively.

3.7.5 Impact Analysis

3.7.5.1 Proposed Project

CEQA Analysis

a) **Impact GHG-1: Project construction and operation would generate GHG emissions. (Less than Significant)**

Construction

Project construction would occur over 24 to 44 months. The majority of Project-related GHG emissions would be generated off-site from construction worker vehicle trips to and from the site and from heavy-duty haul trucks moving soil, gravel, and debris to and from the construction site. Off-road construction vehicle use, including from the use of a crane and excavators, would also contribute to construction GHG emissions.

The BAAQMD's *Revised Draft Options and Justification Report* (BAAQMD, 2009) identifies qualitative and quantitative operations-related thresholds of significance for GHG emissions. For projects other than stationary sources, the qualitative threshold is noncompliance with a qualified climate action plan or qualified general plan. The quantitative threshold is annual operational emissions of more than 1,100 metric tons of CO_2e. For stationary source projects, there is only a quantitative threshold of 10,000 metric tons CO_2e per year. There is no threshold established for GHG emissions generated during construction. In the absence of such thresholds, this analysis applies the BAAQMD's threshold of 1,100 metric tons CO_2e per year for non-stationary source projects as the Project would not result in installation of a stationary source requiring a permit from BAAQMD.

Estimated Project construction GHG emissions are presented in **Table 3.7-2**. Refer to **Appendix C** for the assumptions used to estimate these emissions.

TABLE 3.7-2
CONSTRUCTION-RELATED GHG EMISSIONS (METRIC TONS CO_2E)

Construction Activity Source	**Year 1**	**Year 2**	**Year 3**
Off-road Equipment Emissions	175.1	436.0	119.5
Vehicle Emissions	845.3	550.1	97.9
Total Construction Emissions	1,020.4	986.1	217.3
Significance Threshold	1,100.0	1,100.0	1,100.0
Significant Impact?	**No**	**No**	**No**

As indicated in Table 3.7-2, total short-term Project construction-related GHG emissions would be at most 1,020 metric tons CO_2e per year, which is lower than BAAQMD's quantitative threshold of 1,100 metric tons CO_2e per year for non-stationary sources. Therefore, GHG emissions from Project construction are considered *less than significant*.

The estimates provided in Table 3.7-2 reflect the most intensive construction schedule among the possible options related to tunneling (i.e., concurrent tunnel drive construction, 24 hours per day). Some of the emissions estimated to occur in years 1 and 2 likely would be displaced into year 3 and potentially a fourth year of construction if the tunnel drives were constructed sequentially and/or if tunnel construction was limited to between 7:00 a.m. and 7:00 p.m. because construction would be spread out over a greater number of months (up to 44 months in total). The overall total construction emissions would be similar. Under all circumstances, impacts associated with construction-related GHG emissions would be *less than significant*.

Operation

Once construction is complete, the Project would result in negligible new sources of GHG emissions. GHG emissions would result from the use of a vacuum truck to clean the debris screening device, from vehicles required during other annual maintenance activities, from electricity used to pump water to the wetlands, and from periodic replacement of the Ocean Outlet (approximately 25 years) as bluff erosion proceeds. However, the Project also would allow

Daly City to discontinue pumping treated effluent from the Wastewater Treatment Plant through the force main during wet weather because it would accommodate the use of the gravity pipeline during wet weather. This would eliminate the GHG emissions associated with electricity used to power the pumps that supply water to the force main when needed. Additionally, the LMP includes an operational plan for the proposed Vista Grande diversions, a water quality monitoring plan, and best management practices that could result in occasional maintenance vehicle trips. Therefore, there would be a negligible net change in long-term baseline conditions as a result of the Project, and the long-term operational impact with respect to GHG emissions would be *less than significant.*

Mitigation: None required.

NEPA Analysis

The 25,000 metric tons CO_2e threshold for adverse environmental impacts is described in Section 3.7.3.2. As shown in Table 3.7-2, construction-related GHG emissions would be below this federal reporting threshold for all years (up to 4 percent of the threshold in the first year). Therefore, the Project would have a minor adverse impact with regard to construction related GHG emissions. As described above, operational GHG emissions which would result from the use of electricity to power seasonal pump and diversion gate operations and from occasional vehicle trips to perform maintenance operations would not be a daily occurrence and would generate negligible GHG emissions (less than 1 percent of the threshold). Therefore the Project would have a negligible impact with regard to operational GHG emissions.

3.7.5.2 Tunnel Alignment Alternative

The following describes the greenhouse gas emissions and climate change-related effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.7.5.1, Proposed Project, or Section 3.7.5.3, Canal Configuration Alternative, depending on the option selected. Thus, greenhouse gas and climate change-related effects for the canal portion would be as described in those sections.

CEQA Analysis

Construction

The Tunnel Alignment Alternative would have many similar construction characteristics of the Project. The general construction methods and duration required to construct the Tunnel Alignment Alternative would not change compared to the Tunnel portion of the proposed Project, as described in Chapter 2. The details of the construction activities and methods for the Project, which would be the substantially similar to those of the Tunnel Alignment Alternative with the exception that a digger shield or micro tunnel boring machine would be used in place of a mini excavator, are summarized in Table 2-1 and include demolition; alternative component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. From a GHG emission perspective, use of a digger shield or micro tunnel boring machine in place of a mini excavator would represent replacing one type of diesel engine with another. Both types of equipment engines would operate over the same construction phase duration and have similar engine load factors and would not meaningfully change the GHG emissions estimated for the proposed Project which are primarily determined by these characteristics.

The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated GHG emissions. Like the Project, the Tunnel Alignment Alternative would have annual construction-related GHG emissions that would not exceed the BAAQMD's significance thresholds. Therefore, construction-related GHG emissions associated with the Tunnel Alignment Alternative would be *less than significant.*

Operation

There would be no differences in operational emissions under the Tunnel Alignment Alternative compared to the Tunnel portion of the Project. Operational pumping and maintenance truck trips associated with the Canal portion would be the same as described in Section 3.7.5.1, Proposed Project, or Section 3.7.5.3, Canal Configuration Alternative, depending on the option selected. Vehicle use would also be required during other maintenance activities, which would result in negligible operational emissions from truck operations. Given the limited emissions associated with operations, GHG emissions under the Tunnel Alignment Alternative would be *less than significant.*

NEPA Analysis

The construction methods and duration to construct the alternative would not change substantially compared to the Project. The tunnel excavation would use a micro tunnel boring machine rather than a mini excavator, From a GHG emission perspective, use of a micro tunnel boring machine in place of a mini excavator this would represent replacing one type of diesel engine with another and would not meaningfully change the emissions as estimated for the proposed Project.

The Tunnel Alignment Alternative would require a reduced volume of materials to be off-hauled as compared to the Project, which would reduce the number of truck trips required and their associated emissions. Like the Project, the Tunnel Alignment Alternative would have annual construction-related GHG emissions that would be below the federal reporting threshold for all years (up to 4 percent of the 25,000-ton reporting threshold). Operational GHG emissions resulting from the use of electricity to power seasonal pump and diversion gate operations and from occasional vehicle trips to perform maintenance operations would not be a daily occurrence and would generate negligible GHG emissions (less than 1 percent of the 25,000-ton reporting threshold). Therefore, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.

3.7.5.3 Canal Configuration Alternative

The following describes the greenhouse gas emissions and climate change-related effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.7.5.1, Proposed Project, or Section 3.7.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, greenhouse gas emissions and climate change-related effects for the tunnel portion would be as described in those sections.

CEQA Analysis

Construction

The construction methods and duration to construct this alternative would not change substantially compared to the Project, as described in Chapter 2 except that the collection box and box culvert would not be installed. This would result in reduced duration of construction activity as removal of approximately 1,500 feet of the canal structure and installation of box culverts described for the proposed Project would not occur, resulting in fewer annual emissions. Additionally, truck transport of excavated materials and clean fill associated with the box culvert would not be required under this alternative that would occur under the proposed Project, also reducing annual emissions. Like the Project, the Canal Configuration Alternative would have annual construction-related GHG emissions that would not exceed the BAAQMD's significance thresholds. Therefore, construction-related GHG emissions associated with the Tunnel Alignment Alternative would be *less than significant*.

Operation

There would be no differences in operational emissions under the Canal Configuration Alternative compared to the Project. Like the Project, the Canal Configuration Alternative would require occasional operation of motorized pumps to convey water to treatment wetlands that would be electrically powered and would have marginal indirect GHG emissions. Approximately twice a year a vacuum truck would remove debris from the gross solids screening device and transport the debris to Ox Mountain Landfill. Vehicle use would also be required during other annual maintenance activities, which would result in negligible operational emissions from vacuum truck operations. Given the limited emissions associated with operations, operational GHG emissions under the Canal Configuration Alternative would be *less than significant*.

NEPA Analysis

The construction methods and duration to construct the Canal Configuration Alternative would not change compared to the Project. Construction emissions under the Canal Configuration Alternative would be reduced compared to those presented in Table 3.7-3 for the Project because of the reduced amount of excavation and construction associated with the elimination of the collection box and box culvert. Consequently, like the Project, the Canal Configuration Alternative would have annual construction-related GHG emissions that would be below the federal reporting threshold for all years (less than 4 percent of the 25,000-ton reporting threshold). Operational GHG emissions resulting from the use of electricity to power seasonal pump and diversion gate operations and from occasional vehicle trips to perform maintenance operations would not be a daily occurrence and would generate negligible GHG emissions (less than 1 percent of the 25,000-ton reporting threshold). Therefore, this alternative would have a minor adverse impact with regard to GHG emissions during construction, and a negligible impact during operation and maintenance.

3.7.5.4 No Project/No Action Alternative

Because no new construction would occur under the No Project/No Action Alternative, no construction-related GHG emissions would be generated by this alternative. Under the No Project/No Action Alternative, there would be no changes to the existing operations of the project site and GHG emissions associated with canal and tunnel maintenance activities would not change. Occasional emergency repairs and other activities would occur when the canal floods, causing damage to roads (such as John Muir Drive) and houses in nearby neighborhoods and these activities would result in a short-term increase in GHG emissions.

3.7.6 Cumulative Effects

GHG emissions are inherently a cumulative concern because it is the accumulation of GHG emissions in the atmosphere around the earth that results in global climate change; therefore, the geographic scope of cumulative impacts related to GHG emissions and climate change is global. The Project would result in minor short-term GHG emissions during construction that would be below CEQA thresholds developed by BAAQMD and negligible long-term GHG emissions during operation. The Project would not conflict with the state's GHG reduction goals, and as described in Section 3.7.3.3, Criteria and Thresholds with No Impact or Not Applicable, would support the goals of the Climate Change Scoping Plan. The Tunnel Alignment Alternative and Canal Configuration Alternative would result in reduced construction emissions and substantially similar operation and maintenance emissions compared to the Project. Therefore, they would not conflict with the state's GHG reduction goals, and they would support the Climate Change Scoping Plan. The No Project/No Action alternative would not result in substantial GHG emissions. All of the cumulative projects described in Table 3.1-1 in Section 3.1, *Introduction and Overview*, could contribute to global warming due to the generation of short-term and/or long-term GHG emissions. If GHG emissions continue globally such that climate change results in the impacts described in Section 3.7.1.1, the overall global cumulative impact would be *significant* and adverse. However, the Project's and the alternatives' contributions to this impact would not be cumulatively considerable.

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3.8 Hazards and Hazardous Materials

This section describes existing hazards and hazardous materials conditions that could affect or be affected by the Project. This section also describes laws, regulations, plans, and policies related to hazards and hazardous materials that may be relevant to the Project. Hazards that relate to pollutant emissions are discussed in Section 3.3 Air Quality, and those relating to geology and seismicity are discussed in Section 3.6, Geology and Soils.

3.8.1 Affected Environment

A hazardous material is defined as any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment (State of California, Health and Safety Code, Chapter 6.95, Section 25501). The term "hazardous materials" refers to both hazardous substances and hazardous waste. Under federal and State laws, any material, including wastes, may be considered hazardous if it is specifically listed by statute as such or if it is toxic (causes adverse human health effects), ignitable (has the ability to burn), corrosive (causes severe burns or damage to materials), or reactive (causes explosions or generates toxic gases).

3.8.1.1 Soil and Groundwater Contamination

In California, regulatory databases listing hazardous materials sites provided by numerous federal, State, and local agencies are consolidated in the "Cortese List" pursuant to Government Code Section 65962.5. The Cortese List is located on the California Environmental Protection Agency's (Cal EPA) website and is a compilation of the following lists:

- List of Hazardous Waste and Substances sites from Department of Toxic Substances Control (DTSC) EnviroStor database;
- List of Leaking Underground Storage Tank (LUST) Sites by County and Fiscal Year from the State Water Resources Control Board (SWRCB) GeoTracker database;
- List of solid waste disposal sites identified by SWRCB with waste constituents above hazardous waste levels outside the waste management unit;
- List of "active" Cease and Desist Order and Cleanup and Abatement Order from the SWRCB; and
- List of hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code, identified by DTSC and listed on their EnviroStor database (Cal EPA, 2012).

The five databases cited above identify sites with suspected and confirmed releases of hazardous materials to the subsurface soil and/or groundwater. GeoTracker is the SWRCB's data management system for managing sites that impact groundwater (LUSTs, Department of Defense, and Site Cleanup Program sites) as well as permitted facilities such as operating underground storage tanks

(USTs) and land disposal sites. The DTSC EnviroStor database includes federal and State response sites, voluntary, school, and military cleanups and corrective actions, and permitted sites. The reporting and status of each site changes as identification, monitoring, and clean-up of hazardous materials progress. Typically, a listed site is considered no longer to be of concern and is "closed" once it has been demonstrated that existing site uses combined with the levels of identified contamination present no significant risk to human health or the environment.

Table 3.8-1 lists active hazardous material sites within 0.25 mile of the Project site, based on a search of the EnviroStor and Geotracker databases (SWRCB, 2014; DTSC, 2014a), There are no active LUST sites within 0.25 mile of the Project site. There is one Cleanup Program site, one site under evaluation by DTSC, and one known permitted UST site within 0.25 mile of the Project site.

TABLE 3.8-1
ACTIVE HAZARDOUS MATERIALS SITES LISTED IN THE PROJECT VICINITY (0.25 MILE)

Site Name/ Address	Site Type	Site Summary
San Francisco Police Department – Pistol Range 700 John Muir Drive	Evaluation	Potential contaminants of concern include lead.
Pacific Rod and Gun Club 520 John Muir Drive	Cleanup Program	Potential for surface and groundwater contamination. Potential contaminants of concern include lead.
The Olympic Club 594 Skyline Boulevard	Permitted UST	No known releases

SOURCE: SWRCB, 2014; DTSC, 2014a.

3.8.1.2 Contamination from Spills and Leaks

Spills and leaks of chemicals can contaminate soil and groundwater when proper precautions are not in place. Various businesses and industries transport, use, and dispose of chemicals and may improperly or accidentally release them into the environment. Chemicals can include but are not limited to metals, solvents, and flammable materials. Non-permitted discharges of these chemicals are documented as Cleanup Program Sites by the San Francisco RWQCB in the GeoTracker database. There is one Cleanup Program site, within 0.25 mile of the Project site, at the Pacific Rod and Gun Club on John Muir Drive, northwest of the existing Lake Merced Tunnel Portal.

3.8.1.3 Other Classifications for Contaminated Sites

Other sites with contaminated soil and/or groundwater could include those in the Formerly Used Defense Sites (FUDS) database; Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database; sites under DTSC oversight; as well as sites listed for voluntary cleanup. The San Francisco Police Department Pistol Range has been identified by DTSC as a site under evaluation for lead contamination (DTSC, 2014b).

There are three closed FUDS listings within 0.25 mile of the Project site. Fort Funston and SF Site 61-R (Battery Davis) are located within the GGNRA, and as of July 2012, and June 2014, respectively, cleanup for lead contamination at these sites was complete (DTSC, 2014c, 2014d). The Mussel Rock FUDS, located in Daly City, formerly was used as a fire control station for the San Francisco Harbor Defense and is located within 0.25 mile of the Avalon Canyon access road. Cleanup for lead contamination was complete as of February 2012. (DTSC, 2014e)

3.8.1.4 Military Site Hazards

The U.S. Army Coast Artillery Corps (also known as Laguna Merced Military Reservation) was established in 1901. In 1917, the post was renamed Fort Funston and army engineers began building military facilities. Five batteries were constructed on the property that housed several guns. All batteries were used for military training purposes, and never for combat. Between 1947 and 1963, the California National Guard used a portion of Fort Funston. Over this time, the site contained automatic weapons, antiaircraft guns, and the Nike-Ajax defense missile system (CSMD, 2013). See Section 3.5, Cultural and Paleontological Resources, for further discussion of the history of Fort Funston.

There is risk that unexploded ordnance (UXO) still exists at Fort Funston remaining from previous military uses (NPS, 2003). UXO discoveries occur approximately twice per year within the vicinity of Fort Funston (Sebastian, 2004). The Mussel Rock FUDS has been inspected for ordnance (DTSC, 2014e).

3.8.1.5 Aircraft Operations

Aviation safety hazards can result if a project is sited in the vicinity of an airport. The nearest public airport to the Project site is the San Francisco International Airport, located approximately 7 miles southeast of the Project site. There are no private airstrips in the Project vicinity.

3.8.1.6 Wildfire Hazards

The California Department of Forestry and Fire Protection (CAL FIRE) is required by law to map areas of significant fire hazard based on fuels, terrain, weather, and other relevant factors (Pub. Res. Code 4201-4204 and Govt. Code 51175-89). Factors that increase an area’s susceptibility to fire hazards include slope, vegetation type and condition, and atmospheric conditions. The CAL FIRE Fire Hazard Severity Zone (FHSZ) maps for San Francisco and San Mateo counties do not identify any very high or high fire hazard zones in the Project area (CAL FIRE, 2007a, 2007b, 2008). There are some moderate FHSZs near the Project site, but most of the area surrounding the Project is unzoned for wildfire hazard due to the degree of urban development.

3.8.1.7 Public Health

Location of Exposed Populations and Sensitive Receptors

The general population includes sensitive subgroups that could be at greater risk from exposure to hazardous materials or emitted pollutants. These sensitive subgroups include the very young, the elderly, and those with existing illnesses. In addition, the location of the population in the area surrounding a project site may have a major bearing on health risk. However, there are no known sensitive receptors in the immediate vicinity of the Project site. The closest residences to the Project site are located in Westlake, 160 feet east of the collection box, residences adjacent to the Avalon Canyon access road, and in San Francisco at the Lakewood Apartments complex on John Muir Drive, which is within 100 feet of the Vista Grande Tunnel.

There are no schools or day care facilities located on or within 0.25 mile of the Project site.

Vector-Borne Diseases

Mosquitoes and other arthropods are known to be carriers of many serious diseases. Arthropod-borne viruses ("arboviruses") are viruses that are transmitted by blood-feeding arthropods, such as mosquitoes and ticks, when they bite susceptible humans and animals. There are four main virus agents of encephalitis in the United States: eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, and La Cross encephalitis, all of which are transmitted by mosquitoes. The majority of human infections are asymptomatic or result in nonspecific flu-like symptoms such as fever, headache, nausea, and tiredness (CDC, 2005). West Nile Virus is closely related to the St. Louis encephalitis virus and causes similar symptoms. Of these diseases, only the West Nile Virus was reported in California in 2013. In 2013, no cases of West Nile Virus were reported in San Mateo County, while one case was reported in San Francisco and 368 cases were reported statewide (USGS, 2014).

3.8.2 Regulatory Setting

Federal, state, and local laws and regulations govern the range of hazardous materials issues that may be encountered during Project construction and operation. Various state and local regulatory agencies implement these laws and regulations to minimize risks to human health and the environment from hazardous materials. This section describes the regulatory oversight of hazardous materials storage and handling, emergency response, site investigation and cleanup, and worker safety. In addition, regulations regarding fire hazards and relevant local plans and policies are discussed.

3.8.2.1 Federal Regulations

Toxic Substances Control Act/Resource Conservation and Recovery Act/Hazardous and Solid Waste Act

The federal Toxic Substances Control Act of 1976 and the Resource Conservation and Recovery Act of 1976 (RCRA) authorized the U.S. Environmental Protection Agency (USEPA) to regulate the generation, transportation, treatment, storage, and disposal of hazardous waste. The RCRA was amended in 1984 by the Hazardous and Solid Waste Act, which affirmed and extended the "cradle to grave" system of regulating hazardous wastes.

U.S. Department of Transportation Hazardous Materials Transport Act

The U.S. Department of Transportation, in conjunction with the USEPA, is responsible for enforcement and implementation of federal laws and regulations pertaining to transportation of hazardous materials. The Hazardous Materials Transportation Act of 1974 directs the U.S. Department of Transportation to establish criteria and regulations regarding the safe storage and transportation of hazardous materials. Code of Federal Regulations (CFR) Title 49, parts 171–180 regulate the transportation of hazardous materials, types of material defined as hazardous, and the marking of vehicles transporting hazardous materials.

Occupational Safety and Health Act

The federal Occupational Safety and Health Administration is the agency responsible for assuring worker safety in the handling and use of chemicals in the workplace. The federal regulations pertaining to worker safety are contained in Title 29 of the CFR, as authorized in the Occupational Safety and Health Act of 1970. They provide standards for safe workplaces and work practices, including standards relating to hazardous materials handling.

3.8.2.2 State Regulations

Department of Toxic Substance Control Regulations

The DTSC is the primary agency in California that regulates hazardous waste, cleans up existing contamination, and looks for ways to reduce the hazardous waste produced in California. The DTSC regulates hazardous waste in California primarily under the authority of the federal RCRA and the California Health and Safety Code (primarily Title 22, Division 20, Chapters 6.5 through 10.6; and Title 22, Division 4.5). Other laws that affect hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup, and emergency planning.

Government Code Section 65962.5 (commonly referred to as the Cortese List) includes the DTSC-listed hazardous waste facilities and sites, sites listed by the SWRCB as having UST leaks and which have had a discharge of hazardous wastes or materials into the water or groundwater, and lists from local regulatory agencies of sites that have had a known migration of hazardous waste and/or material.

Safe Drinking Water and Toxics Enforcement Act

The Safe Drinking Water and Toxics Enforcement Act (Health and Safety Code §25249.5 et seq.) identifies chemicals that cause cancer and reproductive toxicity, provides information for the public, and prevents discharge of the chemicals into sources of drinking water. Lists of the chemicals of concern are published and updated periodically. The Act is administered by California's Office of Environmental Health Hazard Assessment.

Hazardous Waste Control Act

The Hazardous Waste Control Act of 1972 created the State hazardous waste management program, which is similar to but more stringent than the federal RCRA program. The Act is implemented by regulations contained in Title 26 of the CCR, which describes the following required aspects for the proper management of hazardous waste: identification and classification; generation and transportation; design and permitting of recycling treatment, storage and disposal facilities; operation of facilities and staff training; and closure of facilities and liability requirements. These regulations list more than 800 materials that may be hazardous and establish criteria for identifying, packaging, and disposing of such waste. Under the Hazardous Waste Control Act and Title 26, the generator of hazardous waste must complete a manifest that accompanies the waste from generator to transporter to the ultimate disposal location. Copies of the manifest must be filed with the DTSC.

Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program)

This program requires the administrative consolidation of six hazardous materials and waste programs (Program Elements) under one agency, a Certified Unified Program Agencies (CUPA). The following Program Elements are consolidated under the Unified Program:

- Hazardous Waste Generator and On-site Hazardous Waste Treatment Programs
- Aboveground Petroleum Storage Tanks
- Hazardous Materials Release Response Plans and Inventory Program
- California Accidental Release Prevention Program
- UST Program
- Uniform Fire Code Plans and Inventory Requirements

The Unified Program is intended to provide relief to businesses complying with the overlapping and sometimes conflicting requirements of formerly independently managed programs. The Unified Program is implemented at the local government level by CUPAs. Most CUPAs have been established as a function of a local environmental health or fire department. Some CUPAs have contractual agreements with another local agency, a participating agency, which implements one or more Program Elements in coordination with the CUPA. As further discussed in Section 3.8.2.3, Local Regulations, the CUPA for San Mateo County is the Hazardous Materials Program, part of the Environmental Health Division within the County's Health System. San Francisco’s CUPA is the Hazardous Materials and Waste Program within the San Francisco Department of Public Health Environmental Health Section.

California Occupational Safety and Health Act

The California Occupational Safety and Health Act of 1973 addresses California employee working conditions, enables the enforcement of workplace standards, and provides for advancements in the field of occupational health and safety. The Act also created the California Occupational Safety and Health Administration (Cal/OSHA), the primary agency responsible for worker safety in the handling and use of chemicals in the workplace. Cal/OSHA’s standards are generally more stringent than federal regulations. The regulations specify requirements for employee training, availability of safety equipment, accident-prevention programs, and hazardous substance exposure warnings.

Hazardous Materials Transportation License

A valid Hazardous Materials Transportation License, issued by the California Highway Patrol, is required by the State of California Vehicle Code Section 32000.5 for transportation of hazardous materials shipments for which the display of placards is required by State regulations; or hazardous materials shipments of more than 500 pounds, which would require placards if shipping greater amounts in the same manner.

Additional requirements on the transportation of explosives, inhalation hazards, and radioactive materials are enforced by the California Highway Patrol under the authority of the State Vehicle Code. Transportation of explosives generally requires consistency with additional rules and regulations for routing, safe stopping distances, and inspection stops (Title 14, CCR, Chapter 6, Article 1, Sections 1150-1152.10). Inhalation hazards face similar, more restrictive rules and regulations (Title 13, CCR, Chapter 6, Article 2.5, Sections 1157-1157.8).

Utility Notification Requirements

California Code of Regulations, Title 8, Section 1541 requires excavators to determine the approximate locations of subsurface installations, such as sewer, telephone, fuel, electric, and water lines (or any other subsurface installations that may reasonably be encountered during excavation work) prior to opening an excavation. The California Government Code (Section 4216 et seq.) requires owners and operators of underground utilities to become members of and participate in a regional notification center. According to Section 4216.1, operators of subsurface installations who are members of, participate in, and share in the costs of a regional notification center, such as Underground Services Alert, are in compliance with this section of the code. Underground Services Alert (known as USA North 811) receives planned excavation reports from public and private excavators and transmits those reports to all participating members of USA North that may have underground facilities at the location of excavation. Members will mark or stake their facilities, provide information, or give clearance to dig (USA North, 2014).

Hazardous Materials Storage and Handling, California Fire Code, California Code of Regulations, Title 24, Part 9, Section 2700 et seq.

The California Fire Code (Chapter 27) includes specific requirements for the safe storage and handling of hazardous materials. These requirements reduce the potential for a release of hazardous materials and for mixing of incompatible chemicals, and specify the following specific design features to reduce the potential for a release of hazardous materials that could affect public health or the environment.

- Separation of incompatible materials with a noncombustible partition, or appropriate distance separation.
- Spill control in all storage, handling, and dispensing areas.
- Separate secondary containment for each chemical storage system. The secondary containment must hold the entire contents of the tank, plus the volume of water needed to supply the fire suppression system for a period of 20 minutes in the event of a catastrophic spill.

California Fire Code (Chapter 14) addresses fire safety during construction and demolition and includes requirements for smoking, waste disposal, cutting and welding, fire protection equipment, fire reporting, access for firefighting.

3.8.2.3 Local Regulations

San Mateo Hazardous Waste Management Plan

The San Mateo County Health System Hazardous Materials Program is the local CUPA. The purpose of the CUPA program is to provide a comprehensive approach to reduce the overlapping and sometimes conflicting requirements of different governmental agencies. The CUPA provides consolidation and consistency in reporting requirements, permit formats, inspection criteria, enforcement standards, and fees for various hazardous materials programs. The CUPA is required by state law to maintain a list of facilities within San Mateo County that are known to use, store, and/or generate hazardous materials/wastes. Facilities that handle hazardous materials or generate hazardous waste must obtain a permit from the CUPA.

Daly City Municipal Code

The Daly City Municipal Code Chapter 8.14 and 8.50 establishes policies regarding recycling and solid and hazardous waste disposal and recycling within Daly City. Furthermore, the Daly City Municipal Code requires projects to comply with Building Code requirements, Fire Code requirements, and Daly City ordinances applicable to development.

San Francisco Emergency Management

The San Francisco Department of Emergency Management is a jurisdiction-wide system that provides San Francisco with management actions for the prevention of, preparedness for, response to, and recovery from, any emergency or disaster. The Emergency Management Plan includes the following elements: Administrative Plan; Preparedness Plan; Hazard Mitigation Plan; and Recovery Plan (forthcoming). The Emergency Response Plan (San Francisco, 2010a) addresses roles and responsibilities during emergency situations in San Francisco and on city-owned lands, including earthquakes, hurricanes, tsunamis, floods, winter storms, and acts of terrorism. The Transportation Annex (Emergency Support Function #1, Appendix B) of the Emergency Response Plan outlines the San Francisco Department of Public Work's priority emergency routes. The primary priority routes in the vicinity of the Project area are the Great Highway, Sloat Boulevard, Lake Merced Boulevard, John Muir Drive, and Brotherhood Way. Ulloa Street is identified as a parallel priority route (San Francisco, 2010b).

San Francisco Wastewater Discharges

Discharges of non-sewage wastewater to the combined sewer system, including groundwater produced during excavation dewatering, are subject to the permit requirements specified in Article 4.1 of the San Francisco Public Works Code and supplemented by Department of Public Works Order No. 158170. The San Francisco pollution prevention program includes requirements for BMPs to minimize the amount of pollutants carried by stormwater to the combined sewer system from industrial uses, and SFPUC conducts periodic inspections to ensure compliance. The BMP requirements also apply to discharges to separate stormwater systems, pursuant to Article 4.1.

3.8.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.8.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section VIII, a project would cause adverse impacts related to hazards and hazardous materials if it would:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school;

d) Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;

e) Be located within an area covered by an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, and result in a safety hazard for people residing or working in the project area;

f) Be located within the vicinity of a private airstrip and result in a safety hazard for people residing or working in the project area;

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or

h) Expose people or structures to a significant risk of loss, injury, or death involving wildfires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

3.8.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook, the Project and alternatives are evaluated to determine whether they would have material adverse effects on public health or safety (NPS, 2001).

Impact Intensity	Impact Description
Negligible:	Alternative would result in no discernable changes in level of public health and safety related to possible increases in exposure to hazards or hazardous materials.
Minor:	Alternative would result in changes in the conditions of public health and safety, although the changes would be slight. The public may or may not be aware of the effects associated with the alternative. This may include release or clean-up of small quantities of hazardous materials. It may also include slightly increased or decreased exposure of the public to existing hazards.
Moderate:	Alternative would result in distinct changes in the health and safety of the public. Changes would be readily apparent. The impacts could have an appreciable health and safety effect. This may include releases or clean-up of moderate quantities of hazardous materials. It may also include noticeably heightened or diminished risk of exposure to existing hazards.
Major:	Alternative would result in substantial changes in the conditions of public health and safety. Impact would be apparent and could have a severe health and safety impact. This may include releases or remediation of large quantities of hazardous materials. It may also include substantially increased or decreased exposure to existing hazards.

3.8.3.3 Criteria and Thresholds with No Impact or Not Applicable

Because of the nature of the Project and its physical setting, the Project would not result in impacts related to the following significance criteria; these criteria are not discussed in the impact analysis for the following reasons:

c) ***Emit Hazardous Emissions or Handle Hazardous or Acutely Hazardous Materials, Substances, or Waste Within 0.25 Mile of an Existing or Proposed School.*** The Project site and alternative site would not be located within 0.25 mile of an existing or proposed school or day care facility. Therefore, the criteria related to safety hazards near schools are not applicable to the Project and are not discussed further.

d) ***Be Located on a Site that is Included on a List of Hazardous Materials Sites Compiled Pursuant to Government Code Section 65962.5 and, as a Result, Create a Significant Hazard to the Public or the Environment.*** According to the environmental database review, Fort Funston is on the FUDS list for lead contamination. However, cleanup for this site was completed as of 2012 (DTSC, 2014c); therefore, for the purposes of this analysis, Fort Funston is not considered an active hazardous materials site that could create a significant hazard to the public or environment as a result of Project or alternative construction or operation and maintenance activities being located here. The Project site is not included on any other lists of hazardous materials sites compiled pursuant to Government Code Section 65962.5. Therefore, this criterion is not discussed further.

e, f) ***Be Located within an Airport Land Use Plan or in the Vicinity of a Private Airstrip***. The Project and alternatives would not be within an area covered by an airport land use plan, and is located more than 2 miles from any public airport or private airstrip. The nearest airport or airstrip is the San Francisco International Airport, which is approximately 7 miles southeast of the Project site. Therefore, the criteria related to safety hazards near airports and private airstrips are not applicable to the Project and alternatives and are not discussed further.

h) ***Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Fires.*** According to CAL FIRE fire hazard mapping, the Project site and alternative sites would not be within an area designated as very high or high fire hazard zones. The Project and alternatives would be located in an urban area that is served by the San Francisco Fire Department and would not include components that would increase the risk of fire beyond existing conditions. In addition, the Project and alternatives would not construct any habitable structures. Therefore, this significance criterion is not applicable to the Project and is not discussed further.

3.8.4 Methodology and Assumptions

This impact analysis focuses on potential effects of hazards, hazardous materials and public health associated with the Project. The evaluation considers current conditions in the Project area, findings of regulatory agency database searches, review of hazardous materials investigation reports, site reconnaissance, applicable regulations and guidelines, and Project construction and operation.

3.8.5 Impact Analysis

3.8.5.1 Proposed Project

CEQA Analysis

a) Impact HAZ-1: Project construction could create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. (Less than Significant)

Project construction activities would use hazardous chemicals, such as gasoline, diesel fuel, oils and lubricants, paints and thinners, solvents, and other chemicals. Impacts could occur if construction-related activities were to result in hazards or the release of hazardous materials and could be considered potentially *significant*. However, construction activities must comply with numerous hazardous materials and stormwater regulations designed to ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect worker safety, and to reduce the potential for a release of construction-related fuels or other hazardous materials to affect stormwater and downstream receiving water bodies (see Section 3.8.2, Regulatory Setting). These requirements would ensure that hazardous materials used for construction are stored in appropriate containers, with secondary containment to contain a potential release. As described in Section 2.5.9, Chemicals and Fuel Storage, the contractor would maintain a binder of material safety data sheets (MSDSs) for all chemicals used or stored on-site. Most chemicals would not be stored on-site and would be transported to the site as needed. Fuels would be stored in skid tanks with fire protection. Because the contractor would be required by construction permits to comply with all hazardous materials laws and regulations for the transport, use, and disposal of hazardous materials, the impacts associated with the potential to create a *significant* hazard to the public or the environment would be *less than significant.*

Project construction would use a diesel-powered emergency back-up generator at the staging area at Fort Funston. The generator would be operated in compliance with all hazardous materials regulations described in Section 3.8.3, Regulatory Setting, for other construction activities.

Therefore, the potential impact related to release of hazardous materials during Project construction would be *less than significant*.

As described in Section 3.9, Hydrology and Water Quality, the construction contractor will be required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) for construction activities according to the National Pollutant Discharge Elimination System (NPDES) General Construction Permit requirements. The SWPPP would list the hazardous materials (including petroleum products) proposed for use and describe measures for preventing spills, inspecting equipment and fuel storage, and providing immediate response to spills. Through compliance with applicable hazardous materials storage, disposal, and stormwater permitting regulations, hazardous materials impacts associated with potential releases from the transport, use, or disposal of hazardous materials or petroleum products during construction would be *less than significant.*

Mitigation: None required.

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b) Impact HAZ-2: Project construction could result in a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. (Less than Significant with Mitigation)

Project construction activities (including potential construction of Lake Management Plan components) would involve excavating, trenching, and grading. As identified in Table 3.8-1, lead is a known contaminant within 0.25 mile of the Project site (DTSC, 2014b-e). If hazardous materials were present in excavated soil or dewatered groundwater and are inadvertently released into the environment, such release could expose the environment, construction workers, and/or the public to contaminants. Such risks could occur from stockpiling, handling, or transportation of soils that have been contaminated by hazardous materials from previous spills or leaks. The dewatering of contaminated groundwater could present risks to public health and safety, and the environment, if the contaminated dewatered groundwater is not handled properly. The potential for contaminated soil and groundwater to be released into the environment during project construction is considered a *significant* impact.

Impacts resulting from the potential release of or exposure to hazardous materials in environment, soils or groundwater would be reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.8-1 (Health and Safety Plan)**, which would require that construction contractors prepare a health and safety plan in accordance with Cal OSHA regulations. The plan would specify training for hazard recognition, personal protective equipment for workers, outline construction measures to reduce the potential for workers' exposures to hazardous materials in soil and groundwater, and describe procedures for handling accidental hazardous materials releases and unanticipated contamination. With implementation of Mitigation Measure 3.8-1, the potential for harmful exposure to hazardous materials present in the environment, soils or groundwater during construction would be reduced to a *less-than-significant* level. Furthermore, as discussed in Section 3.9, Hydrology and Water Quality, the Project would require a SWPPP. Implementation of the Project SWPPP would control runoff from leaving the Project site and limit the potential spread of contaminates potentially present in disturbed soils.

As discussed in Section 3.8.1.4, Military Site Hazards, there is the potential for UXO to be present at Fort Funston (NPS, 2003). During construction, ground-disturbing activities could unearth UXO, which would pose a safety risk to workers on-site. For example, surface and shallow sub-surface UXO could be disturbed by vehicles, workers walking, and/or excavation using shovels or similar hand tools, and deeper sub-surface UXO could be disturbed by the earth movement and excavation processes that would be required during excavation of the tunnel shaft and tunnel. The Drilling Health and Safety Plan described in Section 2.5.10, Construction Safety, would provide training of construction personnel in the recognition, avoidance, and procedures to be implemented if suspected UXO are discovered. With implementation of the Drilling Health and Safety Plan, the potential risks to construction personnel from encountering UXO would be *less than significant*.

Mitigation Measure 3.8-1: Health and Safety Plan.

The construction contractor(s) shall prepare and implement a site-specific Health and Safety Plan in accordance with 29 CFR 1910.120 to protect construction workers and the public during all excavation, grading, and construction activities. The Health and Safety Plan shall include, but is not limited to, the following elements:

- A summary of all potential risks to construction workers and maximum exposure limits for all known and reasonably foreseeable site chemicals;
- Training for hazard recognition, including visual and olfactory cues;
- Specified personal protective equipment and decontamination procedures, if needed;
- Emergency procedures, including route to the nearest hospital;
- Procedures to be followed in the event that evidence of potential soil or groundwater contamination (such as soil staining, noxious odors, debris or buried storage containers) is encountered. These procedures shall be in accordance with hazardous waste operations regulations and specifically include, but are not limited to, the following: immediately stopping work in the vicinity of the unknown hazardous materials release, and retaining a qualified environmental firm to perform sampling and remediation.

Significance after Mitigation: Less than Significant.

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g) Impact HAZ-3: Project construction would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. (Less than Significant with Mitigation)

San Francisco's *Emergency Response Plan* identifies primary evacuation routes in the Project area. The Vista Grande Canal improvements would parallel and temporarily realign John Muir

Drive, a designated primary evacuation route. Other nearby evacuation routes include the Great Highway, Sloat Boulevard, Lake Merced Boulevard, and Brotherhood Way. As described in Section 3.15, Transportation and Traffic, traffic flow would be maintained on John Muir Drive, as well as on other area roadways, at all times. However, construction could affect the availability of travel lanes when construction occurs within or adjacent to John Muir Drive, due to the presence of large, slow-moving trucks that may cause delays. These delays could interfere with implementation of the *Emergency Response Plan*, which would be a *significant* impact. Implementation of a Construction Traffic Management Plan (Mitigation Measure 3.15-1), as described in Section 3.15, Transportation and Traffic, would address localized construction effects (such as increased traffic and the need for coordination with emergency response providers) prior to construction to minimize construction-related disruptions. Therefore, the potential impact to evacuation routes identified in the *Emergency Response Plan* would be *less than significant.*

Mitigation: Implement Mitigation Measure 3.15-1.

Significance after Mitigation: Less than significant.

Impact HAZ-4: Project operation would not increase human exposure to vector-borne diseases as a result of implementation. (Less than Significant)

The Project's constructed treatment wetland cells could have the potential to provide habitat for vectors such as mosquitoes that transmit diseases, if standing water within the cells occurred during periods of low flow (e.g., summer low flows) (Walton, 2003). As described in Section 3.8.1.8, the incidence of West Nile Virus in San Mateo and San Francisco counties is extremely low, and therefore the risk to public health from this vector-borne disease is considered low. The proposed operation of the constructed treatment wetland cells would include pumping lake water into the cells during periods of low flow, reducing the risk that water would be allowed to stagnate in the cells. This would reduce the risk of mosquito breeding within the wetland cells, and therefore would reduce the risk for workers and the public of contracting vector-borne diseases. Further, as discussed in Section 2.6.5, Project Maintenance, maintenance of the constructed treatment wetlands would include mosquito control using bacterial methods on an annual basis. Therefore, the potential impact associated with human exposure to vector-borne diseases would be *less than significant.*

Mitigation: None required.

NEPA Analysis

As described in the CEQA analysis, the Project would result in the change to the risk to the public through the routine transport, use, or disposal of hazardous materials. Construction activities could release or employ small quantities of hazardous materials that could create hazardous conditions to the public. However, adherence to hazardous materials and stormwater regulations, and the NPDES Construction General Permit, which includes implementation of a SWPPP, would ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect the public. This would ensure that the Project would result in minor adverse effects on public safety.

The Project could result in the construction in an area where excavating, trenching, and grading could expose the environment, public, or construction personnel to contaminated soils, groundwater, or UXO. This exposure would be short in nature and only occur during the construction period. Implementation of Mitigation Measure 3.8-1, which calls for the preparation and use of a Health and Safety Plan, would reduce the potential for exposures to hazardous materials in soil and groundwater. The Project SWPPP would control runoff from leaving the Project site and limit the potential spread of contaminates potentially present in disturbed soils or dewatered groundwater. Implementation of a Drilling Health and Safety Plan would ensure that the Project workers are trained on the proper identification, avoidance, and reporting procedures for suspected UXO, resulting in minor safety risks from encountering UXO.

The CEQA analysis also describes the potential for temporary disruption of an evacuation route during construction along John Muir Drive. Disruption of the evacuation route along John Muir Drive would pose a minor threat to the public as a Construction Traffic Management Plan (Mitigation Measure 3.15-1) would ensure that construction activities would not jeopardize the public's safety during an emergency. Furthermore, as described in Section 3.15, Transportation and Traffic, Project construction activities at Fort Funston would not impede emergency access to nay area of Fort Funston. The adverse impact on emergency access would be minor.

The CEQA analysis also includes discussion on the potential increase of human exposure to vector-borne diseases. While reported cases of vector-borne diseases such as West Nile Virus are extremely low in San Mateo and San Francisco counties as described in Section 3.8.1.7, Public Health, the Project includes constructed treatment wetland cells that could provide habitat for vectors (e.g., mosquitoes). The proposed operation of the constructed treatment wetland cells would include pumping lake water into the cells during periods of low flow, reducing the risk that water would be allowed to stagnate in the cells. This would reduce the risk of mosquito breeding within the wetland cells, and therefore would reduce the risk for workers and the public of contracting vector-borne diseases. Further, as discussed in Section 2.6.5, Project Maintenance, maintenance of the constructed treatment wetlands would include mosquito control using bacterial methods on an annual basis. This would result in a minor adverse effect related to the exposure of people to vector-borne diseases.

3.8.5.2 Tunnel Alignment Alternative

The following describes the hazards and hazardous materials effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.8.5.1, Proposed Project, or Section 3.8.5.3, Canal Configuration Alternative, depending on the option selected. Thus, hazards and hazardous materials effects for the canal portion would be as described in those sections.

CEQA Analysis

No additional hazardous material sites beyond those listed in Table 3.8-1 have been identified within 0.25 mile of the Tunnel Alignment Alternative, which would be located within an area between the existing tunnel and a line approximately 700 feet to the south.

Like with the Project, construction activities could result in the routine transport, use, or disposal of hazardous materials, which if released could create a potentially *significant* hazard to the public or the environment. However, this impact would be *less than significant* with compliance with all hazardous materials laws and regulations for the transport, use, and disposal of hazardous materials.

Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils or groundwater or to UXO. However, these impacts would be *less than significant* with implementation of Mitigation Measure 3.8-1 (Health and Safety Plan), the Project SWPPP, and a Drilling Health and Safety Plan.

Construction activities associated with the Tunnel Alignment Alternative would result in impacts on emergency access similar to those identified for the Project. Because this alternative would maintain existing access to Fort Funston, the impact on emergency access associated with construction at Fort Funston would be less than significant with implementation of Mitigation Measure 3.15-1.

NEPA Analysis

The Tunnel Alignment Alternative would result in minor changes to the risk to the public from the routine transport, use, or disposal of hazardous materials. In the absence of environmental and worker safety protocols, construction activities could result in the accidental release of small quantities of hazardous materials that could create hazardous conditions to the public. However, adherence to hazardous materials regulations and the construction SWPPP would ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect the public and the environment. This would ensure that the Tunnel Alignment Alternative would result in minor adverse effects on public safety.

The Tunnel Alignment Alternative would result in the construction in an area where excavating, trenching, and grading could expose the environment, public, or construction personnel to contaminated soils or groundwater or to UXO. This potential for exposure would be short in nature and only occur during the construction period. The Tunnel Alignment Alternative would implement a SWPPP, which control runoff from leaving the Project site and limit the potential for the spread of contaminants potentially present in disturbed soils or dewatered groundwater to the public. Implementation of the Health and Safety Plan described in Mitigation Measure 3.8-1 would reduce the potential for exposure to contaminated soils or groundwater. Implementation of a Drilling Health and Safety Plan would ensure that construction workers are trained on the proper identification, avoidance, and reporting procedures for suspected UXO, resulting in minor adverse safety risks from encountering UXO.

3.8.5.3 Canal Configuration Alternative

The following describes the hazards and hazardous materials effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.8.5.1, Proposed Project, or Section 3.8.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, hazards and hazardous materials effects for the tunnel portion would be as described in those sections.

CEQA Analysis

No additional hazardous material sites beyond those listed in Table 3.8-1 have been identified within 0.25 mile of the Canal Configuration Alternative, which would be located within a subset of the area proposed for ground disturbance under the Canal portion of the proposed Project.

Like with the Project, construction activities could result in the routine transport, use, or disposal of hazardous materials, which if released could create a potentially *significant* hazard to the public or the environment. However, this impact would be *less than significant* with compliance with all hazardous materials laws and regulations for the transport, use, and disposal of hazardous materials.

Like with the Project, construction activities could expose the environment, public or construction personnel to contaminated soils, or groundwater. This exposure would be short in nature and only occur during the construction period. However, these impacts would be *less than significant* with implementation of Mitigation Measure 3.8-1 and the Project SWPPP.

Like the Project, construction could interfere or disrupt the evacuation route along John Muir Drive, as identified in San Francisco's *Emergency Response Plan*, due to the presence of large, slow-moving trucks that may cause delays. Implementation of a Construction Traffic Management Plan (Mitigation Measure 3.15-1) would minimize construction-related disruptions along John Muir Drive. Therefore, construction would not interfere with implementation of the *Emergency Response Plan* and this potential impact would be *less than significant*. The Canal Configuration Alternative includes constructed treatment wetland cells, which have the potential to provide habitat for vectors such as mosquitoes that transmit diseases due to the potential for standing water. The proposed operation of the constructed treatment wetland cells would include pumping lake water into the cells during periods of low flow, reducing the risk that water would be allowed to stagnate in the cells. This would reduce the risk of mosquito breeding within the wetland cells, and therefore would reduce the risk for workers and the public of contracting vector-borne diseases. Further, as discussed in Section 2.6.5, Project Maintenance, maintenance of the constructed treatment wetlands would include mosquito control using bacterial methods on an annual basis.

NEPA Analysis

The Canal Configuration Alternative would result in minor changes to the risk to the public from the routine transport, use, or disposal of hazardous materials. In the absence of environmental and worker safety protocols, construction activities could result in the accidental release of small quantities of hazardous materials that could create hazardous conditions to the public. However, adherence to hazardous materials regulations and the construction SWPPP would ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect the public and the environment. This would ensure that the Tunnel Alignment Alternative would result in minor adverse effects on public safety.

The Canal Configuration Alternative would result in the construction in an area where excavating, trenching, and grading could expose the public or construction personnel to contaminated soils or groundwater. This exposure would be short in nature and only occur during the construction period. Implementation the Health and Safety Plan described in Mitigation Measure 3.8-1 would reduce the potential for the exposure to contaminated soils or groundwater. The Canal Configuration Alternative would implement a SWPPP, which would control runoff from leaving the Project site and limit the potential for the spread of contaminants potentially present in disturbed soils or dewatered groundwater to the public.

As also described in the CEQA analysis, construction could interfere or disrupt the evacuation route along John Muir Drive, as identified in San Francisco's *Emergency Response Plan*, due to the presence of large, slow-moving trucks that may cause delays. Implementation of a Construction Traffic Management Plan (Mitigation Measure 3.15-1) would minimize construction-related disruptions along John Muir Drive. Therefore, construction would not interfere with implementation of the *Emergency Response Plan* and this potential impact would be less than significant.

The Canal Configuration Alternative could also increase the potential of human exposure to vector-borne diseases. As described for the proposed Project, the proposed operation of the constructed treatment wetland cells would include pumping lake water into the cells during periods of low flow, reducing the risk that water would be allowed to stagnate in the cells. This would reduce the risk of mosquito breeding within the wetland cells, and therefore would reduce the risk for workers and the public of contracting vector-borne diseases. Further, maintenance of the constructed treatment wetlands would include mosquito control using bacterial methods on an annual basis. This would result in a minor adverse effect related to the exposure of vector-borne diseases.

3.8.5.4 No Project/No Action Alternative

Under the No Project/No Action Alternative, continued annual maintenance of the Canal would occur. The Canal would occasionally flood, resulting in flow of stormwater across John Muir Drive and into the lake, potential bank damage (though sections have been armored to prevent that) or damage to the road, and continued potential to flood residential neighborhoods to the east. Under the No Project/No Action Alternative, the Project would not be implemented; therefore, no hazards or hazardous materials-related impacts would occur. The Project site would continue to experience existing levels of public safety hazards.

3.8.6 Cumulative Effects

3.8.6.1 Geographic Extent/Context

Depending on the pathway of migration, the geographic scope for cumulative effects relating to hazards and hazardous materials would be the watershed boundary, groundwater basin, or extent of affected soils. Materials delivery routes also would be included in the event of a traffic accident-related spill. Cumulative hazards and hazardous materials-related effects could arise at any point from the Project construction or operation and related activities.

3.8.6.2 Past, Present, and Reasonably Foreseeable Projects

The existing conditions reflect the contributions of past projects. In the vicinity of the Project, there are several projects proposed including groundwater and recycled water projects, commercial and residential developments. Construction and operation of cumulative projects in the Project vicinity would also involve the use and/or transport of hazardous materials or could be located in areas of previously unknown hazardous materials, and could result in accidental releases of these materials. None of the planned projects are industrial in nature, and none are expected to use large quantities of hazardous materials. Therefore, potential impacts related to reasonably foreseeable upset and accident conditions involving a release of hazardous materials at the cumulative project areas are likewise anticipated to be *less than significant*. No other projects that involve ground disturbance would be located in areas (such as Fort Funston) that are known to have UXO present.

3.8.6.3 Construction

Project construction activities would temporarily realign John Muir Drive to accommodate construction between the Canal and Lake Merced, but would maintain traffic flow on John Muir Drive at all times. With implementation of Mitigation Measure 3.15-1, construction would not interfere with San Francisco's *Emergency Response Plan*. Construction of other planned projects in the vicinity during the same time period could cause a cumulative impact with respect to emergency response/evacuation routes if these projects were to cause closures or traffic impacts on John Muir Drive or other emergency response or evacuation routes in the Project vicinity. Because the construction contractor(s) would be required to coordinate with emergency response providers prior to construction (Mitigation Measure 3.15-1), the Project's contribution to a cumulative impact on evacuation routes identified by the *Emergency Response Plan* would not be cumulatively considerable.

Impacts associated with the accidental release of hazardous materials caused by the cumulative projects, combined with the Project, would not result in a *significant* cumulative impact even if all of the projects were to be constructed simultaneously because the Project and all cumulative projects would be required to adhere to the robust body of regulations that govern hazardous materials storage and handling, water quality best management practices, construction work, and fire prevention and management. Together, these measures would ensure that impacts related to exposure to hazardous materials would be minimized and/or avoided. Therefore, the Project's incremental contribution to any hazards and hazardous material-related cumulative impact would not be cumulatively considerable.

3.8.6.4 Operation and Maintenance

In regards to vector-borne diseases, the cumulative projects located in the Project vicinity do not include constructed wetlands or other features that could result in large areas of standing water. The Project would have no additional operational or maintenance-related impacts with respect to hazards and hazardous materials; therefore, Project operation and maintenance would not contribute to a cumulative hazards impact.

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3.9 Hydrology and Water Quality

This section describes the existing surface and groundwater hydrology and water quality conditions that could be affected by construction, operation, and maintenance of the proposed Project. Section 3.9.1, Affected Environment, describes the surface water features and groundwater characteristics including existing stormwater collection systems and stormwater runoff, water quality, and beneficial uses of surface water features. Section 3.9.2, Regulatory Setting, describes the regulations, plans, and policies including federal, state, and local laws related to water resources that are relevant to the Project. The current condition and quality of these water resources, as well as the existing regulatory framework surrounding the proposed Project, was considered the baseline against which to analyze the potential direct and indirect impacts of the Project and alternatives. Section 3.9.5, Impact Analysis, provides that analysis and where necessary, puts forth suitable mitigation measures to reduce the duration and intensity of identified significant impacts.

3.9.1 Affected Environment

This section presents the physical setting of the study area associated with the Project and alternatives and provides the basis for the impact analyses. The study area relevant to construction activities comprises the physical footprint of the Project and alternatives and temporary staging and use areas associated with short term construction activities, as well as adjacent areas (e.g., areas immediately down gradient potentially affected by surface water runoff). The study area relevant to operation of the Project comprises all proposed Project components and adjacent areas, as well as Lake Merced and its watershed, the Westside Groundwater Basin, and coastal areas adjacent to the Ocean Outlet structure.

3.9.1.1 Regional Setting

The study area is located within the San Francisco Coastal South Watershed (USEPA, 2015), which extends from western San Francisco to the southern end of San Mateo County. Lake Merced, the major surface freshwater feature in the study area, is a naturally occurring lake located approximately 0.25 mile from the Pacific Ocean in the southwestern corner of San Francisco. The proposed Project components are all located within the Lake Merced urban watershed, one of eight distinct urban watersheds within the City and County of San Francisco (San Francisco). A natural watershed is the land area that drains to a single body of water such as a stream, lake, wetland, or estuary, whereas an urban watershed can replace overland sheet flow to natural tributaries with constructed storm and sewer systems that separately collect and convey flows. Storm and authorized non-storm flows[1] (also referred to as exempt and conditionally exempt discharges

[1] Authorized non-stormwater discharges (also called exempt and conditionally exempt discharges) are described in detail in Section C.15 of the Municipal Regional Stormwater NPDES Permit, RWQCB Order No. R2-2009-0074; examples include pumped groundwater, runoff from landscape irrigation, water from foundation drains, air conditioning condensate, water from residential car washing activities, and the like. These flows can be conveyed via stormwater systems and discharged during dry and wet seasons, provided that they are in compliance with specified RWQCB requirements. Storm and authorized non-storm flows from Daly City are regulated by the Municipal Regional Stormwater NPDES Permit referenced above and flows from San Francisco are regulated under two separate NPDES permits, as described in Section 3.9.2.

under the Municipal Regional Stormwater Permit, RWQCB Order R2-2009-0074) within the urban watersheds on the western side of San Francisco, including the Lake Merced urban watershed, flow toward the Pacific Ocean through constructed stormwater conveyance systems. Storm and authorized non-storm flow is conveyed through the study area to the Pacific Ocean via the Vista Grande Canal and Tunnel from a 2.5-square-mile urban drainage area in Daly City and unincorporated San Mateo County to the south of the Lake Merced urban watershed.

The Westside Groundwater Basin underlies the study area and most of western San Francisco, and extends from the western portion of San Francisco south to the eastern portion of San Mateo County (California Department of Water Resources [DWR], 2006). It is bounded to the north by a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. The San Bruno Mountains bound the basin on the east. The San Andreas Fault and Pacific Ocean form its western boundary and its southern limit is defined by a bedrock high that separates it from the San Mateo Plain Groundwater Basin. The basin opens to the Pacific Ocean on the northwest and San Francisco Bay on the southeast.

Climate

The study area has a Mediterranean climate, with cool dry summers and mild wet winters. Average annual precipitation is approximately 20 inches, with a majority of the rain occurring in the winter months. January is generally the coolest month with an average temperature of 50.9 °F, while September is the warmest month with an average temperature of 59.9 °F. Seasonal average temperature and precipitation data for the period 1948 to 2012 are presented in **Table 3.9-1**.

TABLE 3.9-1
AVERAGE REGIONAL TEMPERATURE AND PRECIPITATION

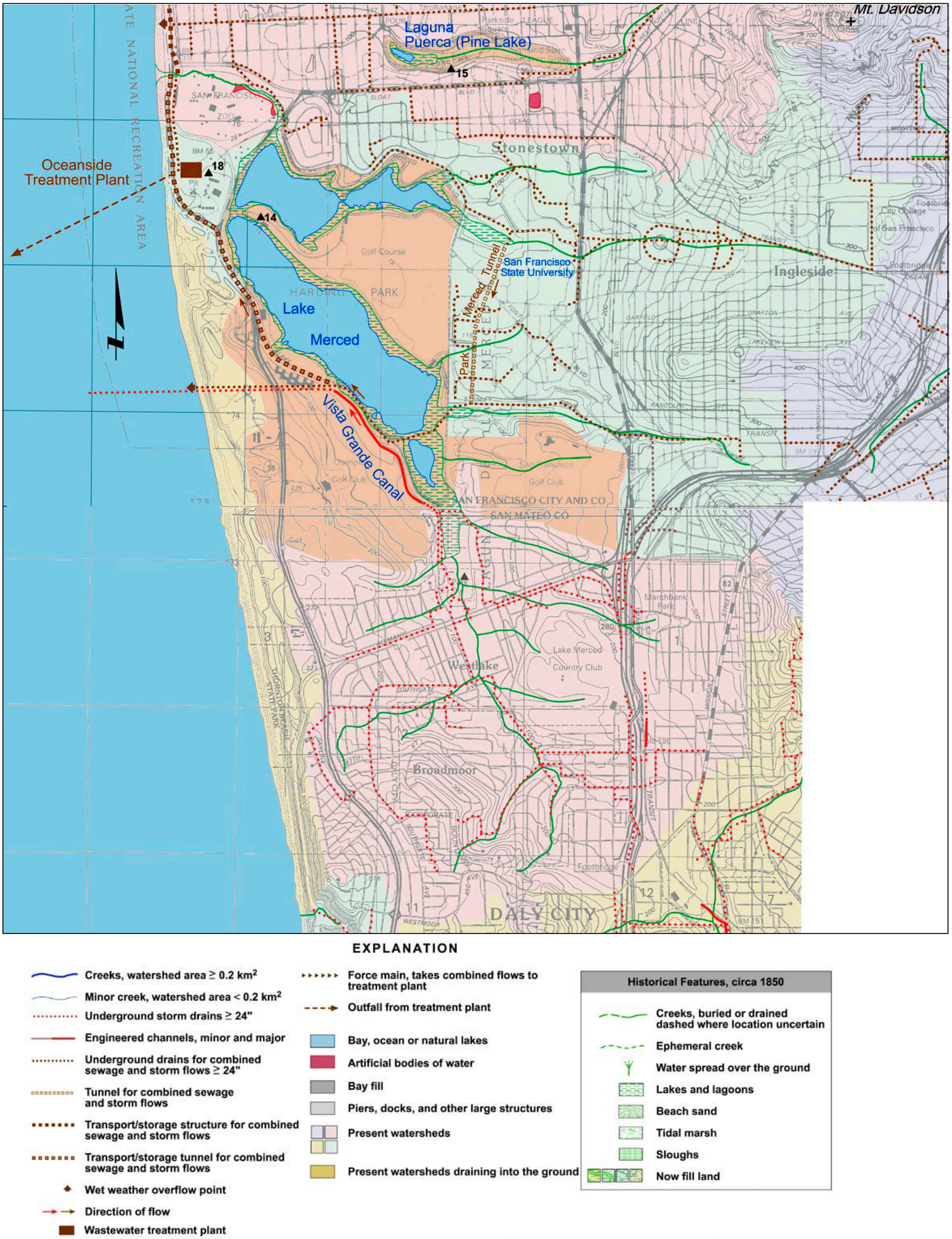
Season	Average Temperature (°F)	Average Precipitation (inches)
Winter (Dec – Feb)	51.5	11.31
Spring (Mar – May)	54.1	4.43
Summer (Jun – Aug)	58.1	0.25
Fall (Sept – Nov)	58.0	3.90
Annual	55.4	19.99

SOURCE: Western Regional Climate Center, 2012

3.9.1.2 Project Hydrologic Setting

Lake Merced Watershed

Urban development has significantly reduced Lake Merced's original estimated watershed size of 6,320 acres (approximately 10 square miles) to its current size of approximately 650 acres (SFPUC, 2011a; Kennedy/Jenks, 2012a). As urban development advanced in the area, surface runoff was diverted away from Lake Merced. Consequently, the southern portion of the original watershed (Daly City), including what is now the Vista Grande Drainage Basin, and the eastern portion of the original watershed (San Francisco) were diverted from flowing into the Lake (**Figure 3.9-1**; Oakland Museum, 2013). The current watershed is bounded by the adjacent roadways that include



SOURCE: Oakland Museum, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-1
Lake Merced Current and Historic Watershed

Lake Merced Boulevard, Skyline Boulevard, and John Muir Drive. Lake Merced itself makes up approximately 43 percent of the watershed area (272 acres). The rest of the watershed is composed of upland areas. Harding Park and Jack Fleming Golf Course account for about 175 acres of the upland watershed; roads and neighborhoods account for approximately 31 acres; and the remainder is primarily undeveloped open space vegetated with wetland and upland species located between the Lake and the surrounding roadways (**Figure 3.9-2**) (SFPUC, 2011a).

Watershed Drainage

Much of the runoff from the eastern portion of the original Lake Merced watershed is now diverted into the San Francisco combined storm sewer system (discussed below), resulting in reduced natural drainage and recharge to the Lake. This runoff diversion makes it difficult to define the limits of the contributing drainage areas that currently make up the Lake Merced Watershed because it is not clear exactly how many of the inlets located within the Lake's natural drainage basin are now part of San Francisco's combined storm sewer system, and because the areas served by these inlets are difficult to accurately delineate (SFPUC, 2011a). Urban development of the Lake's current watershed resulted in an increase in impervious surfaces, which tends to increase surface water runoff from land areas rather than promote infiltration into the ground. A significant portion of stormwater that falls on the areas immediately surrounding the Lake drains directly into the Lake. Stormwater inlets on the streets surrounding the Lake collect stormwater runoff, and route it to the Lake through dedicated drainage pipes (SFPUC, 2011a). Additionally, several catch basins draining into the Lake are located primarily along the southern portion of the lake near Impound Lake, and the majority of the stormwater drains located along the western shore of Lake Merced (Figure 3.9-2) empty directly to the Lake (Kennedy/Jenks, 2012a; SFPUC, 2011a).

Lake Merced

Lake Merced is the largest freshwater lake in San Francisco. Lake Merced is composed of four lakes: North Lake, East Lake, South Lake, and Impound Lake (SFPUC, 2010a). It is bounded by Skyline Boulevard, Lake Merced Boulevard, and John Muir Drive. The Lake was historically a coastal lagoon that was intermittently connected to the ocean via a channel that ran through the current location of the San Francisco Zoo. This connection was permanently closed in 1895 with the construction of Skyline Boulevard and the Great Highway (SFPUC, 2011a). The only physical outlet from Lake Merced is from South Lake via a 30-inch-diameter overflow conduit at a water surface elevation (WSE) of approximately 13 feet City Datum[2] that connects to the Vista Grande Tunnel immediately downstream of the Canal.

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[2] Elevations in San Francisco are commonly referenced to three vertical datums, including the North American Vertical Datum of 1988 (NAVD 88), the National Geodetic Vertical Datum of 1929 (NGVD 29), and the San Francisco City Datum (City Datum). NAVD 88 was established in 1991 and is the most up-to-date and accurate datum. NGVD 29 was used by surveyors and engineers for most of the 20th century and is 2.76 feet lower than NAVD 88. The San Francisco City Datum was set at 6.7 feet above the city's former high water mark and is 11.38 feet higher than NAVD 88 and 8.62 feet higher than NGVD 29. Lake Merced elevations have commonly been referenced to the City Datum. The technical reports prepared in support of the Project used all three datums; therefore, for consistency, this EIR uses the same datum employed in a given technical report when discussing information obtained from that report.

Legend

- Stormdrain Catch Basin
- Stormdrain Manhole
- Stormdrain Junction
- Vista Grande Canal
- Stormdrain Line
- Adjacent to Lake (123 Acres)
- Impervious Areas (31 Acres)
- Harding Park Golf Course (183 Acres)

SOURCE: ESRI Onlin Aerial Imagery, 2007 (2ft resolution)
Stormdrain Data from SFPUC, 2008;
Kennedy/Jenks Consultants

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-2
Lake Merced Watershed

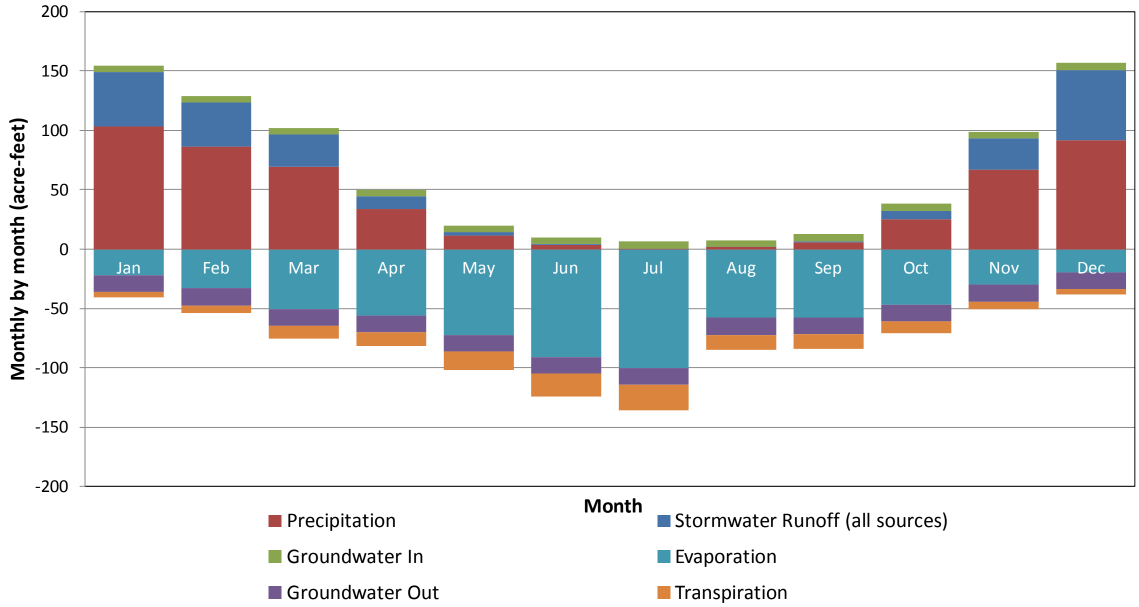
Lake Merced supports recreational activities that involve some water contact; including boating and fishing, as well as other non-contact uses such as pedestrian use of perimeter paved paths, and trails managed by the San Francisco Recreation and Park Department. The SFPUC also maintains Lake Merced as a non-potable emergency water supply to be used for firefighting or sanitation purposes, subject to a boil water order, if no other sources of water are available (SFPUC, 2011a). In the event of a major disaster (e.g., catastrophic earthquake), Lake Merced water could be pumped into San Francisco's drinking water distribution system to maintain firefighting, basic sanitary (e.g., toilet flushing), and other critical needs. Because of this potential for emergency water supply use, full body contact recreation (e.g., swimming, wading) is not allowed in the Lake (SFPUC Resolution No. 10,435; SFPUC, 1950).

Lake Merced Hydrology

Lake Merced is currently replenished primarily by direct precipitation, limited stormwater runoff from immediately adjacent areas, periodic overflows of the Vista Grande Canal (discussed below), and shallow groundwater inflow (**Figure 3.9-3**). Lake Merced is a partially spring-fed system and was not historically a terminal lake. In the past, springs that fed the lake were primarily located on the eastern side and in the southern portion of Lake Merced, but urbanization of the watershed has resulted in the emplacement of large amounts of fill that now impede spring discharge in Lake Merced (SFPUC, 2010a). The Lake levels are supported by a varying groundwater level, precipitation falling directly on the lake surface, local storm water runoff from the immediately surrounding watersheds, periodic overflows from the Vista Grande Canal, and infrequent planned discharges of dechlorinated water into the Lake from SFPUC water operations. Outflows from Lake Merced include evaporation, transpiration from emergent vegetation, and groundwater seepage. Currently, the largest source of outflow is evaporation, followed by transpiration, and groundwater infiltration.

Prior to 1940 and the construction of the San Francisco Zoo, a natural creek connected the North Lake with the Pacific Ocean near Sloat Boulevard, at which time Lake Merced operated at higher water levels (Jacobs Associates, 2011). Urbanization around Lake Merced has reduced the watershed recharge capacity, which has decreased groundwater inflow into Lake Merced, and created lower water levels and a flatter groundwater gradient in the shallow aquifer (discussed below). The reduction in subsurface recharge to Lake Merced results in short-term lake levels being more sensitive to fluctuations in precipitation, since direct precipitation, along with shallow groundwater inflow, are the primary lake recharge mechanisms (SFPUC, 2010a). As a result, Lake Merced is likely to be slow in recovering from drought conditions (Jacobs Associates, 2011).

The existing shape of Lake Merced is typical of a former river-estuary channel, with a rounded rectangular basin, fairly steep sides and a long, narrow trench close to the northeast shore, though it is no longer connected to the ocean. North and South Lakes are hydrologically connected via a conduit, although this connectivity is limited and there is a consistent water level difference of about 1 foot between North Lake and South Lake (SFPUC, 2011a). North and East Lakes are hydrologically connected via a narrow channel under a pedestrian bridge. Impound Lake was formed with the construction of a sewer line and a pedestrian walkway across the southern tip of South Lake (SFPUC, 2010a). Soil has accumulated around the foundation of the walkway and



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project ▪ 207036.01

Figure 3.9-3
Lake Merced Sources of Inflow and Outflow

sewer line crossing, which has restricted the hydrologic connection so that flow between South and Impound Lakes occurs only when the WSE is above 5 feet City Datum (ESA, 2014a), above which water flows freely underneath the pedestrian walkway to connect both lakes.

Lake Surface Area and Water Depth

The total combined surface area of all four lakes has historically ranged from 190 to 319 acres, depending on WSE, with a corresponding total volume that ranged from 1,800 to 7,780 acre-feet. Water levels in Lake Merced normally rise and fall between 2 to 3 feet seasonally due to rainfall, evaporation and groundwater seepage. Drought years can cause more significant lake level fluctuations. The upper water surface level typically occurs in late winter and early spring; lowest levels occur in the early fall. Lake levels can also be affected by groundwater, with lake levels increasing and decreasing as groundwater levels increase and decrease (Jacobs Associates, 2011).

South Lake, which has a surface area of approximately 175 acres (based on a 2009 WSE of 5.4 feet City Datum), is the largest of the lakes, and contains more than two-thirds of the total volume of all four lakes. Following in order of size, North Lake has a surface area of approximately 58 acres, East Lake of approximately 26 acres, and Impound Lake, the smallest and southernmost lake, of approximately 13 acres. Water depth varies between the four lakes, with Impound Lake being the shallowest with depths ranging from 2 to 10 feet, and an average depth of roughly 5.5 to 6 feet. North and East Lakes range in depth from 3 to 20 feet, with an average depth of 10 to 11 feet. South Lake depths range from 3 to 21 feet, with average depths of roughly 13 to 15 feet (SFPUC, 2011a). In recent years, with an annual mean WSE of 6 feet City Datum, Lake Merced is estimated to have a total area of 296 acres.

Lake Merced Water Levels

Water levels in Lake Merced fluctuate seasonally and across different time periods. Prior to 1935 (before the completion of the Hetch Hetchy water system), the Lake was used for municipal water supply. Lake WSEs typically ranged from -10 to 0 feet City Datum, but increased to over 13 feet City Datum by the late 1930s and early 1940s after water deliveries from the Hetch Hetchy water system began (Kennedy/Jenks, 2012b). However, WSEs began to decline again in the 1940s. During the 1940s to late 1950s, WSEs varied between 8 and 13 feet City Datum. Between the late 1950s and early 1980s, lake levels experienced a long-term declining trend, with WSEs ranging between 4 and 10 feet City Datum. The reasons for the overall decline in lake levels between the 1940s and 1980s are reported to be drought, increased municipal groundwater pumping in the Westside Groundwater Basin, and diversion of stormwater runoff due to increased urbanization and development of the watershed.

During the late 1980s and early 1990s, Lake Merced WSEs declined to well below historical averages. The lowest WSE observed was approximately -3.2 feet City Datum in 1993, following the major drought of the late 1980s and early 1990s. Since that time, the WSEs have steadily risen as a result of above-average precipitation, SFPUC water additions to the Lake between 2002 and 2005, reduced irrigation pumping at the Lake Merced-area golf courses as a result of recycled water deliveries, and reduced municipal groundwater pumping as a result of the In-Lieu Recharge

Demonstration Study[3] (see **Figure 3.9-4** for 1926 to 2011 water levels). Since 2006, lake levels have consistently remained between about 5 and 7 feet City Datum. In 2009, the WSE ranged from approximately 4.9 to 6.9 feet City Datum (Kennedy/Jenks, 2012b). As of December 2011, the WSE was approximately 6.8 feet City Datum, though in April 2011, the Lake had reached 7.4 feet City Datum, its maximum WSE in 2011 (SFPUC, 2011b).

Stormwater

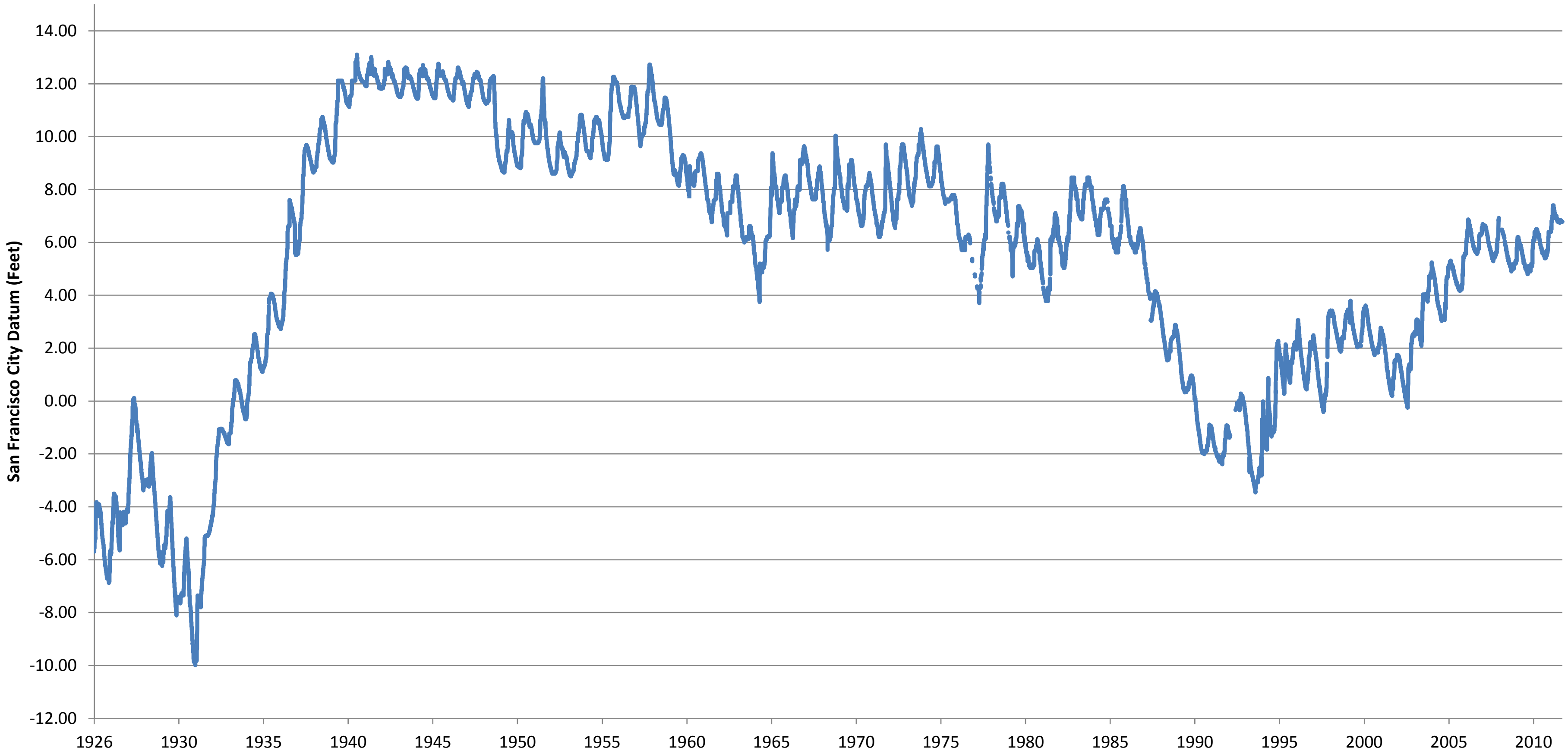
Stormwater relevant to the study area is associated with the Vista Grande Canal and Tunnel storm drain system and the SFPUC combined sewer system.

Vista Grande Drainage Basin

The Vista Grande Drainage Basin (Basin) is directly south of the Lake Merced Watershed (Figure 1-1). Flows from the Basin are conveyed directly to the Pacific Ocean via the Vista Grande Canal and Tunnel. Currently, surface flows from within the Basin only enter the Lake during storm events when Canal capacity is exceeded and flood flows cross John Muir Drive into Lake Merced.

Like the Lake Merced watershed, the Basin has also experienced substantial urban development. Since the watershed lacks significant pervious surface, rainfall quickly sheds from the watershed and generates high, but short duration, peak storm water flows (Jacobs Associates, 2011). The Basin is a densely developed urban community surrounded by hills on the east, west, and south (RMC, 2006). The primary land uses are residential, commercial, and recreational with a high percentage of impervious surfaces, such as roads, roofs, and parking lots. The Basin contains portions of two large golf courses and completely encompasses a third. Residential land uses cover nearly half (45 percent) of the land area within the watershed, and right-of-way areas consisting primarily of streets and sidewalks make up approximately 27 percent. An additional 7 percent of the watershed consists of institutional land uses (schools and other facilities) and 6 percent consists of commercial uses. Just 0.3 percent of the watershed is covered by industrial uses (Sanchez, 2012). The California Office of Environmental Health Hazard Assessment (OEHHA) estimates that rainfall on these land use types typically runs off at rates as high as 70 to 90 percent (OEHHA, 2010). In addition to these land uses, the basin includes approximately 9 percent recreational land, 4 percent vacant land, 0.4 percent agriculture, and 2 percent other land uses (Sanchez, 2012). These land uses typically result in lower rates of runoff than the developed uses described above; however, they do include some impervious surfaces.

[3] From October 2002 through April 2007, the SFPUC and three Partner Agencies (Daly City; California Water Service Company [Cal Water]; and the City of San Bruno) participated in the In-Lieu Recharge Demonstration Study in the South Westside Groundwater Basin to study the effects of the groundwater recharge component of a conjunctive use program. During the Demonstration Study, the Partner Agencies received approximately 20,000 acre-feet of supplemental surface water from the SFPUC “in-lieu” of their normal groundwater pumping. The purpose of the study was to determine if providing supplemental water to the Partner Agencies would result in increased groundwater availability for pumping in dry years and for emergency supply when the SFPUC regional water supply may be reduced. The 20,000 acre-feet of groundwater savings accrued under the Demonstration Study was credited to an SFPUC Storage Account. However, this water would not be withdrawn unless the SFPUC approves the Groundwater Storage and Recovery Project, the SFPUC and the Partner Agencies approve the associated Operating Agreement, and the Groundwater Storage and Recovery Project wells are constructed to enable use of the water in storage (Kennedy/Jenks, 2012a).



SOURCE: ESA, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-4
Historical Measured Lake Merced
Water Surface Elevation (1926 to 2011)

The Basin stormwater drainage system is composed of stormwater sewers, box culverts, manholes, catch basins, and flow equalizations facilities, with approximately 30 miles of pipe, ranging in size from 6 to 72 inches diameter, plus some box culverts, all of which currently are maintained by the Street Division of the Daly City Public Works Department (RMC, 2006). This system collects storm and authorized non-storm flow from a 2.5-square-mile area in Daly City and unincorporated San Mateo County (the Basin) and conveys those flows via several underground culverts to the Vista Grande Canal and Tunnel. The Basin is bordered by San Francisco and the Lake Merced watershed to the north, the Colma Creek watershed to the south and east, and Thornton State Beach and the Pacific Ocean on the west. The Basin drains to the Pacific Ocean via the Vista Grande Canal and Tunnel.

The urban portion of the Basin (i.e., not including those portions within golf courses) is divided into three sub-basins (**Figure 3.9-5**), each of which contribute flow to the Canal headworks at the intersection of John Muir Drive and Lake Merced Boulevard. The sub-basins that contribute flow to the Canal are summarized as follows:

- Sub-Basin #1 has a 118-acre drainage area and flow is conveyed to the Canal headworks via a 24-inch culvert.
- Sub-Basin #2 has a 397-acre drainage area and flow is conveyed to the Canal headworks via a 60-inch culvert.
- Sub-Basin #3 is the largest of the sub-basins with a 1,175-acre drainage area and flow is conveyed to the Canal headworks via a 7-foot by 6-foot box culvert.

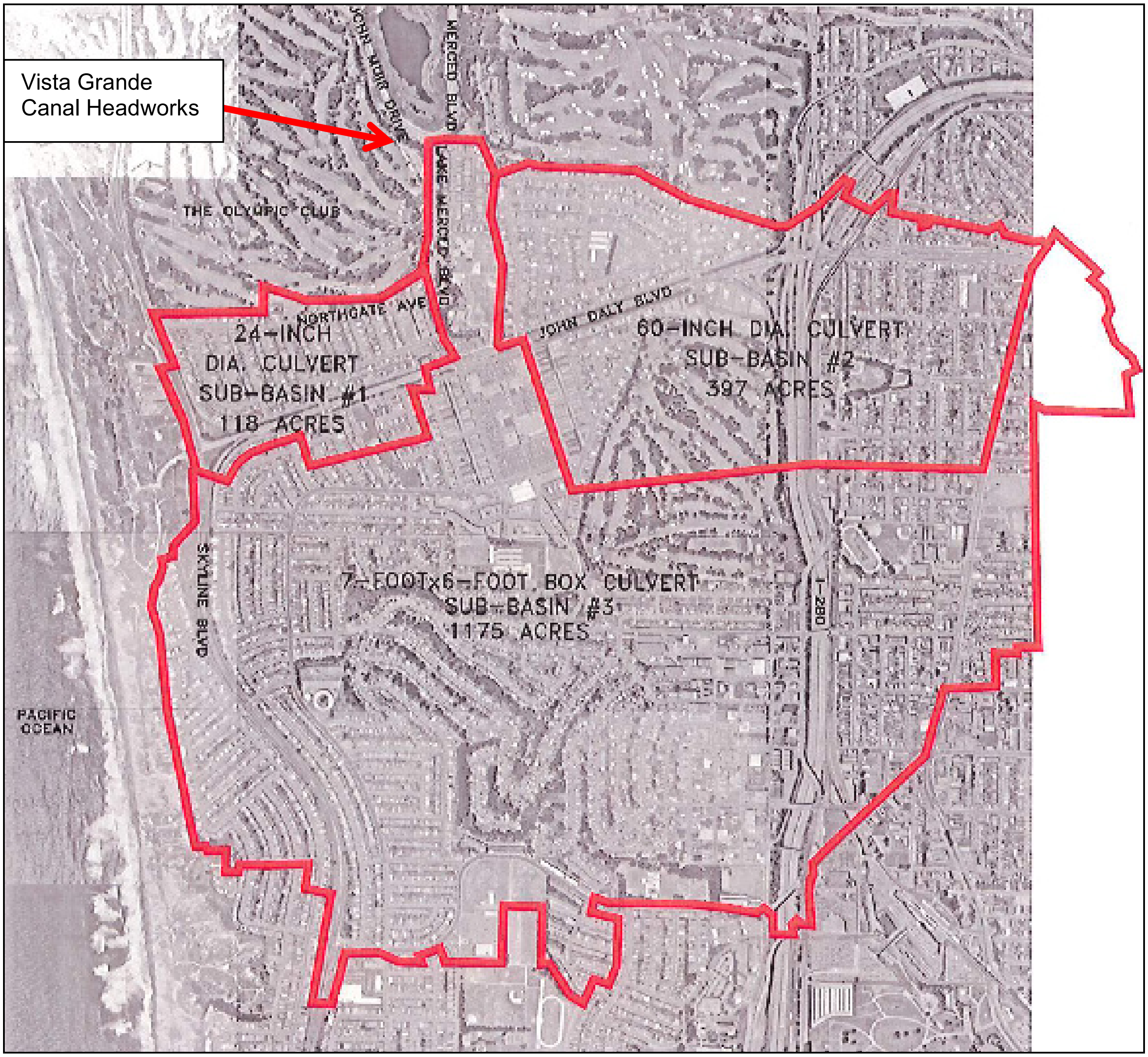
Vista Grande Canal and Tunnel

The Vista Grande Canal (Canal) collects storm and authorized non-storm flows from the Basin and discharges them to the Tunnel. The existing Canal lies parallel to the southwest shores of Lake Merced and adjacent to John Muir Drive in San Francisco. The Canal is a 3,600-foot-long brick-lined trapezoidal channel structure. As the Canal tapers downstream, its dimensions vary. It is 11 feet deep by 11 feet wide with a flow capacity of 900 cubic feet per second (cfs) in some places and 7 feet deep by 4 feet wide with a flow capacity of 500 cfs in other places (RMC, 2006). There is additional capacity provided as a result of earth banks that have built up over the top of the engineered Canal as well as containment berms (John Muir Drive bank) and natural steep slopes (Olympic Club bank) adjacent to the Canal.

At the terminus of the Canal is the mouth of the Tunnel, the primary outlet for stormwater from the Basin, constructed in 1897. The Tunnel is a 3,000-foot-long, 7-foot-tall by 4-foot-wide, egg-shaped gravity conduit with an average cross-sectional area of 22.25 ft^2 (RMC, 2006). Flows exiting the tunnel discharge to the beach below Fort Funston through an ocean outlet structure. The Tunnel has a non-surcharged capacity of 170 cfs, which is not adequate to convey peak Canal storm flows, periodically resulting in flooding in low-lying residential areas and along John Muir Drive.

Vista Grande Canal Flows

As discussed in detail in Section 3.9.1.3, below, a monitoring program was designed and implemented by Daly City for the 2011 and 2012 dry (seasonal flow mainly composed of authorized non-storm flows) and wet (seasonal flows composed of both storm and authorized



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-5
Vista Grande Drainage Basin and Sub-Basins

non-storm flows) seasonal periods to characterize baseline water quality within Lake Merced and the Vista Grande Canal, and to quantify Canal flows in support of the proposed Project. Dry season monitoring was conducted between August 15 and October 31, 2011 and wet season monitoring was conducted from November 20, 2011 to May 31, 2012. The data collected from the Canal during the 2011-2012 monitoring period provide the most comprehensive available baseline assessment of the quantity (and quality, discussed further below) of stormwater that could potentially be diverted to Lake Merced under the proposed Project. Flow (base flow and storm flow) was monitored in the Canal at station VGC-1 (**Figure 3.9-6**), which is located in the Canal, adjacent to the parking lot at the south end of South Lake. A detailed description of the 2011 and 2012 wet and dry seasonal hydrologic monitoring, including methodological design, rationale, sampling and analysis methodologies, data analysis, and results and discussion, is presented in the *Vista Grande Drainage Basin Improvement Project Water Quality Assessment* (WQA) (ESA, 2015).[4]

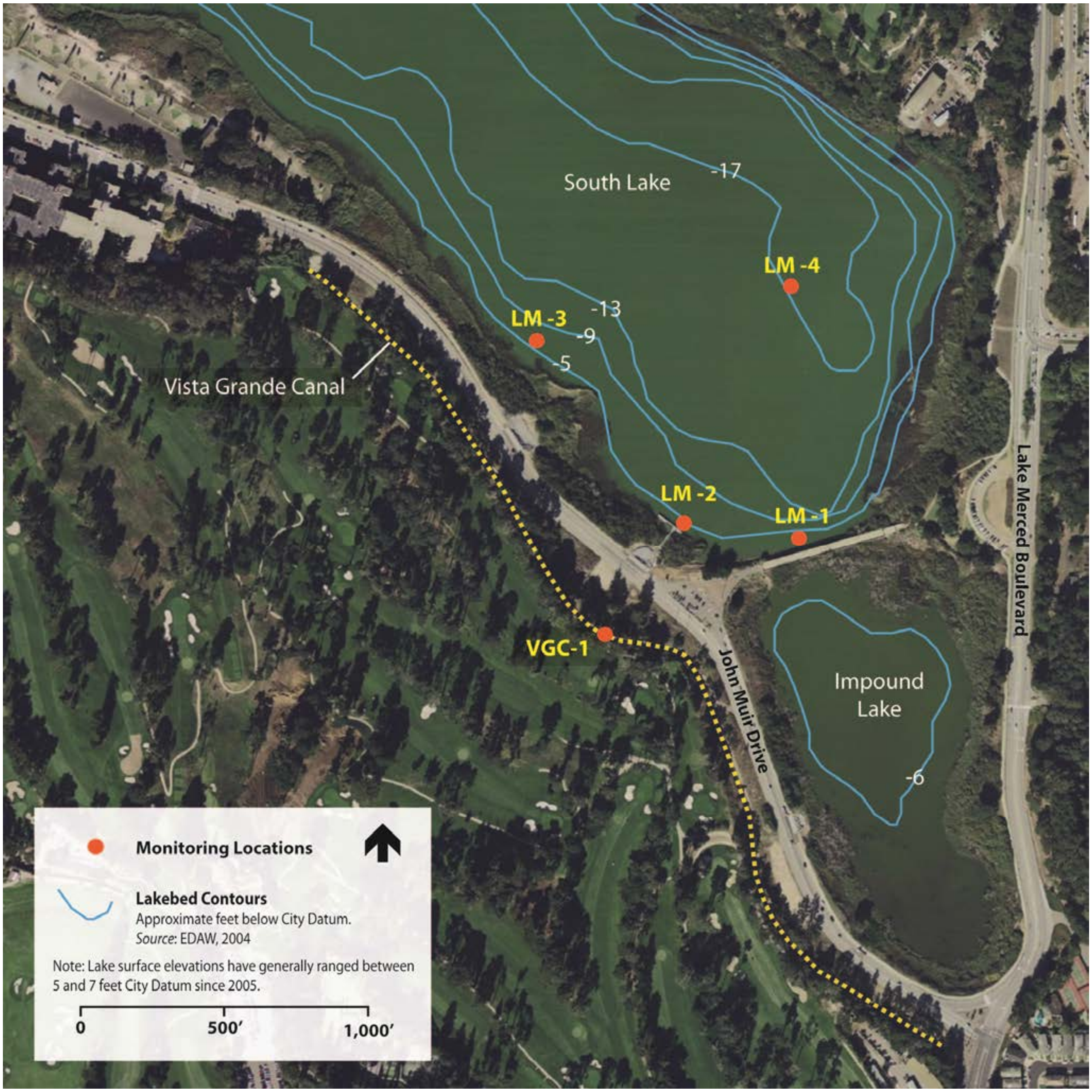
Typical dry and wet season base flow ((authorized non-stormwater runoff) that results from urban or suburban land-uses, such as irrigation runoff, car washing, foundation drains, and planned and unplanned potable water system discharges) within the Vista Grande Canal averages approximately 0.25 cubic feet per second (cfs) or approximately 0.5 acre feet per day (ESA, 2015). Typical wet season base flow (0.20 cfs) within the Vista Grande Canal is periodically lower than summer base flow (0.28 cfs) due to reduced irrigation return flow. Wet season hydrologic monitoring characterized a total of six discrete storm events (**Table 3.9-2**; see also figures on pages B-55 to B-60 of ESA, 2015 for detailed storm hydrographs). Hydrologic monitoring revealed that, in general, storm events within the Basin tend to result in flashy runoff patterns in the Canal. Flow monitoring over the sampling season recorded that runoff events generally lasted 3 to 17 hours (with an average of 9 hours), and that peak runoff was reached after approximately 2.5 hours from the onset of rain, on average.

TABLE 3.9-2
STORM MONITORING HYDROLOGIC SUMMARY

	Storm Event Date (2012)					
	1/19	1/22	2/29	3/13	3/14	3/16
Total Event Precipitation (in)	0.11	0.55	0.36	0.38	1.02	1.09
Antecedent Dry Period (Days)	19	<1	13	11	<1	<1
Peak Flow (cfs)	18	257	184	33	115	193
Storm Event Volume (acre-feet)	3.2	37.9	17.3	21.6	79.7	42.7
Storm Volume as % of LM Storage[a]	0.06	0.67	0.31	0.38	1.42	0.76

NOTES:
[a] Based on Lake volume of 5,625 acre-feet.

[4] A Water Quality Assessment (WQA) was prepared for Lake Merced and the Vista Grande Canal to document existing hydrologic and water quality conditions and provide analysis of potential changes to those existing conditions as a result of Project operations, in support of the proposed Project. The WQA was developed in cooperation with the San Francisco Public Utilities Commission (SFPUC) and the San Francisco Bay Regional Water Quality Control Board (RWQCB). The existing conditions portion of the WQA (ESA, 2015) is summarized in Section 3.9.1 and provides the basis for the hydrology and water quality analysis of the proposed Project and alternatives.



SOURCE: ESA, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-6
2011-2012 Water Quality Monitoring Locations

SFPUC Sewer and Stormwater Systems

The SFPUC Wastewater Enterprise manages San Francisco's wastewater and stormwater collection, treatment, and discharge system. Stormwater flow within San Francisco has been almost entirely diverted to San Francisco's combined sanitary sewer and stormwater system, a system that collects and transports both sanitary sewage and stormwater runoff in the same set of pipes. San Francisco is roughly divided into two major drainages: the eastern and the western basins. The eastern basin (divided into five sub-drainage areas) includes the bayside waterfront, and combined stormwater and wastewater flows from this basin flow towards the San Francisco Bay. Stormwater runoff from the western portions of San Francisco drains to the combined stormwater and sewage system, or one of seven separate sewer systems administered by the SFPUC. The western basin stormwater inlets on the streets surrounding Lake Merced collect stormwater runoff, and route it to the Lake through dedicated drainage pipes. This system consists of catch basins that discharge stormwater directly to the Lake.

Coastal Processes and Bluff Erosion Affecting the Vista Grande System

The existing Vista Grande Tunnel outlet is located on the beach below Fort Funston (Figure 2-2b). The Ocean Outlet structure discharges stormwater from the Basin to the Pacific Ocean either through a submarine outfall pipeline during low flows or across the beach during higher flows. The Ocean Outlet structure, a segment of the Vista Grande Tunnel, and the force main segment are fully exposed to the surf and waves. The stretch of coastline immediately west of Lake Merced in the vicinity of the existing Daly City Ocean Outlet structure is characterized by a narrow beach backed by high, unstable sandy bluffs. The geology of the Project area coastline is characterized by steep bluffs between 100 and 200 feet in height, typically composed of marine sedimentary deposits comprised of medium to fine-grained weakly consolidated sandstone, siltstone, and claystone.

The narrow beach in the vicinity of the existing Ocean Outlet structure does little to protect the base of the bluff from seasonal wave attack (PWA, 2007). Over the years, erosion of the beach and bluff backing the existing Ocean Outlet structure has resulted in exposure of the Tunnel structure on the beach. The entire exposed structure extends roughly 80 feet from the base of the bluff (PWA, 2007). Wave erosion during the winter months typically undercuts the bluff and erosion by surface runoff oversteepens the bluffs, resulting in slides, slumps, and erosion of the bluff face. In general, the morphology of the coastal bluff represents a balance between mass wasting, which tends to decrease the bluff slope, and wave attack, which tends to increase the bluff slope. Mass wasting occurs in the form of slope failure through large block falls, slumps, and landslides, and acts to decrease the bluff slope by redistributing material from the upper portion of the bluff to the toe of the bluff. Wave erosion removes the debris at the base of the slope and can also undercut the base of the bluff, thereby increasing the bluff slope and its susceptibility to erosion (PWA, 2007). Sustained bluff retreat, as has been documented in the vicinity of the existing Ocean Outlet structure, is the result of these competing processes.

Rate of Bluff Erosion

The rate of bluff erosion is the result of multiple parameters and is complex; however, for a given bluff at a given location, the rate of erosion is related to the frequency, duration, and intensity of wave impact on the toe of the bluff (PWA, 2007). The Daly City Ocean Outlet site is located in a less energetic wave regime relative to the shores to the north and south; however, the site is still very exposed to large waves. Moffatt and Nichol (2013) has calculated an annualized long-term average bluff retreat rate at the Project site of 0.5 to 1.0 feet per year for planning purposes, with up to 3 feet per year over the short term due to much of the erosion presumably occurring in the form of episodic slumps and landslides. This observation is generally consistent with the long-term erosion rate of 1.3 to 1.6 feet per year for the stretch of coastline immediately surrounding the Daly City Ocean Outlet site calculated by PWA (2007). However, it must be recognized that this rate can vary significantly with the location alongshore and the time period. The rate for the bluff area south of the structure is about 4 feet per year, while immediately to the north behind the SFPUC's outlet and wing wall the rate is considerably less than the annualized long-term average bluff retreat rate of 0.5 to 1.0 feet per year (Moffatt and Nichol, 2013).

Beach structures may afford some protection to the bluff toe by reducing the severity of wave run-up and erosion at the base of the bluff (known as bluff sheltering, PWA, 2007). While the Daly City Ocean Outlet structure provides some limited protection to the backing bluff, it is not sufficient to arrest bluff retreat, as evidenced by the recession of the bluff face behind the structure. The adjacent SFPUC outlet and adjoining wing walls provide more substantial protection to the backing bluff. Because some bluff erosion has occurred at the project site, the Daly City Ocean Outlet and the SFPUC's outlet and wing wall structures are now protruding onto the beach (Figure 2-3b).

Together, these structures have slowed bluff toe erosion and retreat, while the bluffs to the north and south have continued to recede with erosion at a higher rate than near the structures. Field photographs and aerial images of the site show a promontory extending approximately 60 feet out from the adjacent bluff (PWA, 2007). This promontory represents a potential source for latent erosion, which may occur rapidly at some point in the future in the form of slumping or landsliding due to oversteepening from the sides which increases stress in the bluff. The implication of promontory failure represents a potential coastal landslide hazard that could impact the outlet infrastructure and cause a public safety hazard.

Event Erosion

Event Erosion refers to short term erosion events associated with severe storms, clusters of storms, and severe winters such as those that can occur during an El Niño climatic condition. The bluff recession rate described above is dominated by the sporadic occurrence of localized bluff failures, and recession of the bluff top of up to 80 feet in a single episode has occurred along the stretch of coastline north and south of the Daly City Ocean Outlet (Moffatt and Nichol, 2013). In the winter of 2002-2003, the bluff top immediately north of the SFPUC's outlet retreated approximately 20 feet in a single landslide event. Under El Niño conditions, water levels can increase by 2 feet for short periods and elevate average water levels over the entire winter by about 1 foot. These higher water levels increase erosion because larger waves break at higher elevations on the shore. Also, El Niño conditions can increase storm intensity and modify storm tracks with the effect of increasing the wave power incident to the California coast. When these conditions occur, episodic bluff erosion can be expected. Erosion during an extreme El Niño winter can amount to the same net erosion over several decades (ESA, 2014b). Shoreline changes in excess of 100 feet have been observed over a single year, but the average taken over several decades is similar to the net long term bluff recession rate of 0.5 to 1.0 feet per year (Moffatt and Nichol, 2013). More recent studies of bluff erosion rates at Fort Funston show an acceleration of erosion rates since the 1990s to about 1 to 2 feet per year (Battalio, 2014).

Seasonal Wave Action

In addition to bluff erosion from wave action, winter waves also typically erode the beach, moving sediment offshore and creating a bar feature, resulting in a steeper beach with a well-defined berm. During the subsequent summer season, waves build the beach using the sediment stored offshore in the bar feature, resulting in a flatter beach extending to the bluff toe. Beach profiles using available USGS survey data indicate a seasonal variation in beach slope between 11:1 and 28:1 (horizontal to vertical), with up to a 5-foot variation in beach berm elevation and up to 8 feet sand level variation at the bar feature. As a result of such seasonal variation of sand migration and the beach profile, the existing submarine outfall pipeline is completely or partially buried during summer months and becomes exposed during winter months (Moffatt and Nichol, 2013). When exposed, the submarine outfall pipeline, which extends from the Ocean Outlet structure to the water, impedes access along the beach.

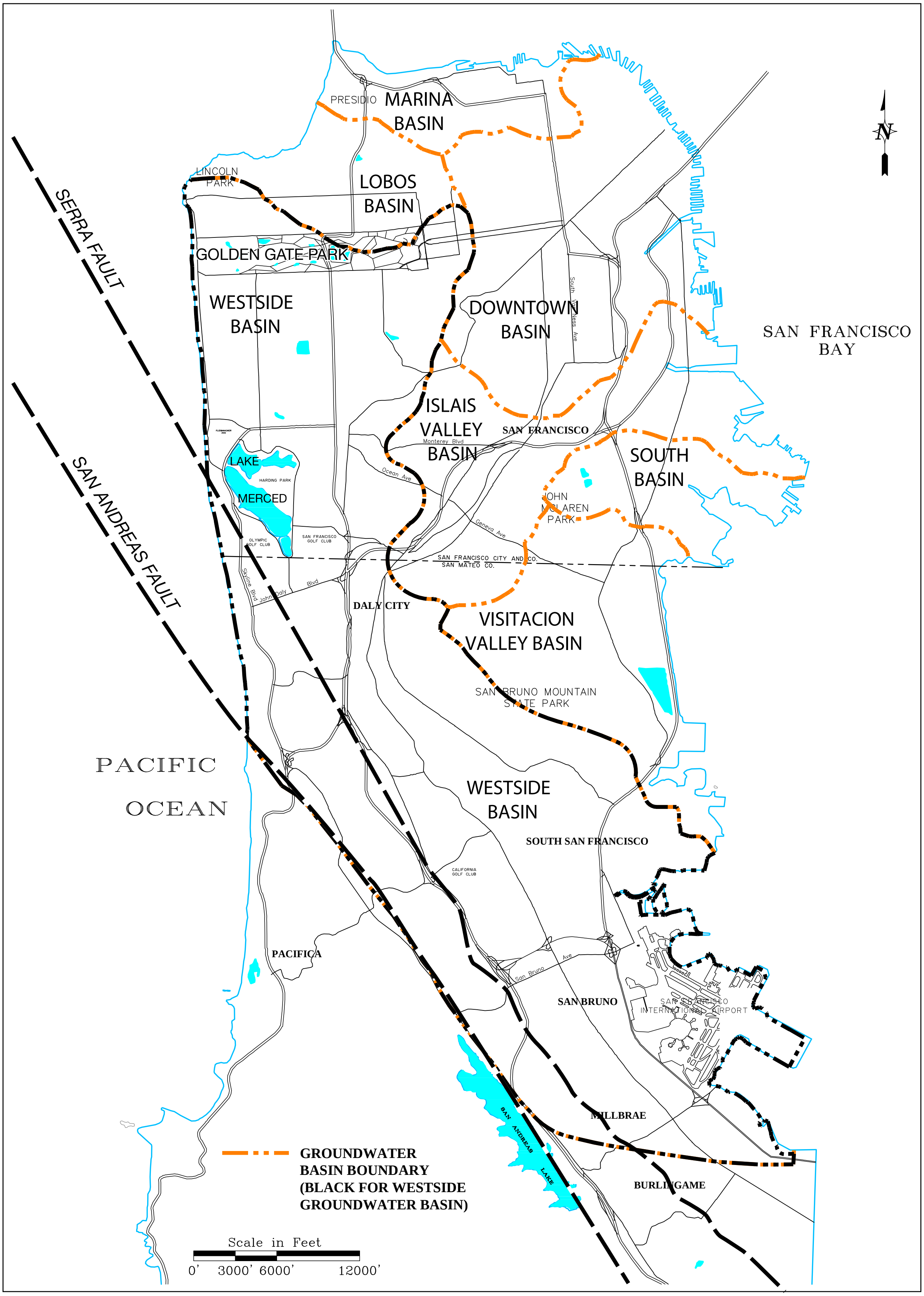
Future Shoreline Conditions

While it is important to understand historic rates of erosion, future erosion rates are of particular importance to consideration of engineering design. In general, erosion rates of coastal cliffs and beaches will increase with rising sea level (California Coastal Commission, 2015). With higher sea levels, the amount of time that bluffs are exposed to the mechanical erosive force of waves increases, causing greater erosion as compared to current or historic rates. The specific effect of increasing sea level at the Project site depends, in large part, on the mechanisms causing bluff toe retreat at present (Moffatt and Nichol, 2013). The combination of unstable geomorphology, high rates of historic shoreline change, high wave energy, and moderate tide range makes this area highly susceptible to adverse effects of sea level rise. It is likely that higher future average water levels associated with sea level rise and tidal datum modification will result in a greater occurrence of waves impacting the base of the bluff, thereby increasing the susceptibility to erosion. The coastal loads and erosion rates in the Project area are expected to increase and may increase non-linearly (accelerate) (PWA, 2007). Additionally, as described above, the winter months are characterized by a narrow, steep beach due to cross-shore movement of sands and formation of an offshore bar over a wave-cut bedrock platform. The bedrock shore platform and its sediment cover controls bluff retreat by dissipating wave energy before it impinges on the bluff face. This dissipation of wave energy may currently limit the extent of beach and bluff erosion during extreme events. In the future, sea level rise will elevate average water levels relative to the bedrock platform such that this dissipative effect will be reduced, allowing higher wave energy to impact the base of the bluff. As this threshold is crossed, rapid recession may occur as the shoreface adjusts to a new equilibrium.

Coastal management often requires future projections of shoreline change, based on observed rates over contemporary time (PWA, 2007). The unknown response of the shoreface under conditions relating to sea level rise contributes to an inherent uncertainty in predicting future bluff recession or erosion rates (PWA, 2007). While there is currently no fully accepted methodology for estimating future bluff erosion with sea level rise, it is typically accepted that future erosion rates can be estimated by modifying historic erosion rates to account for sea level rise (California Coastal Commission, 2015). When there is a range of erosion rates from historical trends, the high rate may be considered as part of projecting future erosion with rising sea level conditions to represent average future trends. Using observed sea level rise rates over the past 50 years or so, and attributing much of the bluff recession to increasing sea levels, the amount of bluff recession per foot of sea level rise has been calculated to range from 83 to 167 feet (Moffatt and Nichol, 2013). Assuming the bluff material composition and geology remains the same and the processes of erosion are not altered, the recession of the bluff toe in the vicinity of the Daly City Ocean Outlet structure by the year 2060 due to a sea level rise of 1.4 feet is estimated to range from 116 to 234 feet (Moffatt and Nichol, 2013). PWA (2007) has also estimated the range of expected future erosion rates in the bluffs surrounding the Project area using two methods. Using a historic trend analysis, future erosion rates from 1.4 to 4.5 feet per year were predicted. Using a Bruun-based analysis, future erosion rates from1.8 to 3.6 feet per year were predicted. However, current estimates for sea level rise are likely to change in the future as model projections and forecasting are refined, leading to further variation of predicted erosion rates. The key aspect relevant to establishing future conditions related to bluff erosion rates at the Project site is that the annualized historic long-term average bluff retreat rate in the vicinity of the Project area—currently 0.5 to 1.0 feet per year (and up to 3 feet per year due to episodic slumps and landslides)—is likely to increase in the future, especially as a result of the anticipated increase in the rate of sea level rise (Moffatt and Nichol, 2013).

Groundwater

As an urban area with little available open space, the Project area and surrounding locations generally lack pervious surfaces. Colma Creek, Lake Merced, and local golf courses and cemeteries are the main pervious features that enable aquifer recharge in the area (Jacobs Associates, 2011). The Westside Groundwater Basin underlies the study area and is one of seven groundwater basins underlying San Francisco (see **Figure 3.9-7**). The Westside Groundwater Basin underlies most of western San Francisco and extends from the western portion of the city south to the eastern portion of San Mateo County (DWR, 2006). With an area of about 45 square miles, the Westside Groundwater Basin is the largest in San Francisco. It is separated from the Lobos Basin to the north by a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. San Bruno Mountain and San Francisco Bay form the eastern boundary, and the San Andreas Fault and Pacific Ocean form the western boundary. The southern limit of the Westside Groundwater Basin is defined by an area of high bedrock that separates it from the San Mateo Plain Groundwater Basin. The basin opens to the Pacific Ocean on the northwest and San Francisco Bay on the southeast. The portion of the basin south of the San Francisco – San Mateo county line has been developed as a municipal water supply since the mid-20th century. The basin north of the county line was historically developed for irrigation and non-potable use; however, its development as a municipal water supply for San Francisco was recently assessed in the SFPUC San Francisco Groundwater Supply Project Final EIR (San Francisco, 2013).



SOURCE: LSCE, 2010a

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-7
Westside Groundwater Basin Location Map

Near Lake Merced, the Westside Groundwater Basin is divided into three geologically distinct basins: the Shallow Aquifer, the Primary Production Aquifer, and the Deep Aquifer. The lake is incised into the upper portion of the Shallow Aquifer and is hydraulically connected to that (USGS 1990). Previous investigations have shown that the lake is essentially an exposed part of the water table that defines the upper boundary of the Shallow Aquifer (San Francisco, 2013). The Shallow Aquifer, the Primary Production Aquifer, and the Deep Aquifer are separated from each other by clay layers.

Flooding

As discussed above, urban development has significantly reduced Lake Merced's original undeveloped drainage watershed and, as a result, the vast majority of surface runoff has been diverted away from the Lake as compared to historic hydrologic conditions. Most Basin surface runoff is currently diverted directly to the Pacific Ocean via the Vista Grande Canal and Tunnel. The existing Tunnel, with a capacity of 170 cfs, does not have adequate hydraulic capacity to convey peak Canal storm flows (500 cfs capacity). Flows in excess of the capacity of the Canal and the Tunnel have resulted in flooding in nearby low-lying residential areas and in overflows across John Muir Drive into Lake Merced, causing property damage, bank erosion, traffic nuisances, and public safety issues.

FEMA Flood Mapping

The Federal Emergency Management Agency (FEMA) is conducting a coastal flood study for San Francisco as part of the California Coastal Analysis and Mapping Project (CCAMP). Results from this Open Pacific Coast Study will produce flood and wave data for the National Flood Insurance Program Flood Insurance Study report and regulatory Flood Insurance Rate Map (FIRM) panels. FIRMs identify areas that are subject to inundation during a flood having a 1-percent chance of occurrence in a given year (also known as a "base flood," "100-year flood," or "1 percent annual chance flood"). FEMA refers to the floodplain as an area that is at risk from a flood of this magnitude as a Special Flood Hazard Area (SFHA). Communities use FIRMS to define planning and construction standards in flood-prone areas, and insurance companies use them to rate flood insurance policies. The Base Flood Elevations mapped on the FIRMs are based on the 100-year (1 percent) stillwater elevation (e.g., extreme high tide), as well as surge components (atmospheric pressure, wind setup, El Niño sea level effects) and wave components (wave setup and swell from the Pacific Ocean). In the CCAMP study panel for the Lake Merced area released in February 2011 (CCAMP, 2011), Lake Merced and the Vista Grande Canal area are located outside the CCAMP study area (Zone A) and therefore outside the anticipated SFHA. However, the seaward end of the Ocean Outlet structure is located within the CCAMP study area, and will likely be located within the SFHA (either Zone VE, with a wave component that is greater than 3 feet in height, or Zone AE, with a wave component of 0 to 3 feet). The final FIRM panel and hazard maps for the area are expected to be adopted in August 2016.

Future Flooding Areas

Rising sea levels increase the potential for coastal flooding, and the issue of sea level rise is important in land use planning and hazard analysis in coastal areas. California Executive Order S-13-08, signed by the Governor on November 14, 2008, specifies that all state agencies planning construction projects in areas that are vulnerable to future sea level rise must consider a range of scenarios for 2050 and 2100 to assess project vulnerability, and, to the extent feasible, must reduce expected risks and increase resiliency with respect to sea level rise. This executive order directed the California Resources Agency, in cooperation with the DWR and the California Energy Commission, to prepare a report assessing the risk and providing recommendations as to how California should plan for sea level rise. In December 2010, the DWR released a report entitled *Climate Change Characterization and Analysis in California Water Resources Planning Studies* (DWR, 2010).

For planning purposes, the Governor of California's Delta Vision Blue Ribbon Task Force adopted a projected sea level rise of 55 inches (4.6 feet) by 2100—until such time that an executive order determines otherwise (Delta Vision Blue Ribbon Task Force, 2008). The DWR, along with four other State of California agencies, the states of Oregon and Washington, and three federal agencies, engaged with the National Research Council to prepare a scientific review of sea-level rise for the West Coast (National Research Council, 2012). This report, entitled "Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future," estimates that sea level rise along the California coast south of Cape Mendocino (which includes the Project area) relative to conditions in 2000 will be 2 to 12 inches by the year 2030, 5 to 24 inches by the year 2050, and 17 to 66 inches by the year 2100. While these estimated levels have not been adopted for planning purposes, the upper end of these ranges are relatively consistent with the projected sea level rise adopted by the Delta Vision Blue Ribbon Task Force.

Based on mapping completed by the Pacific Institute, much of the Pacific Coast could be subject to flooding associated with a 100-year flood event with a sea level rise of 55 inches (Pacific Institute, 2009a, 2009b, 2009c). FEMA has not mapped a flood zone in this area under existing conditions, as discussed above. However, the seaward end of the Ocean Outlet structure is located within the San Francisco's CCAMP coastal flooding study area and is likely to be located within a FEMA Special Flood Hazard Area related to coastal flood risks when mapping is completed. As such, the tunnel outlet structure is located in an area at risk of potential coastal flooding under both existing conditions, as well as with a 55-inch sea level rise (Pacific Institute, 2009a).

Until the year 2050, most of the climate models predict a similar degree of sea level rise; however, after 2050, projections of sea level rise become less certain because of divergent modeling results and differences in various estimates of the degree to which the international community will decrease greenhouse gas emissions (California Climate Action Team, 2010).

Tsunamis, Seiche, and Dam Inundation

Tsunamis (seismic sea waves) are long-period waves that are typically caused by underwater seismic disturbances, volcanic eruptions, or submerged landslides. Tsunamis, which travel at speeds up to 700 miles per hour, are typically only 1 to 3 feet high in open ocean water but may increase in height to up to 90 feet as they reach coastal areas, so can cause potentially large amounts of damage when they reach land (San Francisco, 2014). Generally, subduction zone earthquakes of Mw 7.5 or greater at plate boundaries may cause tsunamis. Because the majority of the region's faults are strike-slip faults, a tsunami is not expected to be a major threat as a result of a near-source, regional earthquake. The primary tsunami threat to the San Francisco Bay Area is from distant-source earthquakes originating in subduction zones elsewhere in the Pacific basin, particularly from the Alaska and Aleutian Subduction Zone. Data from the California Seismic Safety Commission indicates that since 1872, Alaska earthquakes have produced tsunami run-ups in the Bay Area nine times, for a recurrence interval of 15.67 years. Historically, the run-ups from these events have been only a few inches (San Francisco, 2014). In 2009, the California Geological Survey, California Emergency Management Agency (CalEMA), and the Tsunami Research Center at the University of Southern California completed the State's official tsunami inundation maps. Based on this mapping, Lake Merced and the Vista Grande Canal project site are located outside an area identified for potential inundation in the event of a tsunami. The Ocean Outlet structure is located within the mapped tsunami inundation area (CalEMA et al., 2009).

The study area is not located within an area subject to a risk of flooding from dam inundation (Association of Bay Area Governments, 2014).

A seiche is caused by oscillation of the surface of a large enclosed or semi-enclosed body of water such as the San Francisco Bay due to an earthquake or large wind event. Seiches can result in long-period waves that cause run-up or overtopping of adjacent landmasses, similar to tsunami runup. Due to the location of the study area, the hazard of seiche waves is interpreted to be low.

3.9.1.3 Project Water Quality Setting

Lake Merced Water Quality

The water quality setting for Lake Merced includes a review of historic (long-term) and baseline (short-term) data for water quality conditions. These data were gathered from several existing water quality data sources and reports in order to characterize the appropriate existing range of water quality conditions within the context of the proposed Project.

The largest and most robust historic data set summarized here was compiled by SFPUC as part of routine water quality monitoring in Lake Merced. The SFPUC data includes over 10 years of consistent monitoring, which is collected within Lake Merced over a wide spatial area and monitors a broad range of water quality parameters and constituents at multiple depths throughout the year (quarterly). However, while the quarterly monitoring data collected by SFPUC in Lake Merced provides broad scale historic and baseline water quality conditions and trends, it does not provide detailed seasonal, spatial, and temporal dissolved oxygen (DO) and pH data. DO and pH data is necessary to establish the baseline water quality of the proposed receiving waters (Impound Lake and South Lake) within the context of applicable regulatory considerations (i.e., Lake Merced's listing on the Clean Water Act section 303(d) list for impaired water bodies, discussed below). In response to the need for additional data, Daly City designed and implemented a supplemental seasonal monitoring program to document seasonal, spatial and temporal water quality variations in Lake Merced relative to the 303(d) listing. The sections below provide an overview of the water quality regulatory considerations specific to characterizing Lake Merced baseline water quality relevant to the proposed Project and summarize water quality results and analysis from the SFPUC and Daly City monitoring programs.

Regulatory Considerations

The RWQCB has identified the following existing beneficial uses for Lake Merced: body-contact recreation,[5] non-contact recreation, warm freshwater habitat, cold freshwater habitat,[6] fish spawning, and wildlife habitat. Potential beneficial uses include municipal and domestic supplies. The RWQCB has established water quality objectives (WQOs) that are designed to be protective of beneficial uses. As described in more detail below in Section 3.9.2, Regulatory Framework, Lake Merced currently does not meet the generally applicable Basin Plan WQOs for DO and pH. There are currently no provisions in the Basin Plan that acknowledge, in a lake setting, the potential effects of diurnal and/or seasonal stratification, nor of the effects of natural conditions, such as eutrophication, on ambient DO and pH (summarized below and discussed in detail in ESA, 2015). As a result, the USEPA in 2003 included Lake Merced on the Clean Water Act Section 303(d) list of impaired waterbodies for these constituents, notwithstanding the RWQCB's and State Water Resources Control Board's (SWRCB) recommendation not to include those listings. The listing does not identify a source for the impairment.

SFPUC's Existing Water Quality Monitoring Program

The SFPUC continues to routinely monitor a broad range of water quality parameters at various depths and locations within Lake Merced on a quarterly basis (Kennedy/Jenks, 2010). The sampling has been conducted since 1997 between three and eight times per year, but is typically conducted quarterly. For the majority of the parameters, samples at each location are collected at various depths, starting at the lake surface, and decreasing at 5-foot intervals to the lake bottom. The SFPUC South Lake Pump Station water quality monitoring point is identical to the 2011-2012 water quality monitoring location LM-4 (Figure 3.9-6) and, as such, is the most representative location for characterizing baseline water quality parameters relevant to the proposed Project. The following water quality discussion summarizes data collected at the LM-4/SFPUC South Lake Pump Station location. The data presented in this section provide a generalized long-term overview of Lake Merced water quality. The section following this one, *Daly City Seasonal Lake Merced Monitoring Program*, presents the results of monitoring efforts conducted to provide additional data collected more frequently and at a greater range of depths to characterize spatial (depth) and seasonal variations in Lake Merced water quality.

In 2010, Kennedy/Jenks Consultants evaluated the available SFPUC water quality data collected from 1997 to 2009 (Kennedy/Jenks, 2010, included in ESA, 2015, p. D-3, et seq.) to determine if Lake Merced's "health" had improved, remained constant, or degraded over time. Based on a review of the data, water quality parameters that represent lake conditions can be grouped as:

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5 However, swimming and wading in the Lake are prohibited by SFPUC, as discussed in Section 3.9.1.2.

6 The cold freshwater habitat beneficial use is generally designated to achieve and protect water quality supportive of trout and/or anadromous salmon and steelhead fisheries. As discussed in detail in Section 3.4.1.3, Lake Merced does not support a self-sustaining trout population. Trout presence in Lake Merced is maintained entirely through a relatively extensive CDFW stocking program.

- DO, a measure of the amount of dissolved oxygen in water, which is an indicator of fish habitat and healthy biological processes;
- Secchi depth, which is a measurement of lake clarity, and can be affected by algae production and suspended solids;
- Algae, as well as total available nitrogen, and nitrogen-to-phosphorous ratio (N:P), which are indicators of algal production and nutrients, both of which affect long-term lake health; and
- Total coliform and *Escherichia coli* (*E. coli*), both of which are indicators of pathogenic microorganisms and fecal contamination.

The 2010 Kennedy/Jenks evaluation concluded that the water quality of Lake Merced remained relatively constant from 1997 to 2009, and that the lake clarity (Secchi depth) improved slightly (see Figure 3 on page D-25 of ESA, 2015). During the 1997 to 2009 sampling period, no substantial changes in average algal biomass levels occurred, although there were periodic increases in concentration due to algal blooms (see Figure 4 on page D-26 of ESA, 2015).

Dissolved Oxygen

DO levels measured approximately quarterly at the South Lake Pump Station location at the surface, 5-foot, 10-foot, and 15-foot depths between 1997 and 2009 are summarized by season in **Figure 3.9-8**. As expected in a moderately eutrophic, seasonally stratified lake, values generally, but not exclusively, remained above the Basin Plan warm water habitat objective of 5 milligrams per liter (mg/L) and the cold water habitat objective of 7 mg/L in the upper 5 feet of the Lake. Episodes of DO lower than 5 mg/L were observed most frequently during the summer months and closest to the bottom (15-foot depth) (Kennedy/Jenks, 2010). It was determined that DO levels were affected by the naturally occurring periods of weak stratification.[7] However, the quarterly grab sampling data were insufficient to fully characterize the seasonal and spatial extent of stratification occurring in the Lake. This data analysis, and recognition of data gaps, led to the development and implementation of the Daly City Lake Merced monitoring program, beginning in mid-2011, using instrumentation to allow continuous monitoring of DO and pH as well as extensive water quality sampling (see discussion below).

Hydrogen Potential (pH)

pH levels measured between 1997 and 2009 (**Figure 3.9-9**) demonstrate that Lake Merced is an alkaline lake with a pH range of approximately 7.5 to 8.8. The pH levels are typically highest in the upper 5-feet of the Lake. This elevated pH appears to be the result of photosynthesis from algal activity, combined with the elevated alkalinity within the Lake due to it being a terminal lake, with no regularly occurring outflow since it lost connection to the Pacific Ocean in the late 1800s.

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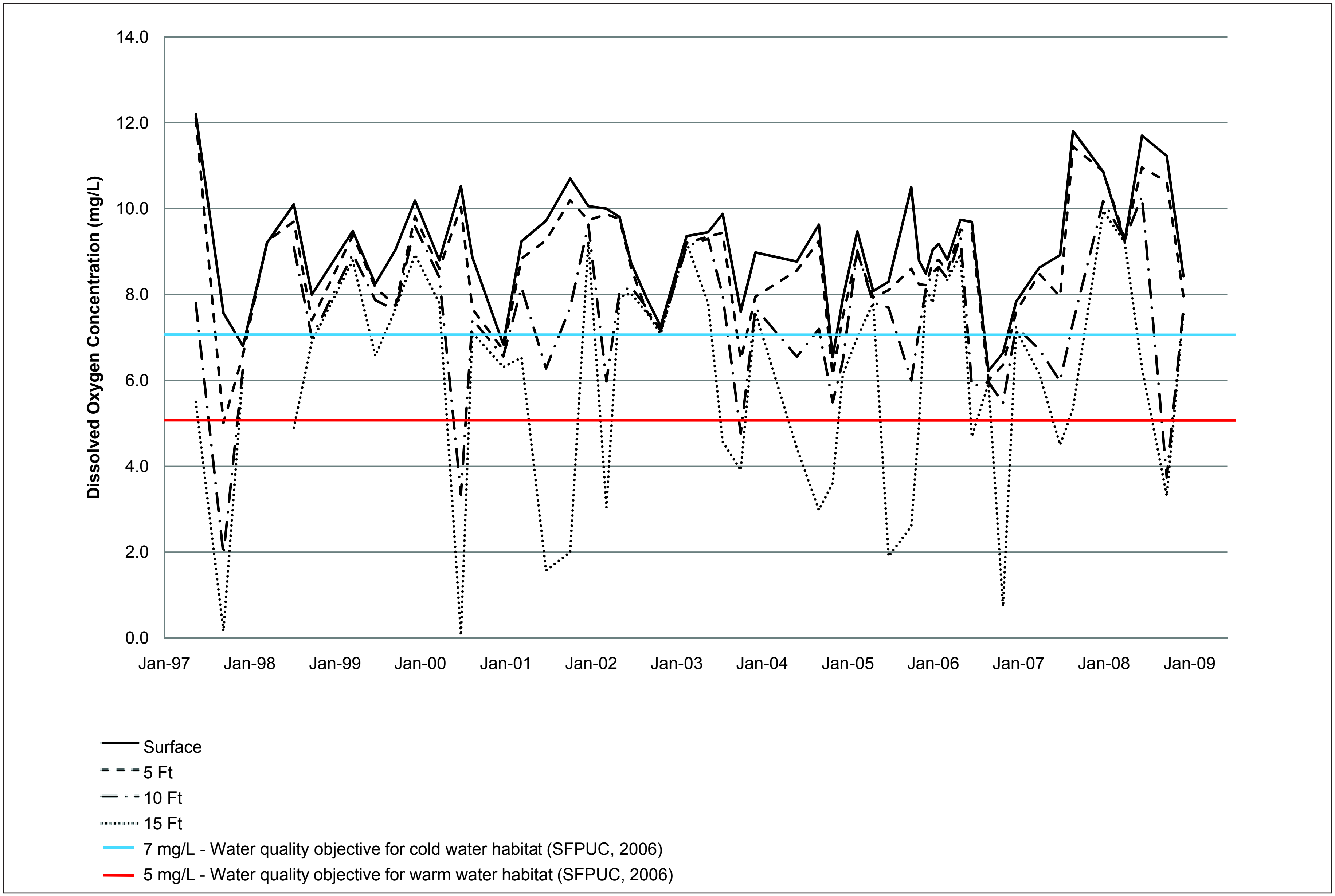
7 Lake stratification is the separation of a lake into three layers: the top of the lake, referred to as the epilimnion; the middle of the lake, referred to as the metalimnion; and the bottom layer of the lake, referred to as the hypolimnion. The amount of lake stratification can vary over the day as well as seasonally, depending on a number of factors (discussed further under "Conditions Affecting Lake Water Quality").

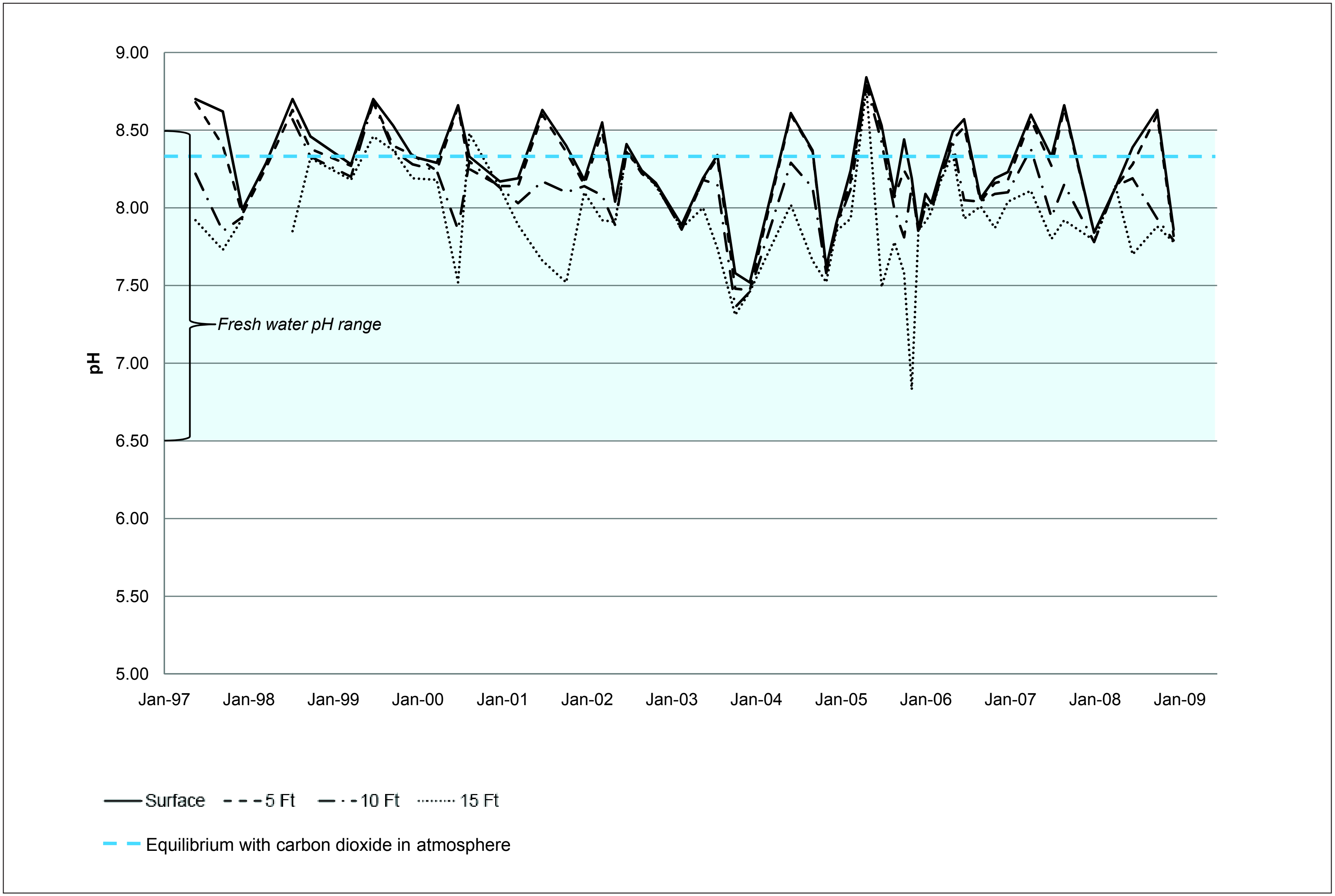


SOURCE: Kennedy/Jenks Consultatns

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-8

Dissolved Oxygen, South Lake Pump Station



SOURCE: Kennedy/Jenks Consultatns

Figure 3.9-9
pH, South Lake Pump Station

SFPUC calculated various summary statistics (median, minimum, maximum, standard deviation, and coefficient of variance) for the water quality data collected between 1997 and 2009 (SFPUC, 2010b). **Table 3.9-3** provides a data summary for key nutrient- and algal-related parameters.[8] The key nutrient- and algal-related parameters demonstrate that Lake Merced is strongly nitrogen-limited and has been since at least 2000. Algae blooms typically occur in the fall, and bioavailable nitrogen typically peaks in the winter or spring.

TABLE 3.9-3
DATA SUMMARY OF KEY NUTRIENT AND ALGAL RELATED PARAMETERS (SOUTH LAKE PUMP STATION)

Parameter	Units	1997-2009					Number of Sampling Dates
		Median	Min.	Max.	Standard Deviation	Coefficient of Variance	
Ammonium (NH_4+)	mg/L	0.04	ND	0.65	0.07	1.22	57
Nitrate (NO_3-)	mg/L	ND	ND	0.62	0.09	2.80	59
Orthophosphate	mg/L	0.05	ND	0.23	0.05	0.86	59
Total Kjeldahl nitrogen (TKN)	mg/L	2.38	ND	28.2	3.67	1.00	55
Total Phosphorus	mg/L	0.15	ND	0.40	0.06	0.41	58
Chlorophyll	µg/L	23	5	100	15	0.58	53
Secchi depth	feet	1.8	1.0	3.0	0.5	0.27	59

NOTES:
ND – Non-detect

SOURCE: SFPUC, 2010b

Daly City Seasonal Lake Merced Monitoring Program (2011-2012)

The need for additional data to document more detailed seasonal, spatial, and temporal (hourly) variations in DO and pH in Lake Merced, as well as the need to evaluate overall potential project "source" water quality within the Canal, prompted Daly City to design and implement a supplemental monitoring program during the 2011 and 2012 dry and wet seasonal periods. One goal of the supplemental monitoring program was to characterize baseline water quality within Lake Merced and the Vista Grande Canal in support of the proposed Project relative to the 303(d) listing. Dry season water quality monitoring was conducted between August 15 and October 31, 2011 and wet season monitoring was conducted from November 20, 2011 to May 31, 2012. Monitoring was conducted concurrently in the Canal and South Lake using consistent analytical methods to assess a similar set of water quality parameters. Development of the monitoring program incorporated input from and review by SFPUC and RWQCB. A detailed description of the 2011 and 2012 wet and dry seasonal monitoring programs, including methodological design, rationale, sampling and analysis methodologies, data analysis, and results and discussion is presented in ESA, 2015. Water quality setting information presented here is summarized from that document.

[8] The WQA (ESA, 2015) contains a more detailed graphical summary of results over this 1997 to 2009 time period from the South Lake (Pump Station) SFPUC monitoring location, including temperature, DO, pH, ammonia, nitrate, and total phosphorus.

For both dry and wet season monitoring, four monitoring locations (Figure 3.9-6) were identified within Lake Merced based on review of historic SFPUC water quality data (Kennedy/Jenks, 2010) and on the potential location of the proposed diversion outlet location into Lake Merced.[9] Additionally, one monitoring location was identified within Vista Grande Canal for concurrent water quality monitoring (described below). During the dry season, grab samples were collected twice monthly at the Lake surface at the LM-4 monitoring station and delivered to a California-certified analytical laboratory for analysis of a suite of water quality constituents (listed in Table 3, pages B-9 and B-10 of ESA, 2015). During the wet season, collection of grab samples for analysis of water quality constituents (listed in Table 1, pages B-21 and B-22 of ESA, 2015) at LM-4 was synchronized with the collection of water quality samples from the Canal. Samples were collected within 24 hours of rainfall that generated storm flow within the Canal (discussed further below). Additionally, samples were collected during dry weather interludes to assess any differences in quality under different flow scenarios. Monitored constituents included those typically present in urban stormwater and non-stormwater runoff (such as nutrients, metals, and bacteria).

Continuously recording (hourly) water quality data loggers were installed at the four Lake Merced monitoring locations (Figure 3.9-6) to record pH, DO, and temperature. The loggers recorded these water quality parameters at multiple depths between the surface and lake bottom. These were installed to provide a more comprehensive data set than the quarterly single grab sample data being collected by SFPUC (described above). The data allowed more precise quantification of the seasonal and spatial extent of stratification, that as expected and observed, occurs in the Lake under baseline conditions (see discussion of thermal and chemical stratification below). The majority of Lake data was collected at Station LM-4, a deep (>20 foot depth) open water location representative of Lake Merced water quality. Use of this location allowed comparison of the Daly City monitoring data to the larger historic record for Lake Merced. LM-4 was the station where Lake water grab sampling for multiple constituents was conducted and where the greatest number of data loggers was installed (at near surface, 10-, 15-, and 20-foot depths). Subsequent to the wet season monitoring, which concluded May 31, 2012, additional continuous temperature, DO, and pH monitoring data were collected in Lake Merced through January 2013 to provide additional multi-year insight into seasonal variability and stratification conditions that occur within Lake Merced.

The following discussion presents a summary of the continuous monitoring results for temperature, DO, and pH, which are the primary focus of the impact analysis presented in Section 3.9.5 due to Lake Merced being 303(d) listed for DO and pH. The continuous time series results demonstrate trends and fluctuations of DO and pH observed over the course of one full year at four discrete monitoring depths within the Lake. Also discussed are the monitoring results for other key water quality constituents as they relate to DO and pH.

9 At the time of the monitoring, the Lake Merced outlet structure was proposed to be located in the southern portion of South Lake. As described in Chapter 2, the location of the proposed discharge is now at the central western shoreline of Impound Lake. However, the monitoring data and associated analyses are still representative of Lake Merced baseline conditions in the vicinity of the proposed outlet structure and appropriate for use in effectively assessing potential Project related impacts.

The 2011-2012 Lake Merced LM-4 grab sample constituent monitoring results (see ESA, 2015, pages B-61 through B-63) were consistent with the historic (1997-2009) SFPUC monitoring results at the corresponding South Lake Pump Station monitoring location (Tables 3.9-4 and 3.9-5). Results from the LM-4 multi-depth data sonde monitoring from August 2011 through January 2013 for DO, pH, and temperature are graphically summarized in ESA, 2015 in the form of box plots and time series plots (Figures 4-9 through 4-13c in ESA, 2015). The continuous (hourly) monitoring water quality results, summarized below, document the diurnal and seasonal changes that occur within the Lake due to thermal and chemical stratification. Further, over a 48-hour period there is a documented trend of natural fluctuation in temperature, DO, and pH levels that occur as a result of diurnal variability in algal photosynthesis and solar warming (discussed in detail and represented graphically in Figures 4-14 through 4-16 in ESA, 2015).

Temperature

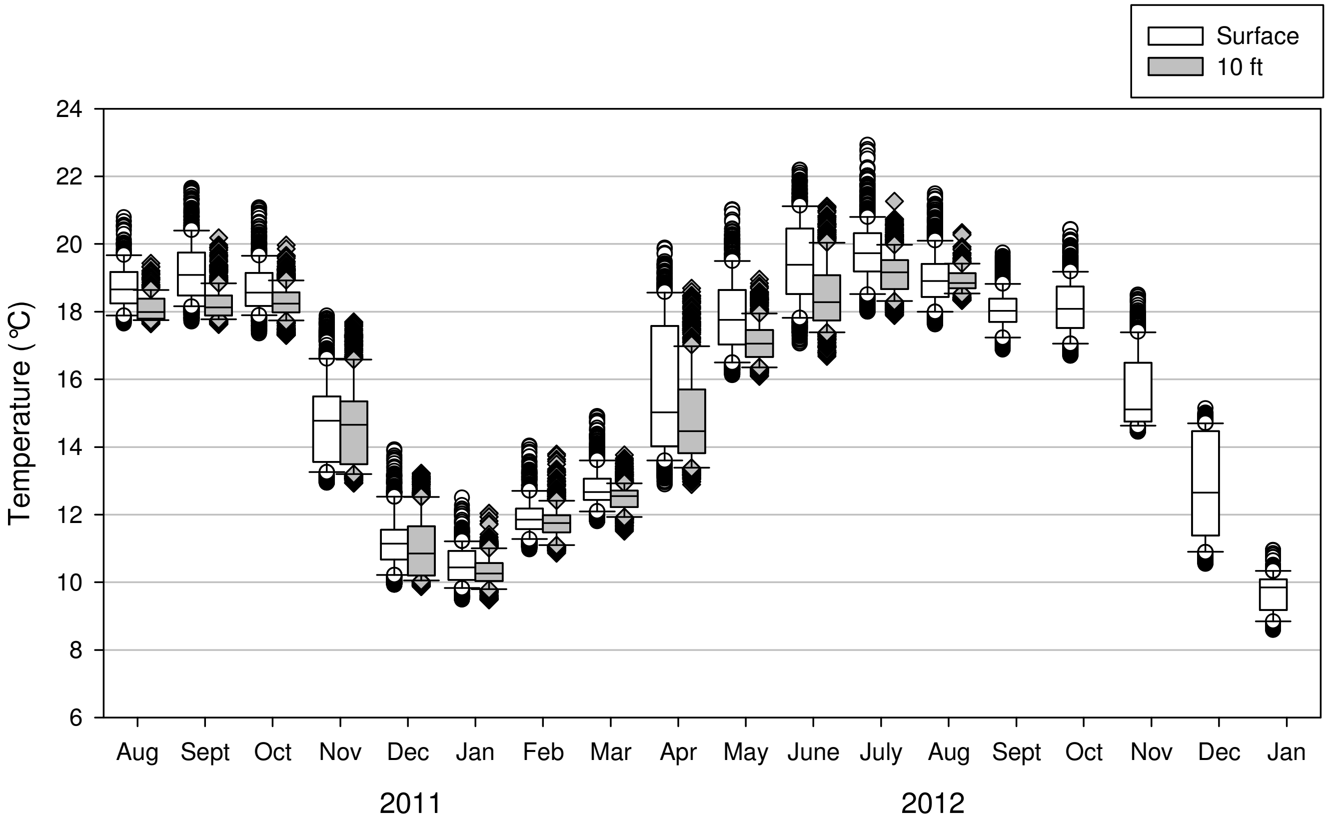
Continuous (hourly) temperature data (**Figure 3.9-10**) indicate that from approximately mid-October through mid-April, the Lake is well mixed with a relatively uniform temperature profile throughout the water column. Water temperatures during that period range from about 10 °C to 18 °C. From late spring through early fall however, rising air temperatures and solar radiation initiate stratification when the surface layers of the Lake are warmed by the sun. In June and July, surface water temperatures regularly exceed 20 °C while hypolimnion temperatures are often above 18 °C.

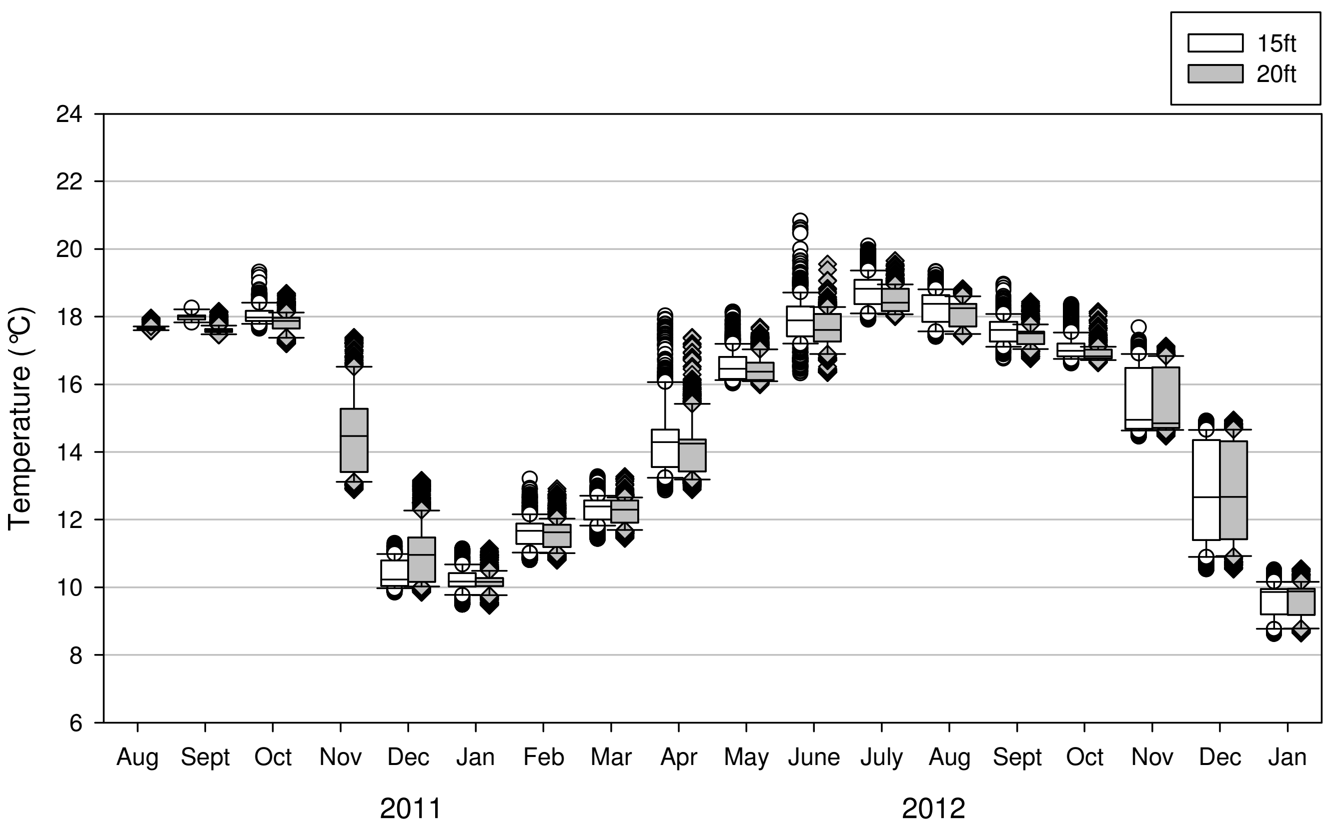
Dissolved Oxygen

To characterize the overall seasonal DO fluctuations within the epilimnion and hypolimnion that occur under baseline conditions, the DO results for the surface and 10-foot depths are averaged and the 15- and 20-foot depths are averaged for comparison (**Figure 3.9-11**). Continuous (hourly) DO monitoring data indicate that from November through March, when cooler air temperatures prevail and the Lake is continually well mixed from top to bottom, DO levels average well above 7 mg/L. However, starting in April and continuing through October when stratification occurs, DO levels in the hypolimnion periodically fall below 5 mg/L. During the initial period of continuous monitoring (August 20 to October 14, 2011), DO near the bottom of the water column was above the 5 mg/L Basin Plan criterion for only about 5 percent of the period (Figure 4-9, ESA, 2015), due to seasonal stratification broken up by intermittent weak mixing events (discussed further below). Functional anoxia (less than 2 mg/L DO) for several weeks is required in the bottom waters before the sediments release substantial amounts of ammonia and phosphate. In Lake Merced, functional anoxia occurred in 2011 for 34 percent of the time (19 non-continuous days with the longest continuous period being only 4 to 5 days). Thus, for about 66 percent of the time, some oxygen was present, albeit between 2 and 5 mg/L.

pH

Lake Merced has a widely fluctuating and elevated pH range, particularly in the portion of the water column near the lake surface. The removal of acidic carbon dioxide on summer afternoons by algal photosynthesis frequently raises the pH of surface water layers above 8.5, typically occurring for about 6 hours, corresponding to peak sunlight periods, and ranging from about 1 to 24 hours in duration. Importantly, the Lake's range of pH (approximately 7.5 to 9.3) is always on the alkaline

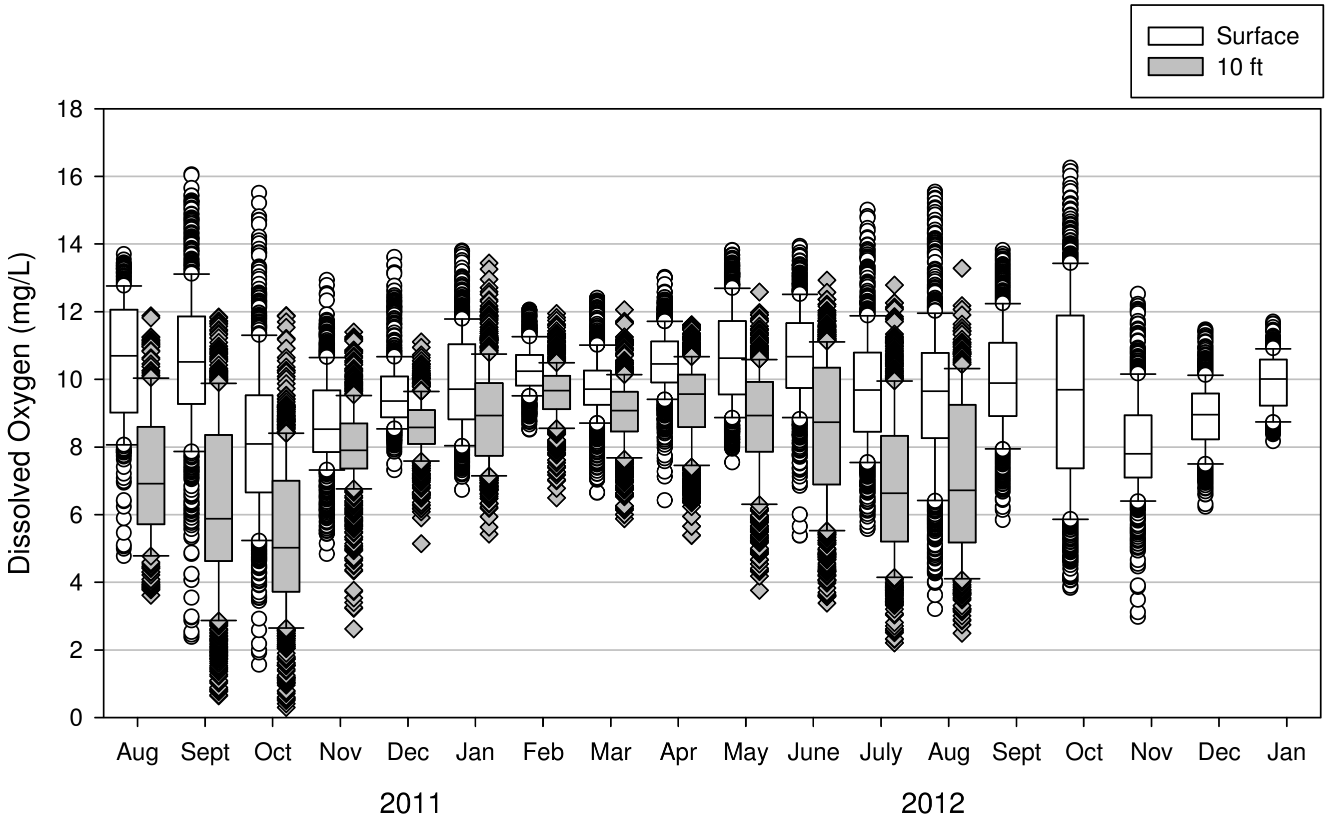


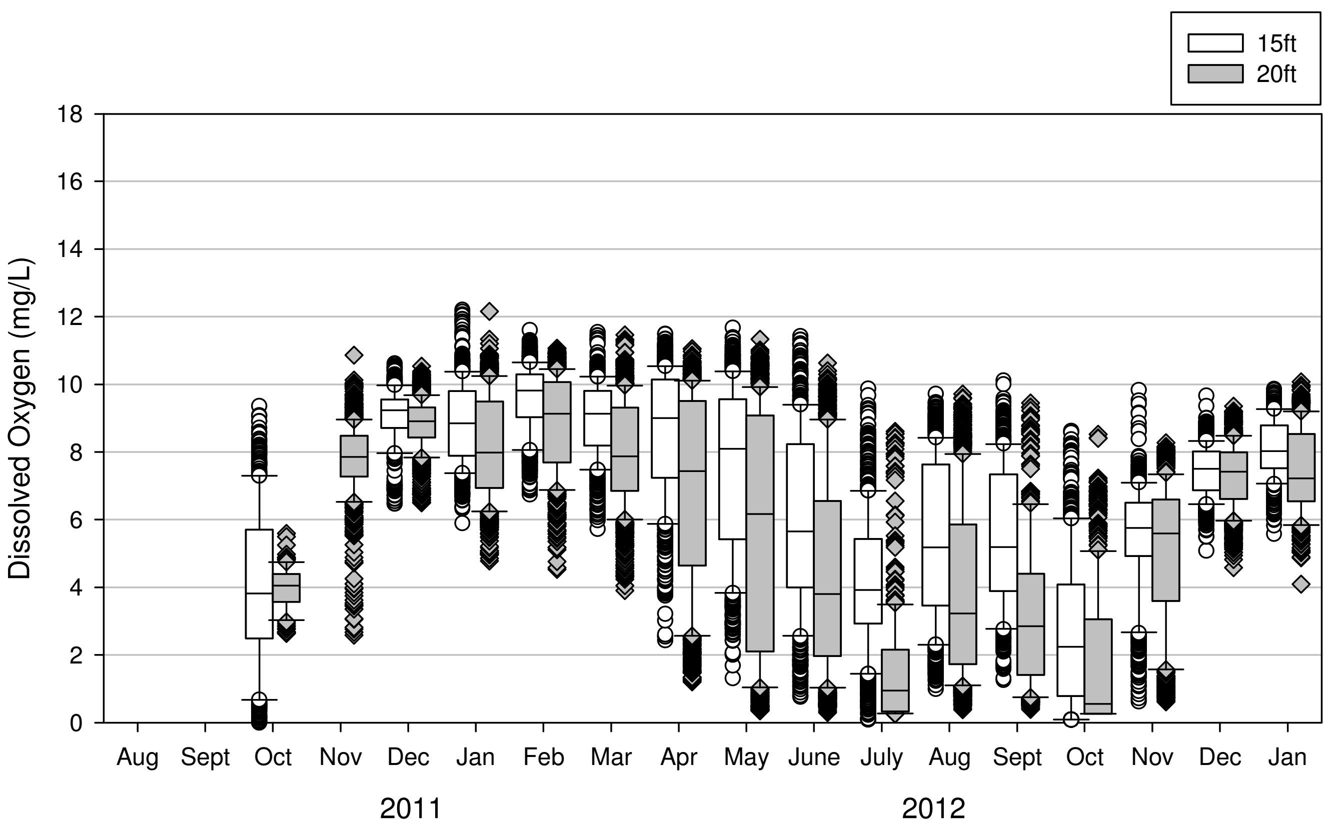


SOURCE: ESA, 2013

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-10
Extended Monitoring Results for Temperature





SOURCE: ESA, 2013

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Figure 3.9-11

Extended Monitoring Results for DO

side and never reaches neutrality (pH 7). Since carbonic acid is produced following decomposition in the sediments, lower pH than that measured in Lake Merced is typically found in deep water at most lakes. To demonstrate the seasonal pH fluctuations within the epilimnion and hypolimnion occurring under baseline conditions, the pH results for the surface and 10-foot depths are averaged and also the 15- and 20-foot depths are averaged for comparison (**Figure 3.9-12**).

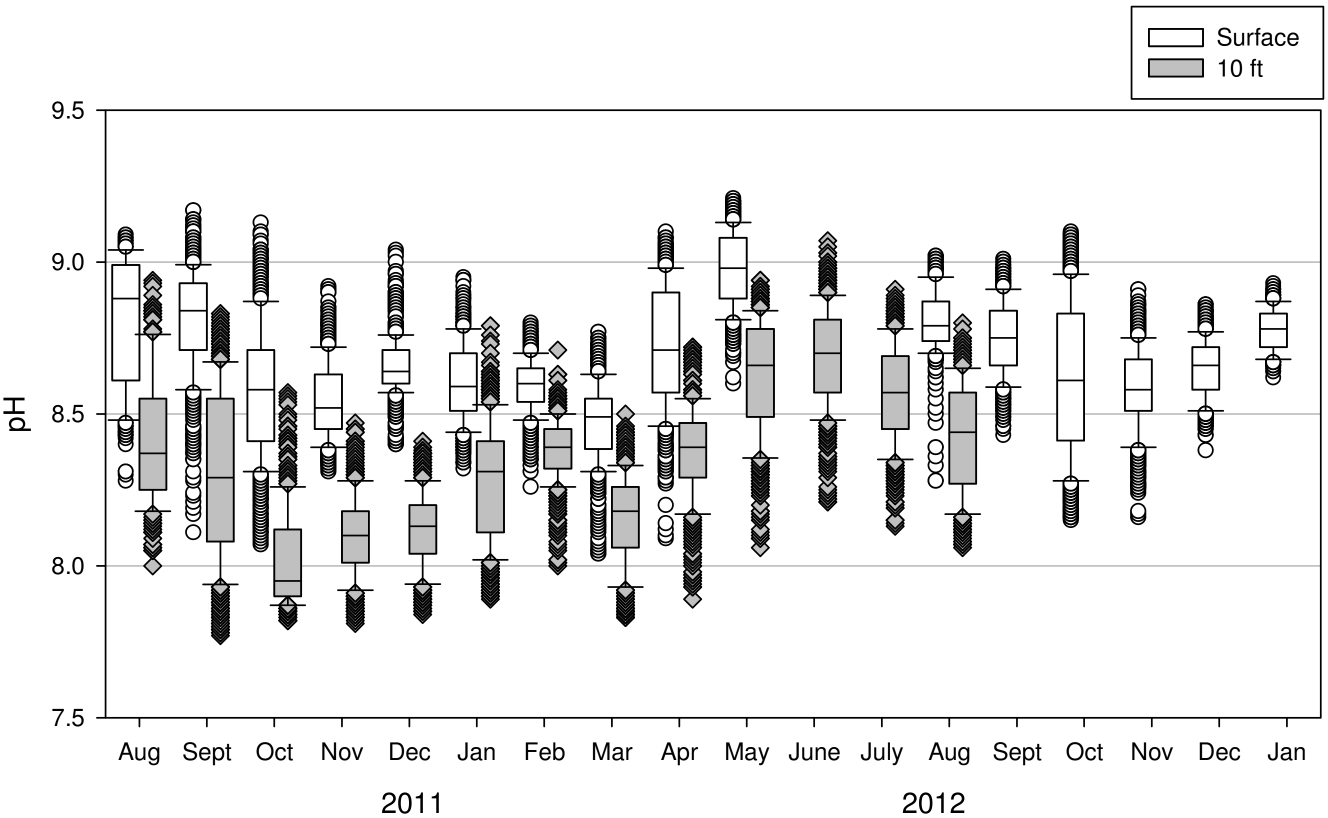
The higher pH values in Lake Merced are not typical for a system such as Lake Merced, given the sandy (acidic) nature of the Lake's drainage soils which should produce a more acid runoff water. Rain is acidic (pH equilibrium 5.7) and should not be easily neutralized passing though sandy soil. Due to its expected acidic drainage and by comparison with similar lakes, more acidic water would be expected in Lake Merced. Lower surface pH (approximately 8) did occur at night on most days but only occurred during the day during the one chemical holomixis (top-to-bottom mixing) event recorded for the initial 2011 monitoring period (October 17 and 18). High pH occurs on almost every day in summer and fall and was similar between 1970 and 2010. Although high pH occurrences are common in eutrophic lakes in the later morning and early afternoon, the frequency, duration, and temporal patterns of high pH found in Lake Merced are not consistent with the Lake's eutrophic state and algal abundance (chlorophyll a approximately 28 micrograms per liter [µg/L]). Typically, higher high values would be expected in the day and lower pH values would be expected at night or on cloudy days.

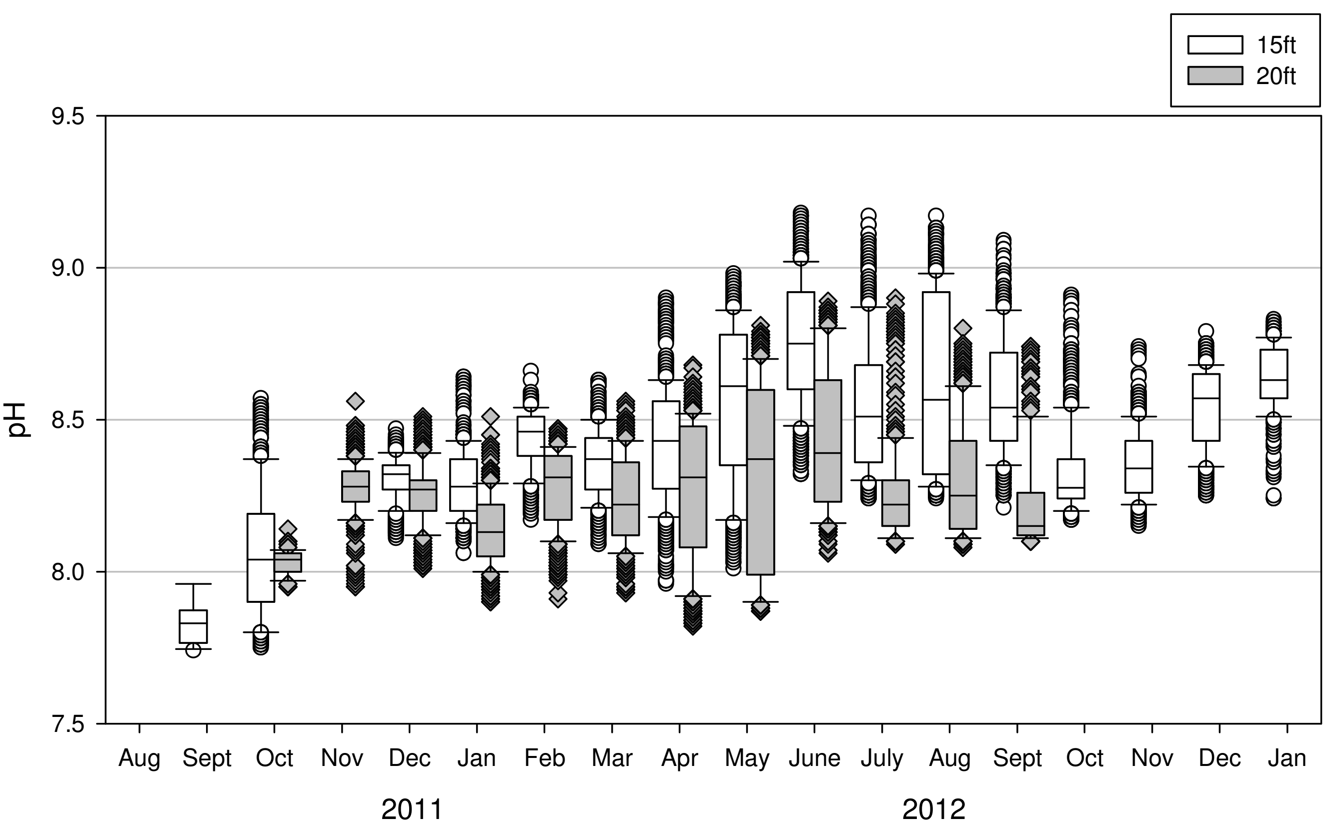
The best explanation for the observed cycle of the highest pH occurring in the day and lowest at night is algal photosynthesis (see "Acidity and alkalinity (pH) in Lake Merced" in the WQA [ESA, 2015]). The cycles of high pH in Lake Merced are due to algal photosynthesis in the day and respiration by algae, zooplankton, and fish at night, on top of a high background pH due to the high concentration of salts like carbonates or alkaline salts.

Conditions Affecting Lake Water Quality

Described above are the existing water quality conditions of Lake Merced. There are numerous processes and variables within the Lake that can affect water quality, particularly the extent and duration of seasonal stratification. These processes are summarized here (and discussed in greater detail in ESA, 2015) as part of the setting for the analysis presented in Section 3.9.5, which assesses the implications of the Project on the ecology and health of the Lake.

As discussed in Section 3.9.1.2, the WSE of the Lake is lower than it has been in the past, primarily due to the loss of inflow from the historic watershed. The existing water quality conditions in Lake Merced for DO and pH are due in part to its current depth. Deep (greater than 300 feet) and very shallow (less than 3 feet) lakes rarely show any depletion of oxygen in the bottom waters. Lakes with depths between the two extremes are affected by the balance between wind mixing (which can stir oxygen down from the surface waters) and biological oxygen demand (BOD) from the decay of algae and other organic matter in the deep water and sediments. A second critical limnological factor affecting DO and pH is extended lake stratification that typically occurs between spring and fall. At this time, most of the mixing energy in the water is confined to the surface water layer and the deeper, cooler bottom water is relatively undisturbed. The critical depth at which extended stratification would occur is about 30 to 35 feet in the Bay Area climate. However, this depth is not





SOURCE: ESA, 2013

Figure 3.9-12
Extended Monitoring Results for pH

within the range of lake depths possible for Lake Merced. The following section, summarized from ESA, 2015, describes the key lake processes related to water quality and provides a brief assessment of the current and historical trends for Lake Merced with respect to these processes.

Thermal and Chemical Stratification

Thermal stratification is the separation of water layers within a lake system, wherein warm, less dense surface waters (epilimnion) float over a deeper layer of cooler, denser waters (hypolimnion). Chemical stratification, shown by gradients of chemicals like oxygen and nutrients, often results after thermal stratification. Thermal stratification develops as surface water temperatures rise during spring and a vertical temperature gradient, or thermocline, develops. Bottom waters are then separated from the surface waters, due to the differences in water temperature and thus density. Stratification in Lake Merced occurs and persists from mid-spring through late fall and thermal mixing can occur every 9 to 11 days depending on seasonal climatic and wind mixing conditions.

Thermal stratification has important water quality implications because of its influence on DO levels, nutrient dynamics, and habitat quality for fish and other aquatic organisms. In eutrophic lakes with large algal populations, stratification can have significant effects on pH and DO levels in the separated surface and bottom waters. As indicated by Secchi disk (lake clarity) readings, sufficient sunlight for algal growth only penetrates about 4.6 feet (approximately 2.3 times Secchi depth) in South Lake. Since algal photosynthesis is primarily limited to this shallow photic zone, the growth of algae in the Lake is most likely limited by access to light, and not by nutrients, since half of the algae spend the daylight hours mixed down into the darker deeper water with limited available light for growth.

During photosynthesis, algae take in carbon dioxide from the water to produce organic (carbon-based) matter, and in the process produce and release oxygen. During intense photosynthesis, the imbalance between instantaneous uptake of carbon dioxide and its resupply from the air or the dissolved carbonate pool causes the pH to rise. There are sufficient algae levels in Lake Merced (chlorophyll a approximately 26 to 30 µg/L) to produce intense photosynthesis in surface waters. This is why the surface waters in the Lake can show both elevated pH levels (>8.5) and DO levels (>8 mg/L) compared to deeper water. The effect is most pronounced on calm, sunny days when the upper few feet of the Lake become unusually warm and stable. Under more normal conditions, afternoon winds stir the upper waters, resulting in elevated pH through much of the epilimnion. The high pH in Lake Merced is also due to the high background pH from the naturally high concentration of carbonates and alkaline salts in this terminal (no discharge) lake.

Conversely, in the cooler, denser bottom waters of the hypolimnion, separated from the warmer, less dense and mixed surface waters, pH and DO levels are lower. No photosynthesis occurs below the photic zone; therefore, there is no photosynthesis-driven increase in pH. The waters below 10 to 15 feet in depth remain partially or totally isolated from the surface and from potential reaeration via diffusion and wind mixing. Algal respiration depletes the available oxygen and produces carbon dioxide, reducing pH in deep waters. Possibly more important relative to contributing to low DO conditions (< 5 mg/L) is the oxygen demand from the decay of organic matter in the bottom sediments. These factors can combine to reduce bottom DO levels to near zero for periods of time until the stratification breaks down and the Lake mixes again.

For Lake Merced, data collected during the monitoring program conducted by Daly City showed that complete mixing of the water column (top to bottom) occurred on average every 9 to 11 days. The rate of mixing in summer-fall 2011 was usually insufficient to carry enough oxygen down to offset the BOD of the sediments created by organic matter decay. Complete holomixis probably occurred only once in summer-fall 2011. The result was an extended period of low DO in the deeper waters. The limited surface to bottom mixing events were not of sufficient strength or duration to consistently raise DO levels above 5 mg/L until complete and extended mixing occurred during the colder winter months (December through March). Additional environmental variables that may influence the degree and extent of stratification in Lake Merced, and discussed in detail in ESA, 2015 in the context of the proposed Project, include temperature, season, wind, water depth, and water clarity.

Nutrients and Nutrient Enrichment

Nutrient dynamics are important to water quality, as high concentrations of nutrients can lead to eutrophication. Potential external sources of nutrient inputs to Lake Merced include watershed sources from the portion of the Lake Merced watershed located within San Francisco discharged to the Lake via stormwater runoff and authorized non-stormwater sources, groundwater infiltration, atmospheric deposition, and algal biological nitrogen fixation. Internal sources of nutrients in Lake Merced include sediments and decomposition of deposited organic matter. Bottom sediments in lakes can be a large reservoir for nutrient storage. Under aerobic conditions, an oxidized surface layer forms on the sediment acting to retain nutrients. However, under anoxic conditions created during periods of stratification or low mixing rates, nutrients may be released from sediments into the water column, contributing to eutrophication. The degree of nutrient release is dependent upon lake conditions. Warmer water promotes more internal loading of nutrients, and longer periods of anoxia contribute more than short ones. The rate of supply of nutrients has been more than sufficient to render the Lake eutrophic and to support relatively high concentrations of algae year-round.

The degree of algal growth is usually restricted by the amount of the most limiting nutrient, which in aquatic systems is usually nitrogen or phosphorus. The available evidence, presented in ESA, 2015, indicates that the shortage of bioavailable nitrogen (the sum of nitrate and ammonia, which is referred to as total inorganic nitrogen or TIN) most likely limits algal growth in Lake Merced unless there are so many algae and/or sediments present that light is the growth limiting factor. At the end of the spring bloom of algae, nutrients are depleted and the only sizable new source is via mixing from the sediments to the surface water. As described above, monitoring in Lake Merced documented that holomixis occurred on average every 9 to 11 days. Thus, approximately every week and a half, the surface water nutrients can be replenished to some extent by deep water nutrients.

Vista Grande Canal Stormwater Quality

Daly City is the largest city in San Mateo County. The Vista Grande Basin within Daly City has been highly urbanized for many years and contains the various urban land uses as described in Section 3.9.1.2. The type and concentration of substances in urban stormwater can vary considerably, both during the course of a storm event and from event to event at any given area (based on the intensity of rainfall), as well as from site to site within a given urban area (based on land use characteristics) (USEPA, 1993). Base flow in the Canal is present year round and results from a combination of sources within the urbanized Vista Grande watershed.

Stormwater runoff and authorized non-storm flows from Daly City have been regulated under Municipal Separate Stormwater System (MS4) NPDES permits since 1993(described in detail in Section 3.9.2). These MS4 permits, including the current Municipal Regional Stormwater Permit (MRP), contain technology-based requirements, typically in the form of Best Management Practices (BMPs), for cities to implement actions to minimize the extent of pollutants in stormwater to the Maximum Extent Practicable (MEP) and to protect receiving water quality. Daly City has an effective stormwater management program that fully implements the requirements of the MRP. For example, street sweeping is conducted weekly, removing potential pollutant particulates from land-based and vehicular sources, atmospheric deposition, and other sources that would otherwise accumulate during dry weather periods and be conveyed later into stormwater drains and waterbodies. Non-stormwater sources are identified in and are regulated under Provision C.15 of the MRP as Exempted and Conditionally Exempted Non-Stormwater Discharges. The MRP specifies required BMPs and monitoring and reporting requirements for these various discharges. The MRP requires that pollutant concentrations in these various discharges be controlled via implementation of applicable BMPs to the MEP standard.

Due to a lack of historic existing data for Canal base flow and storm flow water quality, a seasonal monitoring program was developed in collaboration with RWQCB staff and implemented by Daly City in 2011 and 2012 during seasonal dry and wet periods (as discussed above and described in detail in ESA, 2015). The primary goal of the monitoring program was to provide hydrologic (discussed in Section 3.9.1.3, above) and water quality data to characterize baseline conditions in the Canal, including storm event flows and seasonally variable base flow conditions. The monitoring program included collection of detailed baseline water quality data within the Canal coincident with baseline water quality data collection in the Lake. The data collected from the Canal during the 2011-2012 monitoring period represents the most comprehensive available documentation of the existing quality of Canal flow. ESA, 2015 provides a detailed description of the water quality and hydrologic sampling rationale and methodology employed as part of the monitoring program.

The water quality monitoring conducted within the Canal determined that concentrations of key water quality constituents were generally in the ranges expected for urban stormwater and non-storm runoff. **Table 3.9-4** and **Table 3.9-5** present summaries of the key dry and wet season water quality data that were collected for the Canal during the 2011-2012 monitoring season. More detailed results of Canal water quality monitoring are included in the Dry and Wet Season Monitoring Results tables on pages B-61 through B-63 of ESA, 2015. The following sections discuss the monitoring results for key water quality parameters (temperature, DO, and pH; summarized in Table 3.9-4) as well as a broader suite of constituents (presented in Table 3.9-5).

TABLE 3.9-4
VISTA GRANDE CANAL WATER QUALITY DATA SUMMARY

Parameter	Dry Season Base Flow			Wet Season Base Flow			Wet Season Storm Flow		
	Mean	Min	Max	Mean	Min	Max	Mean	Min[a]	Max
Temp (ºC)	17.73	15.6	20.4	14.48	12.2	17.2	13.79	11.09	17.42
DO (mg/L)	12.89	12.07	16.6	11.70	8.41	16.2	10.15	5.83	11.23
pH	8.8	8.7	8.8	8.12	7.3	9.3	7.63	7.1	8.1

NOTES:
[a] Periodically, the stilling well containing the water quality sonde became clogged with fine sediment, causing malfunction. Data associated with such events typically expressed extreme values with rapid transitions between high and low readings. Such events were recorded in field notes and associated data was subsequently flagged and removed from data summaries.

SOURCE: ESA, 2015

Temperature, Dissolved Oxygen, and pH

Overall, the water quality of storm flows in the Canal is similar to that of Lake Merced during the corresponding seasonal period in terms of temperature, DO, and pH. For storm flows, water quality parameters were typical of urban stormwater. Temperatures and pH levels were generally similar to those in Lake Merced (described above), as would be expected during the colder wet season period. DO levels were generally equal to or higher than those in Lake Merced, as would be expected during the colder wet season and as a result of the turbulent mixing of storm flows in the Canal. Base flow water quality parameters ranged more widely than storm flows. The pH values above 8 and DO values above 12 mg/L in the base flows (Table 3.9-4) are likely a reflection of photosynthesis by benthic (bottom growing) algae that would be exposed to full sunlight conditions within the Canal.

Other Water Quality Constituents

The concentrations of key water quality constituents (nutrients, selected metals, and bacteria) in Canal base flow and stormwater observed in the 2011-2012 wet season monitoring are summarized in Table 3.9-5 and discussed below.

Nutrients and Total Suspended Solids

A key constituent of potential concern for the proposed Project is Total Inorganic Nitrogen (TIN), the sum of nitrate and ammonia concentrations, as this constituent has been documented as being the algal growth limiting nutrient in the Lake (discussed in detail in ESA, 2015), whereas phosphate is present at levels above those likely to limit algal growth.

The median dry season base flow TIN concentration was 5.0 mg/L (nitrate, 4.2 mg/L, ammonia, 0.08 mg/L). The median wet season base flow TIN concentration was 3.8 mg/L (nitrate, 3.6 mg/L; ammonia, 0.2 mg/L). Nonetheless, the concentration of nutrients in winter varies considerably with periods of higher nutrient concentrations occurring when rains follow a few weeks of dry winter conditions. The median storm flow TIN concentration was considerably lower than the base flow TIN values at approximately 0.5 mg/L (nitrate 0.31 mg/L, ammonia 0.15 mg/L). Rain contains an estimated 0.2 mg/L TIN, diluting the base flow TIN. Potential sources of nitrogen within the watershed include atmospheric deposition, fertilizer in residential irrigation runoff, and illicit animal waste.

TABLE 3.9-5
VISTA GRANDE CANAL 2011-2012 MONITORING DATA SUMMARY

Constituent or Physical Property	Unit	Dry Season Base Flow[a]			Wet Season Base Flow[b]			Wet Season Storm Flow[c]		
		Min.	Max.	Median	Min.	Max.	Median	Min.	Max.	Median
Nutrients										
Total phosphorous [P]	mg/L	0.15	0.4	0.2	0.16	0.77	0.255	0.12	0.62	0.17
Orthophosphate as P	mg/L	ND (<0.1)[d,f]	0.27[d,f]	0.079[d,f]	0.089[f]	0.42	0.125[f]	ND (<0.1)[d]	0.27	0.12[e]
Nitrate as N	mg/L	3.1	4.7	4.15	2.6	4.9	3.6	0.21	1.1	0.31[e]
Total Kjeldahl Nitrogen (TKN)	mg/L	0.61	1.5	0.875	0.63	2.8	1.65	0.41	4.3	0.70
Ammonia as N	mg/L	0.05[d]	0.32[d]	0.078[d]	ND (<0.05)[d]	0.19	0.117[d]	ND (<0.05)[d]	1.1	0.15[d]
Oxygen Demand										
Chemical Oxygen Demand (COD)	mg/L	17	33	22	10	36	18.5	9.9	57	12[d,f]
Biochemical Oxygen Demand (BOD)	mg/L	ND (<4)[d]	4[d]	4[d]	ND (<4)[d]	4.3	4[d]	ND (<4)[d]	29	4[d,e]
Metals (Total)										
Copper (Cu)	µg/L	4.3	6	5.55	4.9	9.6	6.3	12	59	17.5[e]
Nickel (Ni)	µg/L	4.1	6.6	4.8	5.2	8	7.05	3	12	3.6[e]
Metals (Dissolved)										
Copper (Cu)	µg/L	ND (<0.5)[d]	5[d]	3.35[d]	3.7	8.4	4.35	ND (<0.5)[d]	32	7.7[d]
Nickel (Ni)	µg/L	ND (<0.5)[d]	5.8[d]	4[d]	4.8	7.5	5.65	ND (<0.5)[d]	6.1	1.45[d]
Physical Parameters										
Total Suspended solids (TSS)	mg/L	2.2[e]	34[e]	3.5[e]	2.4[e]	19.2[e]	3.5[e]	4.2	119	21.8[e]
Bacteria/Organisms										
Total Coliform	cfu/100 mL	5,100	140,000	14,900	100[d]	3,100,000	12,200[d]	10000	520000	70,000
Fecal Coliform	cfu/100 mL	120	5,700	980	10[d]	19,000	120[d]	2000	8000	4,900
E. coli	cfu/100 mL	1,000	20,000	3,750	100[d]	10,000	600[d]	10000	200000	10,000[d]
Enterococcus	cfu/100 mL	45	6,300	540	10[d]	16,000	350[d]	4000	42000	14,500
MS-2 (Bacteriophage, Male Specific)	pfu/mL	ND(<1)[d]	322[d]	6.5[d]	ND(<1)[d]	184	20	4	52	25

TABLE 3.9-5 (Continued)
VISTA GRANDE CANAL 2011-2012 MONITORING DATA SUMMARY

Constituent or Physical Property	Unit	Dry Season Base Flow[a]			Wet Season Base Flow[b]			Wet Season Storm Flow[c]		
		Min.	Max.	Median	Min.	Max.	Median	Min.	Max.	Median
Bacteria/Organisms (cont.)										
Giardia	cysts/L	ND (<0.1)[d]	3.58[d]	0.23[d]	ND (<0.13)[d]	1.2	0.13	ND (<0.12)[d]	0.12	0.12
Cryptosporidium spp.	oocysts/L	0.1[d]	0.23[d]	0.14[d]	ND (<0.1)[d]	0.13	0.125[d]	ND (<0.13)[d]	0.12	0.12
Bacteroidales - General		Present	Present	-	Present	Present	-	Present	Present	-
Bacteroidales – Human		ND	Present	-	Present	Present	-	ND	Present	-

NOTES:
a Dry season samples were taken on August 17, September 1, September 15, September 30, October 13, and October 27, 2011.
b Wet season base flow samples were taken October 4, 2011 and January 13, January 24, February 6, and February 17, 2012. Note that although the October 4, 2011 base flow sampling event took place during the dry season window (August 15 to October 31), it was included as a wet season sampling event because it occurred after the first storm event of the season on October 3, 2011.
c Wet season storm samples were taken on January 19, January 23, February 28, March 13, March 14, and March 16, 2012.
d One or more samples in the group was Non-Detect.
e One or more samples in group have a dilution factor that is greater than DF=1.
f One or more samples in this group is J-flagged: concentration between the method detection limit (MDL) and reporting limit (RL) statistically derived as a numerical value.

SOURCE: ESA, 2015

Total suspended solids (TSS) rose from median values of 3.5 mg/L in base flows in both summer and winter to 22 mg/L during storm flows (Table 3.9-5). Most of the constituents monitored tend to be associated with particulates (measured as TSS). As the length of the antecedent dry period before a storm increases, it is expected that the amount of particulates and levels of associated constituents would also increase. However, the existing BMPs (such as street sweeping) reduce the amount of particulate accumulation in stormwater and therefore, reduce the potential for conveyance into the stormwater system and, in this instance, into the Canal.

Biochemical and Chemical Oxygen Demand

The concentration of potential oxygen demanding substances in the Canal was measured as BOD and chemical oxygen demand (COD). BOD measures the oxygen demand of readily oxidizable organic matter and ammonia in a water sample over a 5-day period. The detection limit for the BOD test is 4 mg/L. COD is calculated through an oxidation test method that also measures the oxygen demand from reduced chemical substances such as sulfides. To the extent it may be present above background levels, BOD in urban runoff can be derived from naturally occurring organic matter such as leaves, grass clipping, and animal waste.

Overall, BOD and COD levels were relatively low and were consistent in the Canal during both wet and dry season periods. The majority of BOD sampling results from the Canal for all samples was close to or below the 4 mg/L test detection limit. Exceptions occurred during two storm flow sampling events following long antecedent dry periods when BOD values rose to 29 mg/L and 10 mg/L (measured on January 20 and 29, 2012, respectively; ESA, 2015). TSS and volatile suspended solids (VSS) concentrations were also higher, indicating the more decomposable organic matter had been conveyed into the stormwater system and the Canal during those storm events. COD values were generally higher than corresponding BOD values. During the dry weather period, COD ranged from 17 to 33 mg/L in Canal base flows (as compared to 25 to 34 mg/L in Lake Merced during the corresponding sampling period; ESA, 2015). During the wet weather period, the range of COD was similar; 12 to 36 mg/L for Canal base flows (and 10 to 57 mg/L in Lake Merced, potentially representing oxidation of the higher algal biomass present). Higher COD concentrations were also seen (as for BOD) during the January 20 and 29, 2012 storm events (99 and 57 mg/L, respectively; ESA, 2015).

Bacteria and Other Microorganisms

Overall, the bacterial and related results indicate that water quality conditions in the Canal are similar to what would be expected in stormwater and authorized non-storm flows from a highly urbanized area. The bacterial indicators and specific organisms Total Coliform, Fecal Coliform, E. coli, and Enterococcus are analyzed as indicators of the presence of pathogens, but they are not pathogens themselves (Table 3.9-5). Of these, E. coli is the organism most widely recommended by USEPA for evaluating the microbiological condition of fresh waterbodies. These organisms naturally die off at rates depending on temperature, sunlight (UV) exposure, and predation. They are often associated with particles and therefore subject to removal from the water column by settling.

In addition to the indicator organism monitoring, sampling was also conducted for the pathogenic protozoans *Giardia* and *Cryptosporidium*. These protozoans can be transmitted via infected human sources, but more commonly by animal sources. *Cryptosporidium* was detected only once in the Canal (October 13, 2011) and at a level equal to the detection limit (0.1 oocysts/L). *Giardia* was detected during 3 out of 11 Canal sampling events. The highest concentration of 3.58 cysts/L was observed from a dry season event on September 15, 2011. The other two detectable results of 1.2 and 0.23 oocysts/L occurred during wet season base flow sampling on October 4, 2011 and January 13, 2012, respectively.

To further evaluate the likelihood of fecal contamination, analyses were conducted for General Bacteroidales and for Human Bacteroidales. This is a genetic assay test that indicates the presence or absence of fecal related genetic material. The General Bacteroidales test indicates the presence of fecal contamination from any source, and the Human Bacteroidales test indicates the presence of fecal contamination from human activities. This latter test is not specific for only human markers and also detects the presence of fecal material from domesticated animals that share some of the same markers with humans. General Bacteroidales were detected in all of the Canal samples (and in all of the Lake samples). Human Bacteroidales were detected in 10 of the 15 Canal samples (but in only 1 of the 15 Lake samples on August 17, 2011, at LM-4). In this type of urban environment, the results of the Human Bacteroidales test is likely detecting dog fecal matter at least, in part. Daly City has a very effective Sanitary Sewer System Management Program, so it is unlikely that raw wastewater is a contributing source.

Metals

In the 1990s and early 2000s, wastewater and stormwater management programs placed a significant emphasis on identifying and controlling potential sources of metals to the environment. These programs have been effective in controlling metals sources, particularly copper, to the MEP. Copper is the only metal still recognized as a pollutant of concern by the MRP. The copper controls identified in MRP Provision C.13 have been fully implemented for many years by Daly City. The primary remaining source of copper is from vehicle brake pads, and legislation has been adopted requiring a progressive reduction in the amount of copper in brake pads.

Other metals, such as nickel and zinc, are generally present at low levels in urban stormwater. It is the dissolved fraction of metals that exert the most toxicity and are the most bioavailable. However, in the presence of organic matter (e.g., ligands) and inorganic constituents such as hardness, the dissolved fraction of most metals, including nickel and particularly zinc, is rapidly converted into less toxic metal complexes. The California Toxics Rule and Basin Plan WQOs are expressed as dissolved metals and as a function of ambient hardness. The WQOs also have both short-term exposure (acute) and long-term exposure (chronic) components. For stormwater, which is generally of a short-term and intermittent nature, typically the acute WQOs are used when evaluating the potential for water quality impacts.

In the context of the proposed Project, assuming a conservative ambient Lake hardness of 200 mg/L, reported in mg/L calcium carbonate ($CaCO_3$), the acute WQOs for lead, copper, nickel, and zinc are 197, 27, 843, and 216 µg/L, respectively. The maximum observed dissolved concentrations in the Canal for these four constituents were 1.6, 32, 12, and 120 µg/L, respectively. The second highest observed Canal dissolved copper concentration was 15 µg/L with other values of as low as < 0.5 µg/L. Metals concentrations are almost universally low and available BMPs are currently implemented to maintain these levels and, in the case of copper, further reduce them over time (as brake pad reformulation occurs).

Quality of Underlying Groundwater

SFPUC maintains an extensive network of groundwater monitoring wells in the Westside Groundwater Basin. These wells were installed between 2002 and 2010 and are primarily used to assess general mineral content, including nitrate, iron, manganese, and chloride concentrations. The California Department of Public Health has established primary and secondary maximum contaminant levels (MCLs) for drinking water, which are also incorporated by reference into the Basin Plan. An MCL is the maximum allowable amount of a contaminant in drinking water which is delivered to the consumer. Primary MCLs are established to protect public health and are enforceable standards established to protect the public against consumption of drinking water contaminants that present a risk to human health. Secondary MCLs represent non-mandatory water quality guidelines for 15 contaminants that assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor (USEPA, 2013). Title 22, Division 4 of the California Code of Regulations specifies recommended, upper, and short-term secondary MCLs for four parameters including total dissolved solids (TDS), specific conductance, chloride, and sulfate. Groundwater quality within the SFPUC wells is summarized below from analyses conducted by San Francisco (2013):

- ***Chloride.*** In general, chloride concentrations at the monitoring wells have remained below the recommended secondary MCL (250 mg/L) throughout the monitoring period at all monitoring wells screened in the Shallow Aquifer and Primary Production Aquifer, with the exception of one location near Lake Merced in the Shallow Aquifer that detected a reading of 393 mg/L in 2009 (below the upper secondary MCL of 500 mg/L).

- ***Iron.*** Iron concentrations were sporadically monitored between 1993 and 2010 and included monitoring for total and/or dissolved iron.[10] Total iron concentrations did not exceed the secondary MCL (0.30 mg/L) at any Shallow Aquifer locations but did exceed the secondary MCL at five Primary Production Aquifer locations; none of these locations are near Lake Merced or the Project vicinity. None of the measured dissolved iron concentrations exceeded the secondary MCL.

- ***Manganese.*** Manganese concentrations were sporadically monitored between 1993 and 2010 and included monitoring for total and/or dissolved manganese. Total manganese concentrations exceeded the secondary MCL (0.05 mg/L) at one Shallow Aquifer location near 22nd Avenue and Sloat Boulevard, and six Primary Production Aquifer locations including the Lake Merced Pump Station. At the Pump Station, total manganese concentrations in the Primary Production Aquifer ranged between 0.57 to 0.63 mg/L from 2005 through 2006; dissolved manganese concentrations in the Deep Aquifer were measured at 0.24 mg/L in 2007.

[10] Analysis for total metals concentrations in groundwater involves analyzing the entire sample, including entrained sediment. Groundwater samples for dissolved metals are filtered to remove sediment from the sample. Because dissolved concentrations are representative of groundwater quality, these concentrations are compared to maximum contaminant levels for drinking water to determine compliance.

- ***Nitrate.*** Nitrate (as NO_3) concentrations have remained below the primary MCL (45 mg/L) during the entire monitoring period except at four locations in the Primary Production Aquifer and three locations in the Shallow Aquifer that include locations near the project vicinity. In 2010 and 2011, nitrate concentrations in the Primary Production Aquifer at Lake Merced ranged from 45.5 to 48.7 mg/L. Earlier data from the Shallow Aquifer indicated nitrate concentrations of 50.9 mg/L in 2004 and 52.0 mg/L in 2009 at Lake Merced and a range of 48 to 49 mg/L between 2005 and 2007 at the Pump Station.

- ***TDS.*** TDS concentrations remained below the recommended secondary MCL (500 mg/L) throughout the monitoring period at all monitoring wells screened in the Primary Production Aquifer. Five wells completed in the Shallow Aquifer exhibited TDS concentrations in excess of the recommended secondary MCL of 1,000 mg/L, including multiple stations near Lake Merced.

Monitoring of proposed groundwater production wells near Lake Merced that was implemented by SFPUC on a near-yearly basis from 2004 through 2011 was generally consistent with the results presented above, with occasional exceedances of the MCLs for nitrate, iron, and manganese. Additional information about this monitoring is described in the SFPUC San Francisco Groundwater Supply Project Final EIR (San Francisco, 2013).

Offshore Water Quality

Water quality along San Francisco's Pacific shoreline is influenced by multiple natural and anthropogenic phenomena on multiple scales. These drivers include ocean-wide climate-driven cycles such as El Niño – La Niña cycles and the Pacific Decadal Oscillation, regional phenomena such as coastal upwelling, to more local processes such as stormwater runoff, San Francisco Estuary outflow, and combined sewer overflows. Unlike the multiple water quality monitoring programs within San Francisco Bay that collect data on a broad range of physical, chemical, and ecological parameters (e.g., programs implemented by USGS, RWQCB, and the San Francisco Estuary Institute (SFEI)), most water quality monitoring along San Francisco's Pacific Coast focuses solely on bacterial characteristics to determine whether or not coastal waters are safe for contact recreation (e.g., swimming and surfing).

The SFPUC conducts the Southwest Ocean Outfall Regional Monitoring Program (SFPUC, 2006) to assess the environmental effects on ocean water quality related to discharges of treated stormwater and wastewater from the Oceanside Water Pollution Control Plant (OWPCP) and associated facilities. The Pacific Ocean is listed as an impaired water body for bacteria at Baker Beach (SWRCB, 2011). The Southwest Ocean Outfall Regional Monitoring Program includes a Beach Monitoring Program to evaluate bacterial concentrations at recreational beaches. Under this program, the SFPUC posts public notices at beaches when any state bacterial standards for recreational uses are exceeded or a combined sewer discharge occurs. SFPUC monitors water quality in the vicinity of the Daly City Ocean Outlet structure below Fort Funston at station Ocean #22 SL during known overflow events. From 1997 through 2005, 45 discharges were reported under the Southwest Ocean Outfall Regional Monitoring Program; three of these had elevated bacteria counts (SFPUC, 2006). During this time period, the beach at Fort Funston was closed to contact recreation an average of 2 days per year due to elevated bacteria counts and

7 days per year due to combined sewer discharges, making the beach available for contact recreation approximately 97 percent of the time (SFPUC, 2006).

The Southwest Ocean Outfall Regional Monitoring Program also includes a regional Offshore Monitoring Program; under this program, ocean water samples are analyzed for various physical, chemical, and biological parameters to allow for a comparison of conditions in the Southwest Ocean Outfall area to reference conditions. The results of this program indicate that biological parameters and sediment pollutant concentrations at the Southwest Ocean Outfall discharge area have generally been the same or essentially the same as at the reference stations.

3.9.2 Regulatory Setting

3.9.2.1 Federal and State Regulations

Clean Water Act

The federal Clean Water Act ("Act") and subsequent amendments, under the enforcement authority of the USEPA, was established "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave the USEPA the authority to implement pollution control programs, such as setting wastewater standards for industry and requirements for stormwater control. In California, the SWRCB and nine RWQCBs are delegated the authority to implement and enforce compliance with the Clean Water Act via California's Porter-Cologne Water Quality Control Act.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code) provides the basis for water quality regulation within California. This Act establishes the authority of the SWRCB and the nine RWQCBs. The SWRCB administers water rights, sets state policy for water pollution control, and implements various water quality functions throughout the state, while the RWQCBs conduct planning, permitting, and most enforcement activities. The Project site lies within the jurisdiction of the San Francisco Bay RWQCB (Region 2), and references to the RWQCB throughout this section refer to Region 2.

The Porter-Cologne Water Quality Control Act requires the SWRCB and/or the RWQCBs to adopt statewide and/or regional water quality control plans, the purpose of which is to establish water quality objectives for specific water bodies. In the San Francisco Bay region, the Water Quality Control Plan, known as the Basin Plan, is the RWQCB's master policy document. The Act also authorizes the SWRCB and RWQCBs to implement the NPDES program, which establishes discharge limitations and receiving water quality requirements for discharges to waters of the United States.

Water Quality Control Plans and Beneficial Uses

The RWQCB's Basin Plan establishes regulatory standards and objectives for water quality in the San Francisco Bay region (RWQCB, 2015). The Basin Plan identifies existing and potential beneficial uses for surface water and groundwater and provides numerical and narrative water quality objectives designed to protect those uses. Applicable water quality objectives for a specific water body are determined on the basis of the beneficial use(s) of the water. The Basin Plan also specifies that beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist. Existing beneficial uses that have not been formally designated in the Basin Plan are protected whether or not they are identified.

The San Francisco Bay RWQCB Water Quality Control Plan (Basin Plan) designates Lake Merced as supporting the following beneficial uses:

- Cold Freshwater Habitat (COLD)
- Warm Freshwater Habitat (WARM)
- Fish Spawning (SPWN)
- Wildlife Habitat (WILD)
- Body-contact Recreation (REC1)
- Noncontact Water Recreation (REC2)
- Municipal And Domestic Supply (MUN)

Of the above designated uses, the uses that are most directly sensitive to the degree of eutrophication and stratification and associated pH and particularly DO levels within Lake Merced are those related to habitat quality for aquatic organisms; specifically, COLD, WARM, SPWN, and WILD. It should be noted that under stratified conditions, the respective uses may exist to differing degrees depending on the relative temperature, DO, and pH in the separated upper and lower portions of the Lake. REC1 and REC2 uses could also be affected to the extent that if algal growths were to increase to nuisance proportions, it could interfere with recreational activities or adversely affect the aesthetic quality of Lake Merced. While the Basin Plan lists REC-1 (including full body-contact recreation) as a beneficial use of Lake Merced, swimming and wading in the Lake are not allowed by San Francisco since the Lake is also designated as a potential MUN source, as described in Section 3.9.1.2, Water Quality Objectives.

The Basin Plan contains narrative and numeric WQOs that apply to most waters in the region and are intended, in part, to ensure that beneficial uses are protected. The current WQOs for biostimulatory substances (i.e., nutrients), DO, and pH are cited below from the Basin Plan. While it is recognized that other WQOs exist for additional water quality constituents (pathogens, metals, etc.), the objectives presented below are those most relevant for review of overall Lake health.

Biostimulatory Substances. Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances.

Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

Dissolved Oxygen. For nontidal waters, the following objectives shall apply:

Waters designated as:

COLD	7.0 mg/L minimum
WARM	5.0 mg/L minimum

The median DO concentration for any three consecutive months shall not be less than 80 percent of the DO content at saturation.

DO is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/L and 7 mg/L are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

pH. The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels (RWQCB, 2015).

It is important to note that the Basin Plan does not generally contain implementation provision language about how these WQOs, particularly DO and pH, should be applied in different types of waterbodies (e.g., shallow versus deep waters, lake environments). Additional detail on this topic is provided below.

Lake Merced Section 303(d) Listing

Under Section 303(d) of the Clean Water Act, states are required to develop a list of impaired waters, defined as water bodies that do not meet state water quality standards, every two years. Water quality standards include designated beneficial uses and WQOs (40 CFR 131.3(i)).

On November 28, 2001, during the 2002 303(d) listing process, Lake Merced was included on the RWQCB's "Preliminary List of Waterbodies and Pollutants" for "Low Dissolved Oxygen/Organic Enrichment." This was in Table 5 in the Board item approving transmittal of the 2002 303(d) list to the SWRCB. The accompanying staff report (p. 35) stated that:

> Regional Board staff recommends that DO and pH be monitored systematically by a public agency such as the SFWD [San Francisco Water District], the San Francisco Public Utilities Commission, or other stakeholder. This monitoring should be conducted at the same sites as the SFWD program plus additional sites within the different portions of the lake, and more frequently than before, continuously where resources allow, to assess whether the lake is truly impaired due to lack of DO or elevated pH. In the next listing cycle the Regional Board will re-evaluate DO and pH information, including the 1997-2000 data, and either accept or reject an impairment determination for DO and pH.

On February 28, 2003 the SWRCB transmitted the State's 2002 303(d) list to USEPA. The SWRCB included Lake Merced on the "Monitoring List" for "Low Dissolved Oxygen." This did not require development of a Total Maximum Daily Load (TMDL). Waters were placed on the Monitoring List where "minimal, contradictory or anecdotal information suggests standards are not met but the available data or information is inadequate to draw a conclusion."

On June 5, 2003, the USEPA partially approved and partially disapproved California's 2002 Section 303(d) list. The USEPA added Lake Merced to the 303(d) list under Category 5 (TMDL required) for DO and pH. As its rationale, the USEPA stated in part that:

> The San Francisco Bay Basin Plan includes numeric standards for dissolved oxygen and pH that are applicable to this water (San Francisco Bay RWQCB, 1995, p. 3-3). EPA's analysis of available data in the State's record found that 46-83% of available samples exceed the existing numeric water quality standards for DO and pH in Lake Merced, depending upon the monitoring station (n=14). The State has not provided a sound rationale for concluding that the water quality standards for pH and DO are not exceeded. The stated rationale that the available data may not be representative is unpersuasive.
>
> Data were collected at several locations over a recent multi-year time frame. The rationale that samples taken at depth should not be considered and that analysis only of surface samples demonstrates attainment is also unpersuasive because the Basin Plan includes no provisions indicating that these standards are to be applied only at the surface. EPA concludes that absent Basin Plan language to the contrary, these standards apply at all water depths. Based on these considerations, EPA has determined that this water should be identified for inclusion on the list for pH and DO.
>
> **EPA is establishing a low priority for this listing based on the considerations that no specific beneficial use impairments have been associated with DO and pH problems in the Lake, and that additional monitoring is warranted to verify these listings prior to developing TMDLs.** (emphasis added)

Lake Merced remains on the final California 2008-2010 Section 303(d) list (as approved by USEPA October 11, 2011) as impaired for DO and pH caused by unknown sources. The list indicates that a TMDL is to be completed by 2019. This is the most recent 303(d) list and is not scheduled for updating for Region 2 until the 2016 Integrated Report is prepared.

The SWRCB on September 30, 2004 adopted a "Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List" (Resolution No. 2004-0063). This policy provides the currently applicable guidance (that was not in place at the time of the original Lake Merced listing) on criteria to use for adding and removing waterbodies from the 303(d) list including using a weight-of-evidence based approach.

Subsequently, the SWRCB on June 16, 2005 adopted the "Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options" (Resolution No. 2005-0050). This policy provides alternatives to TMDLs for addressing 303(d) listings. This policy also provides a rationale for considering complex and variable parameters in environments where there is low DO due to “natural conditions” (e.g., sediment/benthic oxygen demand, limited flushing, diurnal fluctuation, seasonal stratification, etc.). The policy (p. 3, item B) states that:

> If the failure to attain standards is due to the fact that the applicable standards are not appropriate to natural conditions, an appropriate regulatory response is to correct the standards.

NPDES Discharge Permits

The federal Clean Water Act established the NPDES program to protect the water quality of receiving waters of the United States. Under the Clean Water Act, Section 402, discharging pollutants to receiving waters of the United States is prohibited unless the discharge is in compliance with an NPDES permit. For California, the USEPA determined that the state’s water pollution control program had sufficient authority to manage the NPDES program under California law in a manner consistent with the Clean Water Act. Stormwater flows from Daly City and from San Francisco are regulated under two separate NPDES permits as described below.

Statewide General NPDES Permit for Construction Activity

The State of California adopted a revised Construction General Permit (CGP) on September 2, 2009 (Order No. 2009-0009-DWQ as amended by 2010-0014-DWQ and 2012-0006-DWQ) (General Construction NPDES Permit). The General Construction NPDES Permit regulates construction site storm water management. Dischargers whose projects disturb one or more acres of soil, or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the CGP for discharges of storm water associated with construction activity. Construction activity subject to this permit includes clearing, grading, and disturbances to the ground, such as stockpiling or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

To obtain coverage under this permit, project operators must electronically file Permit Registration Documents, which include a Notice of Intent, a Stormwater Pollution Prevention Plan (SWPPP), and other compliance-related documents. An appropriate permit fee must also be mailed to SWRCB. The SWPPP identifies BMPs that must be implemented to reduce construction effects on receiving water quality based on potential pollutants. The BMPs identified are directed at implementing both sediment and erosion control measures and other measures to control potential chemical contaminants. The SWPPP also includes descriptions of the BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site (post-construction BMPs).

The permit includes several new requirements (as compared to the previous CGP, 99-08-DWQ), including risk-level assessment for construction sites, an active storm water effluent monitoring and reporting program during construction (for Risk Level II and III sites), rain event action plans for certain higher risk sites, and numeric effluent limitations (NELs) for pH and turbidity as well as requirements for qualified professionals that prepare and implement the plan. The permit became effective July 1, 2010. In San Francisco, compliance with the Construction General

Stormwater Permit is generally implemented through the SFPUC's Stormwater Management Plan, described below in Section 3.9.2.2.

RWQCB Dewatering Requirements

Construction of the proposed Project would require excavation and trenching activities. Such activities in areas with shallow groundwater or that are located adjacent to surface water bodies could require dewatering to create a dry area. Discharges of dewatering flows to the local stormwater drainage system or to vegetated upland areas are conditionally exempt provided they meet the water quality criteria in the General Construction NPDES Permit. The RWQCB requires that the dewatering flows be tested for possible pollutants; the analytical constituents for these tests are generally determined based on the source of the water, the land use history of the construction site, and the potential for the flow to impact the quality of the receiving water body.

Waiver of Waste Discharge Requirements

California Water Code Section 13269 authorizes the RWQCB to waive WDRs for specific discharges or specific types of discharges where such a waiver is consistent with any applicable state or regional water quality control plan and is in the public interest. Waivers may be granted for discharges to land and may not be granted for discharges to surface waters or conveyances thereto that are subject to the federal Clean Water Act requirements for NPDES permits.

Daly City Stormwater Regulation

Stormwater runoff and authorized non-storm flows (conditionally exempt discharges) from Daly City and the other San Mateo County cities have been regulated under MS4 NPDES permits since 1993. These MS4 permits, including the current Municipal Regional Permit, RWQCB Order No. R2-2009-0074 (MRP), have contained increasingly prescriptive requirements, typically in the form of enhanced BMPs. Consistent with the requirements of the Clean Water Act at section 402(p), the MRP requires that the covered counties and cities implement BMPs to the standard defined as the "maximum extent practicable," (MEP) to minimize the extent of pollutants entrained in stormwater and authorized non-storm flows. The RWQCB also requires actions to protect the water quality of receiving waters. Annual reports are required to be submitted by co-permittees, documenting compliance with applicable elements of the MRP. Daly City has an effective stormwater management program that fully implements the requirements of the MRP.

The MRP contains extensive monitoring requirements focused primarily on TMDL-based Pollutants of Concern within targeted watersheds and receiving waterbodies, and MRP Provision C.1 specifies how compliance may be demonstrated with receiving water limitations. Provision C.1 states that if exceedances of WQOs persist in receiving waters, MRP Permittees are to "submit a report to the Water Board that describes the BMPs that are currently being implemented, and the current level of implementation, and additional BMPs that will be implemented, and/or an increased level of implementation, to prevent or reduce the discharge of pollutants that are causing or contributing to the exceedance of water quality standards or objectives."

RWQCB staff indicated that the proposed diversions from the Canal to Lake Merced are covered under the existing MRP. Daly City understands that no additional NPDES permits are needed for operation of the proposed Project.

San Francisco Stormwater Regulation

Although San Francisco's population is greater than 100,000, the threshold for Phase I MS4 permit coverage, San Francisco was exempt from Phase I stormwater regulations because most of San Francisco is served by a combined storm sewer system that is regulated by a separate type of permit, discussed more fully below. San Francisco, therefore, must comply with Phase II of the regulations, which became effective March 2003 for jurisdictions in urbanized areas with populations of less than 100,000 (Order No. 2003-0005-DWQ), for any stormwater discharges not contained within the combined storm sewer system.

Stormwater inlets on the streets surrounding Lake Merced collect stormwater runoff, and route it to the Lake through dedicated drainage pipes. This system consists of catch basins that do not provide stormwater treatment prior to discharge to the lake. Runoff also reaches the Lake by surface sheet flow, mostly on the slopes between the surrounding streets and the Lake. Additional watershed related information is provided in the comprehensive Lake Merced Watershed Report (SFPUC, 2011a). Those portions of San Francisco not served by the combined storm sewer system, which includes the Lake Merced Watershed, are covered by the SWRCB Phase II Small MS4 General Permit that became effective July 1, 2013 (Order No. 2013-0001 DWQ). This permit replaced the first SWRCB Phase II General Permit adopted in April 2003. Stormwater management, monitoring, and reporting requirements under the Phase II permit are extensive and similar to those under the Phase I MRP. The SFPUC Wastewater Enterprise manages stormwater activities under the Phase II permit.

Oceanside Water Pollution Control Plant, Collection System, and Westside Wet Weather Facilities Permit (RWQCB Order No. R2-2009-0062)

The following permit description is provided in the context of the potential use of the SFPUC outlet for stormwater and authorized non-stormwater discharges during the construction phase when the Vista Grande Tunnel would be replaced.

The Oceanside NPDES permit is issued pursuant to the federal Clean Water Act (CWA) §402 and implementing regulations adopted by the U.S. Environmental Protection Agency (USEPA) and California Water Code (CWC) Chapter 5.5, Division 7 (commencing with §13370). It serves both as an NPDES permit for point source discharges from this facility to surface waters, and as Waste Discharge Requirements (WDRs) pursuant to CWC Article 4, Chapter 4, Division 7 (commencing with §13260). USEPA and the Regional Water Board jointly issue this permit. It covers Discharge Point 001, the Southwest Ocean Outfall, which is 3.4 to 3.6 nautical miles offshore in Federal waters. (The territorial waters of the State end three nautical miles from shore.) It also covers Discharge Points CSD-001 through CSD-007, which are near-shore in State waters.

During dry weather, the Oceanside NPDES permit requires compliance with effluent limits for conventional, nonconventional, and toxic pollutants that are discharged into the waters of the United States. Because Oceanside is a combined sewer system, during wet weather flows are subject to CWA §301(b)(1)(A) and are not subject to secondary treatment regulations. Wet weather flows from combined sewer systems are addressed by the Combined Sewer Overflow Control Policy (59 Federal Register 18688-18698). The Wet Weather Water Quality Act of 2000 incorporated this policy into the CWA. The policy establishes a consistent national approach for controlling discharges from combined sewers to the nation's waters. Using the NPDES permit program, the policy initiates a two-phased process. During the first phase, a discharger is required to implement "nine minimum controls" (e.g., prevent dry weather overflows). These controls constitute the technology-based requirements of the CWA as applied to combined sewer facilities (i.e., best conventional pollutant control technology, BCT, and best available control technology economically achievable, BAT). The controls are intended to provide immediate and relatively low-cost water quality improvements for dischargers who, unlike San Francisco, have not implemented a long-term control plan. The second phase of the process involves implementation of the long-term control plan developed in the first phase. The purpose of this long-term control plan is to comply with CWA water quality requirements. San Francisco's program, which continues to implement its long-term plan, is consistent with the CSO policy and the Regional Water Board policy on wet weather overflows described in Basin Plan. During wet weather, discharges from shoreline points CSD-001 through CSD-007 and the Southwest Ocean Outfall are subject to this policy. Based on 70 years of historical rainfall records, the Westside Wet Weather Facilities were designed to achieve a long term average of eight discrete shoreline discharge events per year.

In April 1994, the USEPA adopted the Combined Sewer Overflow Control Policy, which became part of the Clean Water Act in December 2000. This policy established a consistent national approach for controlling discharges from combined sewers to the nation's water. As specified in the NPDES permit, the policy initiated a two-phased process, with higher priority given to more environmentally sensitive areas.

During the first phase, the permittee is required to implement the following nine minimum controls that constitute the technology-based requirements of the Clean Water Act and that can reduce the frequency of combined sewer overflows and their effects on receiving water quality:

- Conduct proper operation and regular maintenance programs for the combined sewer system and combined sewer overflow outfalls
- Maximize the use of the collection system for storage
- Review and modify pretreatment programs to ensure that combined sewer overflow impacts are minimized
- Maximize flow to the treatment plant for treatment
- Prohibit combined sewer overflows during dry weather
- Control solids and floatable materials in combined sewer overflows
- Develop and implement pollution prevention programs that focus on contaminant reduction activities
- Notify the public
- Monitor to effectively characterize combined sewer overflow impacts and the efficacy of combined sewer overflow controls

San Francisco is currently implementing these controls, as required by the Combined Sewer Overflow Control Policy. This included development of the SFPUC Water Pollution Prevention Program to minimize pollutant entry into San Francisco's combined sewer system and to address pollutants from residential, commercial, industrial, and nonpoint sources.

During the second phase, the permittee is required to continue implementation of the nine minimum controls, properly operate and maintain the completed combined sewer discharge controls in accordance with the operational plan, and implement the post-construction monitoring program. In conformance with the Combined Sewer Overflow Control Policy, San Francisco has developed and fully implemented a long-term control plan to select combined sewer discharge controls to protect the beneficial uses of the receiving waters. The control plan utilized the "presumptive approach" for the protection of water quality and in accordance with the Combined Sewer Overflow Control Policy, this approach must meet at least one of the following criteria:

- An average of four combined sewer overflow events per year
- Elimination or capture of no less than 85 percent by volume of the combined sewage collected in the combined sewer system during precipitation events on a systemwide average basis
- Removal of the mass of any contaminant causing water quality impairment that would be otherwise removed by eliminating or capturing the flow as specified above

The Combined Sewer Overflow Control Policy requires that any combined sewer discharges that occur after implementation of the nine minimum control measures receive a minimum of primary clarification (removal of floatables and settleable solids), solids and floatable disposal, and disinfection (if necessary to meet water quality standards and protect the beneficial uses of the receiving water). However, the San Francisco Wastewater Control Program exceeds the specifications of the Combined Sewer Overflow Policy because 100 percent of the combined sewer flows are captured and treated rather than the 85 percent specified in the Combined Sewer Overflow Policy. As defined in the policy, San Francisco has no remaining untreated overflow events because all combined flows are captured and treated to a minimum of the equivalent of primary treatment within the storage/transport boxes, and this treatment consists of removal of floatables and settleable solids.

In 1997, San Francisco completed improvements associated with the 20-year, $1.6 billion Wastewater Master Plan, which included extensive storage, transport, and treatment upgrades to the combined sewer system that met approved design criteria for the overall protection of beneficial uses. Operation of the improved facilities satisfies the requirements of the Combined Sewer Overflow Control Policy, including maximizing use of the system during wet weather.

SWRCB Ocean Plan

The SWRCB regulates water quality in the Pacific Ocean through regulatory standards and objectives outlined in the Water Quality Control Plan, Ocean Waters of California (commonly referred to the Ocean Plan) (SWRCB, 2012). The Ocean Plan identifies beneficial uses of ocean waters and provides WQOs that are protective of these uses. The plan provides objectives for bacteriological, physical, chemical, biological, and radioactive characteristics, as well as general requirements for the management of waste discharges to the Pacific Ocean. The Southwest Ocean Outfall discharges to federal ocean waters 3.75 miles from shore and the USEPA relies upon the WQOs of the Ocean Plan for the purposes of regulating discharges from the Southwest Ocean Outfall and Daly City Ocean Outlet. The Ocean Plan designates the following beneficial uses for the ocean waters of the State of California: industrial water supply; water-contact and noncontact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture; preservation and enhancement of designated Areas of Special Biological Significance; rare and endangered species; marine habitat; fish migration; and fish spawning and shellfish harvesting. The Plan lists a suite of water quality objectives in support of these beneficial uses. These objectives cover three broad groups of criteria: bacterial characteristics (e.g., Total Coliform, Fecal Coliform, and *Enterococcus*), physical characteristics (e.g., aesthetics, absence of floating matter), and chemical characteristics (e.g., DO, pH, sulfides, nutrients, organic materials, and pollutants that can impact marine life and public health).

RWQCB Policy on the Use of Constructed Wetlands for Urban Runoff (Resolution No. 94-102)

Regional Board Resolution 94-102 provides a policy framework for the establishment of constructed wetlands to control urban stormwater runoff and other discharges. Pursuant to 40 CFR Part 122.2, wetlands constructed and operated under the policies set forth in Resolution 94-102 are waste treatment systems and, as such, are not waters of the United States. The Regional Board will consider the use of wetlands for urban runoff treatment in cases where the wetlands are constructed or “artificial” systems. Use of such systems requires the proponent to demonstrate (1) a commitment of an adequate amount of land to maintain urban runoff treatment functions in the constructed wetland and (2) a commitment to manage the constructed wetland to maintain urban runoff treatment functions. Prior to authorizing the construction of an urban runoff treatment wetland, the Regional Board will require demonstration that the wetland will be managed so as not to create vector problems and nuisance, and therefore minimize avian botulism and other infectious diseases. The Regional Board will also require reasonable monitoring to demonstrate that substances transferred to the constructed wetland do not harm wildlife. Further, prior to approving a constructed wetland, the Regional Board will require a management plan that provides detailed information regarding operation and maintenance of the constructed wetlands.

Coastal Zone Management Act

The Coastal Zone Management Act (1972) is administered by NOAA and provides for the management of the nation’s coastal resources. The goal is to “preserve, protect, develop, and where possible, to restore or enhance the resources of the nation’s coastal zone.” Federal actions are subject to federal consistency review under the Coastal Zone Management Act. This review process distinguishes between projects undertaken by federal agencies and projects undertaken by non-federal agencies subject to federal approval. The former requires a consistency determination, while the latter requires a consistency certification.

California Coastal Act of 1976

The California Coastal Commission, in partnership with coastal cities and counties, plans and regulates the use of land and water in coastal areas under the California Coastal Act of 1976 (see Division 20 of the Public Resources Code). Under the Coastal Act, the state legislature mapped an official coastal zone. In accordance with the California Coastal Act, a permit is required for development activities within the coastal zone. The Coastal Act broadly defines development activities to include (among others) the construction of buildings, division of land, and any activity that changes the intensity of land or water use, or public access to and along the coast. The following sections of the Coastal Act contain requirements relevant to the proposed Project.

Section 30235: Construction altering natural shoreline. Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal dependent uses or to protect existing structures or public beaches in danger from erosion, and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fish kills should be phased out or upgraded where feasible.

Section 30253: Minimization of Adverse Impacts. New development shall do all of the following:

a. Minimize risks to life and property in areas of high geologic, flood, and fire hazard.

b. Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

California Coastal Commission Sea-Level Rise Policy Guidance

The California Coastal Commission has developed Sea-Level Rise Policy Guidance intended to help local governments, permit applicants, and other interested parties address the challenges presented by sea-level rise in California's coastal zone. The California Coastal Commission's adopted 2015 Sea-Level Rise Policy Guidance (CCC, 2015) outlines the types of information, analysis, and design considerations the agency's staff requires in order to determine whether shoreline projects conform to the above listed Coastal Act policies. Specifically, the Sea-Level Rise Policy Guidance provides step-by-step guidance on how to address sea-level rise in new and updated Local Coastal Programs (LCPs) and Coastal Development Permits (CDPs) according to the policies of the California Coastal Act. LCPs and the CDP process are the fundamental land use planning and regulatory governing mechanisms in the coastal zone. While it is advisory, the data requirements, resource considerations, projections for sea-level rise, alternatives analyses, and monitoring requirements outlined in detail in the California Coastal Commission's Sea-Level Rise Policy Guidance represent information Daly City would likely be required to produce as part of the California Coastal Commission's evaluation of Project conformity with Sections 30235 and 30253 for shoreline development. Specifically, to comply with Coastal Act Section 30253, the Sea-Level Rise Policy Guidance outlines that projects will need to be planned, located, designed, and engineered for the changing water levels and associated impacts that might occur over the life of the development. In addition, project planning should anticipate the migration and natural adaptation of coastal resources (beaches, access, etc.) due to future sea level rise conditions in order to avoid future impacts to those resources from the new development.

NPS Management Policies

The NPS Management Policies (2006; Section 4.8.1.1) state that natural shoreline processes (such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration) will be allowed to continue without interference. New developments will not be placed in areas subject to wave erosion or active shoreline processes unless (1) the development is required by law; or (2) the development is essential to meet the park's purposes, as defined by its establishing act or proclamation, and:

- no practicable alternative locations are available;
- the development will be reasonably assured of surviving during its planned life span without the need for shoreline control measures; and
- steps will be taken to minimize safety hazards and harm to property and natural resources.

3.9.2.2 Regional and Local Regulations

SFPUC Stormwater Management Plan

The federal regulations adopted under the Clean Water Act and the MRP and/or Phase II permits require local governments to prepare plans for managing stormwater. The SFPUC Stormwater Management Plan describes measures to minimize stormwater pollution in areas of the city that are served by separate storm sewer systems (SFPUC, 2010c). The plan is required under the federal Clean Water Act, within NPDES regulations, and is applicable to those portions of San Francisco that are served by separate stormwater and sanitary wastewater systems.

The SFPUC Stormwater Management Plan consists of six program areas meant to address water quality: public education; public involvement/participation; illicit discharge detection and elimination; pollution prevention/good housekeeping for municipal operations; construction site stormwater runoff; and post-construction stormwater management in new developments and redevelopment areas. The Stormwater Management Plan thereby requires implementation of a variety of stormwater pollution reduction measures, including the implementation of stormwater BMPs (including construction-period BMPs and long-term post-construction BMPs). Required BMP categories mirror the six program areas listed above.

San Mateo County Stormwater Management Plan

As part of the MRP permit (described in detail in Section 3.9.2.1), the San Mateo Countywide Stormwater Pollution Prevention Program (SMCSPPP), a consortium of cities (including Daly City) located within San Mateo County and the County, developed a Stormwater Management Plan, which describes what the SMCSPPP will be doing to prevent and control stormwater pollution in San Mateo County. Through the MRP, SMCSPPP has established baseline levels of effort and performance standards by which each discharger in San Mateo County must comply.

The State recognizes the MRP as a comprehensive stormwater control program, and requires the MRP be implemented to meet the stated stormwater goals and objectives. To meet those requirements, the Stormwater Management Plan includes five major pollution prevention and control sections: Municipal Maintenance Activities; Industrial and Illicit Discharge Controls; Public Information/Participation; New Development and Construction Controls; and, Watershed and Monitoring. Each of the Plan's sections describes goals, existing conditions, and tasks that will be accomplished over a five-year period (Daly City, 2015). Of most relevance to the Project, the new development and construction controls portion of the Stormwater Management Plan addresses pollution during construction projects, including sediment and erosion control, as well as incorporating permanent controls into project designs. The Daly City Specifications and the General Conditions of Approval, which apply to all projects, contain language requiring stormwater pollution prevention practices.

Construction-Related Stormwater Discharges

In accordance with SFPUC controls developed pursuant to Article 4.1 of the San Francisco Public Works Code, construction projects of all sizes in San Francisco must develop and implement pollution prevention and construction site runoff controls. Under Article 4.1, development and implementation of an erosion and sediment control plan specifying measures to control erosion and prevent stormwater pollution and control runoff from construction sites is required. The plan must conform to any applicable requirements of the Construction General Stormwater Permit described above and must comply with stormwater management controls adopted by the SFPUC.

Specifically, the plan must include: a site map showing the location and perimeter of the site, the location of nearby storm drains and/or catch basins, and existing and proposed roadways and drainage pattern within the site; a drawing or diagram of the sediment and erosion control devices to be used on site; a visual monitoring program and a chemical monitoring program for nonvisible pollutants; and minimum BMPs. BMPs specified in the plan must address housekeeping (storage of construction materials, waste management, vehicle storage and maintenance, landscape materials, and pollutant control); non-stormwater management; erosion control; sediment control; and run-on and runoff control. Additional BMPs could be required, and the SFPUC can conduct inspections of all BMPs to ensure compliance with regulatory requirements.

Daly City Municipal Code

Title 14 Stormwater Management and Discharge Control

Chapter 14.04 of the Daly City Municipal Code, also known as the Daly City Stormwater Management and Discharge Control Ordinance, prohibits non-authorized, non-stormwater discharges to the Daly City storm drain system. The purpose of the ordinance is to reduced and/or eliminate non-authorized non-stormwater discharges to the municipal separate storm drain system, control the discharge of spills, dumping or disposal of materials other than stormwater, and reduce pollutants in stormwater discharges into the storm drain system to the MEP. Chapter 14.12 gives Daly City the authority to make an inspection of projects to enforce any of the provisions of Title 14.

Chapter 15.62 Grading, Erosion and Sediment Control

Chapter 15.62 of the Daly City Municipal Code, also known as the City of Daly City Grading, Erosion and Sediment Control Ordinance, sets forth rules and regulations to control site clearing, vegetation disturbances, land- fills, land excavations, soil storage, and other such activities which may cause sediments and other pollutants to enter the public drainage facilities. The chapter establishes the regulations, permit requirements, and procedures for administration and enforcement of permits to properly control the aforementioned activities to preserve and enhance public health, safety, and environment. Section 15.62.230 requires the permittee to maintain a copy of the permit, approved plans and reports and make these available for city inspection. Section 15.62.270 gives the City Engineer authority to suspend or revoke a permit for violation or non-compliance with Chapter 15.62.

Daly City 2030 General Plan

The Daly City General Plan includes no requirements that are relevant to the proposed Project.

San Francisco General Plan

The San Francisco General Plan includes the following policy designed to reduce impacts relating to hydrology relevant to the proposed Project (San Francisco, 1996):

> **Policy 1.10:** Examine the risk of flooding due to climate change related effects, such as storm surges, changes in precipitation patterns, and sea level rise as well as adaptation actions that will reduce population, built environment, and ecosystem vulnerability due to these threats.

San Mateo County General Plan

Chapter 2, Section 2.17 of the San Mateo County General Plan Policies (San Mateo County, 1986) includes the designation to regulate development to minimize soil erosion and sedimentation; including, but not limited to, measures which consider the effects of slope, minimize removal of vegetative cover, ensure stabilization of disturbed areas and protect and enhance natural plant communities and nesting and feeding areas of fish and wildlife.

3.9.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.9.3.1 CEQA Significance Criteria

Based on California Environmental Quality Act (CEQA) Guidelines Appendix G, an impact related to hydrology and water quality is considered significant if implementation of the proposed project would:

a) Violate any water quality standards or waste discharge requirements;

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

f) Otherwise substantially degrade water quality;

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows;

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or

j) Expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow.

In addition to the above significance criteria taken from the CEQA Guidelines Appendix G Section IX, the following significance criterion has been adapted from the Appendix G Section X checklist for purposes of assessing impacts relating to coastal landforms and processes. An impact related to coastal landforms and processes is considered significant if implementation of the proposed project would:

k) Conflict with any applicable plan, policy, or regulation related to alteration of coastal landforms and processes adopted for the purpose of avoiding or mitigating an environmental effect.

3.9.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have adverse effects on water resources, including water quality and water quantity; as well as on coastal landforms and physical processes, which are addressed in this section due to their relationship to the waters of the Pacific Ocean. In addition, the analysis will consider the context, duration, and intensity of any identified adverse effects related to water resources in the project vicinity with impact intensity based on the descriptions in the following tables.

Water Quality

Impact Intensity	Impact Description
Negligible:	Impacts to existing surface and groundwater hydrology and water quality would be imperceptible or would be improved.
Minor:	Impacts to existing surface and groundwater hydrology and water quality would be slightly perceptible and localized, without the potential to expand if left alone. Where water quality data were available, minor impacts (chemical, physical, or biological effects) would be those that would be well below water quality standards or criteria, and would be within the historical or desired water quality conditions.
Moderate:	Impacts would be apparent and have the potential to expand. Where water quality data were available, moderate impacts (chemical, physical, or biological effects) would be those that would be at or below water quality standards or criteria; however, for adverse effects, historical baseline or desired water quality conditions would not be met on a short-term basis. Beneficial impacts (chemical, physical, or biological effects) would be those that would be equal to or above water quality standards or criteria, and would be within the historical or desired water quality conditions.
Major:	Impacts would be substantial, highly noticeable, have the potential to expand and could be permanent. Where water quality data were available, major impacts (chemical, physical, or biological effects) would be those that would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; or for adverse effects chemical, physical or biological water quality standards or criteria would not be met on a short-term basis. Beneficial impacts (chemical, physical, or biological effects) would be those that would be above water quality standards or criteria, and would be within the historical or desired water quality conditions on a frequent basis.

Floodplains

Impact Intensity	Impact Description
Negligible:	There would be no change in the ability of a floodplain to convey or store floodwaters, or its values and functions. The project would not contribute to a flood.
Minor:	There would be a change in the ability of a floodplain to convey or store floodwaters, or its values and functions. The change would be barely quantifiable and local. The project would not contribute to a flood. No mitigation would be required.
Moderate:	There would be changes in the ability of a floodplain to convey or store floodwaters, or its values and functions. The changes would be quantifiable and local. For adverse impacts, the project could contribute to a flood. The adverse impact could be mitigated by modification of proposed facilities in floodplains.
Major:	There would be changes in the ability of a floodplain to convey or store floodwaters, or its values and functions. The changes would be quantifiable and widespread. For adverse impacts, the project would contribute to a flood. The adverse impact could not be mitigated by modification of the proposed facilities.

Coastal Processes

Impact Intensity	Impact Description
Negligible:	Coastal landforms and physical processes would remain unchanged, or any change would be at such low levels of detection that it would not have a discernible effect on resources or public safety.
Minor:	Alterations of coastal landforms and/or physical coastal processes would be detectable but localized, and would not have an appreciable effect on resources or public safety. No mitigation would be required.
Moderate:	Alterations of coastal landforms and/or physical coastal processes would be readily apparent and long-term, with substantial, noticeable changes in risks to the public and/or the environment over an area local to the project site. The adverse impact could be mitigated by modification of proposed facilities and/or maintenance practices.
Major:	Alterations to coastal landforms or physical coastal processes would be readily apparent and long-term, and would result in substantial changes in risks to the public and the environment throughout the study area. The adverse impact could not be mitigated by modification of the proposed facilities and/or maintenance practices.

3.9.3.3 Criteria and Thresholds with No Impact or Not Applicable

Based on Project characteristics and the water resources in the area, no impacts are anticipated with respect to the following topics, and they are not discussed further:

g) ***Placement of Housing within a 100-Year Flood Zone.*** The Project does not propose the construction of housing, so there would be no impact related to the construction of housing within a 100-year flood zone. Therefore, this criterion is not applicable to the Project and is not discussed further.

i) ***Exposure to Flooding from Failure of a Levee or Dam.*** The Project components are not located within a zone of potential inundation due to levee or dam failure. Therefore, there would be no impact related to potential flooding from failure of a levee or dam. Therefore, this aspect of criterion i is not applicable to the project and is not discussed further. The Project's potential to expose people or structures to a significant risk of loss, injury or death involving flooding not related to failure of a levee or dam is addressed in Section 3.9.5.1 under Impact HYD-5.

3.9.4 Methodology and Assumptions

The analysis of impacts considers whether the Project and alternatives would alter an existing hydrologic or water quality related condition as well as the duration and the intensity of any such change. Direct impacts are those resulting from the Project and occur at the same time and place. Indirect impacts are caused by the Project, but can occur later in time or farther removed in distance while still reasonably foreseeable and related to the proposed action. Impacts are identified and evaluated based on relevant CEQA, NEPA, NPS, and local standards, policies, and guidelines.

The analysis of Project impacts on hydrology and water quality addresses the Project construction phase (short-term) and the operation and maintenance phase (long-term). Short-term effects include direct impacts such as the release of sediments or hazardous substances into downgradient or downstream water bodies. Long-term direct impacts relate to potential changes in Lake Merced water quality and hydrology, beach erosion, and local flooding hazards. Specifically, this evaluation considers, in part, how Project operation may indirectly influence future stratification and eutrophication conditions in Lake Merced. In particular, it focuses on the effects of depth increases and nutrient levels on the two key indicators of Lake "health," algal concentration (chlorophyll a) and Lake clarity (Secchi depth) and the primary factors (e.g., stratification, mixing frequency, nutrient concentrations, extent of constructed wetland treatment) that control them.

Analysis of potential water quality effects to Lake Merced considers stormwater quality for a range of constituents within the context of those Project elements that are designed to maintain or improve the water quality of Lake Merced. This includes, for example, consideration of regulatory controls for water quality, and the relative volume of Canal flows as compared to overall lake volume. Specifically, this evaluation considers, in part, how Project operation may indirectly influence future stratification and eutrophication conditions in Lake Merced. In particular, it focuses on the effects of depth increases and nutrient levels on the two key indicators of Lake "health," algal concentration (chlorophyll a) and Lake clarity (Secchi depth) and the primary factors (e.g., stratification, mixing frequency, nutrient concentrations, extent of constructed wetland treatment) that control them.

The impact analysis on hydrology and water quality considers compliance with laws, regulations, and mandatory regulatory permit-prescribed actions that reduce adverse effects of implementation. Additionally, consideration is given to implementation of Project-specific plans (such as the Lake Management Plan), operational criteria, and physical water quality control measures (such as the use of treatment wetlands) that are specifically designed to ensure that both direct and indirect hydrology and water quality-related impacts are avoided or minimized. Where Project impacts remain substantial even after such actions are implemented, mitigation measures are proposed to reduce the severity of the Project impacts.

3.9.5 Impact Analysis

3.9.5.1 Proposed Project

CEQA Analysis

a, e, f) Impact HYD-1: Project construction could violate water quality standards and/or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality. (Less than Significant with Mitigation)

Project construction could result in violation of water quality standards or waste discharge requirements, or otherwise degrade water quality as a result of construction-related soil disturbance, discharge of construction stormwater, or in-water construction activities. Additionally, fuels and other chemicals used during construction could also degrade the water quality of receiving waters if spilled and entrained into stormwater runoff or dewatering discharges. Potential construction-related water quality impacts are assessed and discussed below for the following Project-related construction activities:

- Stormwater runoff from construction sites and receiving water quality;
- Dewatering activities relating to excavation;
- In-water work and dewatering of construction areas to be isolated by a cofferdam;
- Stormwater diversions during Tunnel construction; and
- Construction of Lake Management Plan (LMP) related improvements.

HYD-1a: Construction Site Stormwater Runoff

This section addresses water quality effects related to stormwater runoff from soil disturbance associated with construction activities, which is a common source of pollutants to receiving waters such as Lake Merced and the Pacific Ocean. During construction of the various Project components, water quality could be affected by grading and earthmoving operations, which would expose soil during construction and could result in erosion and excess sediments loads in stormwater runoff. In addition, the use of fuels and other chemicals during construction could be spilled and carried in stormwater runoff, and other construction activities could generate stormwater pollutants such as trash and excess materials. The primary stormwater pollutant at construction sites is excess sediment. Excess sediment can cloud the water, which reduces the amount of sunlight reaching aquatic plants, clog fish gills, smother aquatic habitat and spawning areas, and impede navigation in our waterways. Sediment also transports other pollutants such as nutrients, metals, and oils and greases. Construction activities can impact a construction site's runoff sediment supply and transport characteristics both during and after the construction phase.

As a discharger, Daly City must comply with the requirements of Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ, otherwise referred to as the CGP. The CGP authorizes discharges of stormwater associated with construction activity so long as the dischargers comply with all requirements, provisions, limitations and prohibitions in the permit. The appropriate Legally Responsible Person (LRP) must obtain coverage under the CGP. To obtain coverage, the LRP or the LRP's Approved Signatory (such as a construction contractor) must file Permit Registration Documents (PRDs) prior to the commencement of construction activity. Failure to obtain coverage under this CGP for storm water discharges to waters of the United States is a violation of the CWA and the California Water Code.

The CGP requires the development of a site-specific SWPPP. The SWPPP must include the information needed to demonstrate compliance with all requirements of the CGP, and must be kept on the construction site and be available for review. The discharger shall ensure that a Qualified SWPPP Developer (QSD) develops the SWPPP and only a QSD may revise or amend a SWPPP for a project site. To ensure proper site oversight, the CGP requires a Qualified SWPPP Practitioner (QSP) to oversee implementation of the BMPs required to comply with the CGP. The discharger must ensure that all BMPs required by the CGP are implemented by a QSP. A QSP is a person responsible for non-storm water and stormwater visual observations, sampling and analysis. Specifically, the SWPPP shall be designed to address the following objectives:

- All pollutants and their sources, including sources of sediment associated with construction, construction site erosion and all other activities associated with construction activity are controlled;
- Where not otherwise required to be under a Regional Water Board permit, all non-storm water discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in storm water discharges and authorized non-storm water discharges from construction activity to the applicable defined standard;
- Calculations and design details as well as BMP controls for site run-on are complete and correct, and
- Stabilization BMPs installed to reduce or eliminate pollutants after construction are completed.

To demonstrate compliance with requirements of the CGP, the QSD must include information in the SWPPP that supports the conclusions, selections, use, and maintenance of BMPs implemented for use. Further, the discharger must make the SWPPP available at the construction site during working hours while construction is occurring and make the SWPPP available upon request by a State or Municipal inspector. When the original SWPPP is retained by a crewmember in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing must be left with the field crew and the original SWPPP must be made available via a request by radio/telephone.

The SWPPP is a standard requirement, is based upon the approved final Project, would be prepared prior to Project implementation, and would specify established BMPs, such as specific materials and methods for controlling sediment (such as use of check dams and fiber rolls for reducing erosion on slopes and retaining sediment in stormwater) that would be implemented during construction. BMPs are typical measures that exist as part of the established legal framework of the CGP applied and undertaken to control degradation of surface water by preventing soil erosion or the discharge of pollutants from the construction area. Compliance with the CGP, including preparation and implementation of the SWPPP and associated BMPs as well as inspection and reporting, would effectively reduce and minimize degradation of surface water quality and thus, the potential for degradation of water quality, including ocean water quality where construction actions take place in coastal locations, to a *less-than-significant* level. The required adherence to these requirements would also effectively reduce potential impacts associated with spills or leaks of hazardous materials and stormwater quality during construction and thus, impacts would be *less than significant*.

Further, and in addition to the requirements of the CGP, the Project components constructed in the Canal construction area (summarized in Table 2-1), where served by the SFPUC separate storm sewer system, would also be subject to compliance with the SFPUC Stormwater Management Plan measures to minimize stormwater pollution in areas of San Francisco that are served by separate storm sewer systems, as described in Section 3.9.2.2, above. In accordance with Article 4.1 of the San Francisco Public Works Code, and consistent with the SFPUC's Water Pollution Prevention Program, Daly City would be required to develop and implement an Erosion and Sediment Control Plan specifying measures to prevent stormwater pollution and control runoff at each applicable site. The plan must include the following information: location and perimeter of the site; location of nearby storm drains and/or catch basins; existing and proposed roadways and drainage pattern within the site; and a drawing or diagram of the sediment and erosion control devices to be used on site. At a minimum, the plan would also contain a visual monitoring program and a chemical monitoring program for nonvisible pollutants. The Erosion and Sediment Control Plan would also specify minimum BMPs related to housekeeping (storage of construction materials, waste management, vehicle storage and maintenance, landscape materials, pollutant control); non-stormwater management; erosion control; sediment control; and run-on and runoff control. Control of storage and use of hazardous materials at the Project site during construction activities, as well as all required BMPS related to non-stormwater management; erosion control; sediment control; and run-on and runoff control would be conducted in compliance with all measures specified in the required SFPUC Stormwater Management Plan, as well as the Erosion and Sediment Control Plan. Additional BMPs could also be required as part of the Stormwater Management Plan and/or the Erosion and Sediment Control Plan to protect water quality of Lake Merced beyond the minimum monitoring and BMP requirements described above. Additional BMPs could include activities such as implementation of more stringent runoff controls; soil stabilization measures for active construction areas; use of linear sediment controls along any exposed slopes; use of designated site access points that employ effective controls to eliminate off-site tracking of sediment; more stringent inspection and record keeping requirements for BMPs implemented at the construction site; and advanced planning for a rain event to ensure that measures are in place to prevent a discharge of sediment or construction-related materials to Lake Merced, and to respond to a release if one occurred. The construction contractor would be required to develop and implement the Erosion and Sediment Control Plan prior to construction and the SFPUC may conduct routine inspection of all BMPs. Such additional BMPs, if required as part of the construction permits and approvals, would be in addition to the requirements described under the CGP and would further reduce and minimize degradation of surface water quality during construction.

Impact Summary: Construction Site Stormwater Runoff

Compliance with the CGP, including preparation and implementation of the SWPPP and associated BMPs, inspection and reporting requirements, as well as implementation of construction site stormwater requirements associated with San Francisco ordinances would effectively reduce and minimize degradation of surface water quality, including ocean water quality, and would ensure that water quality impacts related to stormwater runoff during construction would be *less than significant*.

HYD-1b: Excavation Related Construction Dewatering

This section addresses water quality impacts from expected excavation related dewatering activities. As described in Section 2.5.8, it is possible that subsurface excavation during Project construction could intercept shallow groundwater tables and dewatering could be required to maintain a reasonably dry working environment so that construction activities may proceed. Dewatering would be required during excavations for the box culvert, diversion structure, Lake Merced portal, and Tunnel. Dewatering typically would involve pumping water out of the excavated area into holding tanks and, following appropriate on-site treatment, discharging the water over land or into San Francisco's combined or separate sewer system, or to the Vista Grande Canal. While it is not anticipated that dewatering would generate contaminated water that would require special handling or disposal, the contractor shall have the necessary facilities (portable water treatment units located in the staging areas) to collect, handle, and treat flows that may be contaminated with cementitious products, silts and sediments, oil and grease derived from equipment, and other potential contaminants (see Section 2.5.8). Discharge water quality would be tested and maintained in accordance with dewatering discharge permit requirements.

Under the Clean Water Act, Section 402, discharging pollutants to receiving waters of the United States is prohibited unless the discharge is in compliance with an NPDES permit. Thus, discharge of non-stormwater from a trench or excavation that contains sediments or other pollutants to sanitary sewer, storm drain systems, or receiving waters is prohibited without first securing appropriate NPDES permit authorization. Discharge of uncontaminated groundwater from dewatering is conditionally exempted by the RWQCB and construction dewatering activities involving uncontaminated groundwater would be covered by requirements of the CGP (described above). The State Water Board recognizes within the CGP that certain non-storm water discharges may be necessary for the completion of construction projects. Authorized non-storm water discharges may include uncontaminated ground water dewatering, and other discharges not subject to a separate general NPDES permit adopted by a RWQCB. The CGP authorizes such discharges provided they meet the following conditions:

- are infeasible to eliminate;
- comply with BMPs as described in the SWPPP;
- filter or treat, using appropriate technology, all dewatering discharges from sedimentation;
- meet the Numeric Action Limits (NALs) for pH and turbidity; and
- do not cause or contribute to a violation of water quality standards.

However, the removed water could potentially be contaminated with chemicals released from construction equipment, sediments from excavation, or, although unlikely (see Section 3.8, *Hazards and Hazardous Materials*), from contaminated groundwater from offsite sources. If the removed water is found to be contaminated, excavation dewatering will be collected, handled, and treated on-site using the portable treatment units described in Section 2.5.8 and discharged in compliance with requirements of the CGP or a separate NPDES permit. Discharges of dewatering flows to vegetated upland areas are conditionally exempt provided they meet the water quality criteria in the CGP after testing for possible pollutants. California Water Code Section 13269 authorizes the RWQCB to waive Waste Discharge Requirements (WDRs) for specific discharges or specific types of discharges to land where such a waiver is consistent with any applicable state or regional water quality control plan. Therefore, disposal of dewatering discharge would be required to comply with State permit conditions, either an NPDES Permit, or a waiver (exemption) from the RWQCB.

Alternatively, a permit from local agencies for discharge to storm sewers, which would establish discharge limitations for specific chemicals (if they occur in the dewatering flows) to reduce potential impacts to water quality, could be obtained. The control measures would be implemented by Daly City during construction activities at the Project site. Should any dewatering activities associated with the Project result in discharges to the SFPUC sewerage system, such discharges would be required to be conducted in accordance with Article 4.1 of the San Francisco Public Works Code, as supplemented by Order No. 158170, and would require a permit from the SFPUC. Under Article 4.1 of the San Francisco Public Works Code. Industrial waste discharge limits are imposed on groundwater dewatering discharges to the sewerage system, which covers both the combined system and separate sanitary and stormwater systems. Daly City (or the construction contractor) would be required to submit its plans to the Wastewater Enterprise division of the SFPUC for review and approval of a permit for any planned groundwater dewatering discharges during Project construction. This permit would contain appropriate standards to regulate the quantity and quality of discharges and could require the installation of meters to measure the volume of discharge.

Impact Summary: Dewatering

All Project-related dewatering discharges would be performed in accordance with regulatory requirements; therefore, impacts related to violating water quality standards or degrading water quality due to discharges of groundwater during construction dewatering would be *less than significant.*

HYD-1c: In-Water Work

This section addresses the water quality impacts to Lake Merced from dewatering in-water construction areas that would be isolated through use of a cofferdam to create a dry work environment. Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake, and of the Lake Merced overflow structure in South Lake, could result in discharges of pollutants to Lake Merced directly, resulting in substantial water quality effects. Mitigation Measure 3.4-2 in Section 3.4, Biological Resources, requires the installation of a cofferdam around Lake Merced in-water work areas, as well as dewatering of the isolated work areas to avoid impacts to sensitive species. Waters isolated within cofferdam areas have a high potential to contain high concentrations of sediment as a result of the level of ground disturbance within the isolated work area. The direct discharge of such waters from the cofferdam areas to Lake Merced could result in localized increases in suspended sediment and turbidity that persist for the duration of dewatering activities. Further, the dewatering discharge from the Lake Merced outlet structure cofferdam area would be directed to Impound Lake, a relatively small water body with little capacity to dilute or disperse such turbidity increases. If the water from the isolated work areas were discharged directly to Lake Merced, these discharges could violate water quality standards or substantially degrade water quality resulting in a potentially *significant* water quality impact. However, **Mitigation Measure 3.9-1, Implement Dewatering BMPs for In-Water Work**, would reduce this potential impact on water quality to a *less-than-significant* level by requiring the implementation of standard BMPs to remove sediment from the dewatering discharge directed to receiving waters and to control the rate of discharge such that adverse effects related to runoff, flooding, and damage to adjacent structures would not occur.

Mitigation Measure 3.9-1: Implement Cofferdam Dewatering BMPs for In-Water Work

If dewatering discharge produced during construction of the Lake Merced outlet and overflow structures is not discharged to the sewer system, a requirement shall be included in construction specifications that requires the construction contractor(s) to implement standard BMPs developed and approved by Daly City for the treatment of sediment-laden water produced during cofferdam dewatering activities. BMPs could include discharging water through filtration media, such as filter bags or a similar filtration device, or allowing the cofferdam dewatering discharge to infiltrate into the soil. If infiltration is used, application of the dewatering discharge shall be conducted at a rate and location that does not allow runoff into Lake Merced or drainage conveyances, such as storm drains, and does not cause flooding or runoff to adjacent properties. The dewatering discharge shall also be conducted at a rate that does not allow ponding, unless the ponding is a result of implementing BMPs to reduce the velocity of the flow and occurs within constructed containment, such as an excavation or berm with no outlet. The discharge must also be applied at a sufficient distance from building foundations or other areas that could be damaged from ground settling or swelling. Alternatively and if feasible, the filtered dewatering effluent could be used for construction dust suppression. Any BMPs developed and implemented shall remove sediment in a manner sufficient to meet the Water Quality Objective for turbidity as specified in the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan). Specifically, receiving waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses and increases in turbidity related to dewatering discharges shall not be greater than 10 percent in areas where natural turbidity is greater than 50 Nephelometric Turbidity Units (NTU).

Significance after Mitigation: Less than Significant.

HYD-1d: Stormwater Diversions to Lake Merced during Tunnel Construction

This section addresses the water quality impacts of temporarily diverting storm flows to Lake Merced during the Tunnel construction period when the Tunnel would not be available for use to discharge flows in the Canal via the Ocean Outlet. Construction of the proposed Canal improvements and diversion structure would be completed prior to commencement of Tunnel construction. During the Canal construction phase, Canal flows would be diverted around the construction area via a bypass pipeline to the Tunnel for discharge via the Ocean Outlet, as occurs under existing conditions. Once construction of the diversion structure is completed, Tunnel construction would commence and would occur prior to construction of the treatment wetlands. During Tunnel construction (estimated to be 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling), Canal flows could not be conveyed through the Tunnel for discharge via the Ocean Outlet as such conveyance would interfere with Tunnel construction activities.

During Tunnel construction, all Canal flows would be diverted directly to Lake Merced via the proposed diversion structure. It is also proposed that base flows and some stormflows be diverted to the SFPUC combined sewer system. Daly City and the SFPUC are under discussion to route base flows (average of 0.25 cfs) and the first hour of some storm flows that follow a long antecedent dry period to the SFPUC combined sewer system. However, Daly City and SFPUC have not completed an agreement for such diversions. Therefore, the impact analysis presented below first assesses the potential impacts of temporarily diverting all Canal flows to Lake Merced during the tunnel construction period, and then considers the scenario where base flows and some storm flows that follow a long antecedent dry period are diverted to the SFPUC combined sewer system.

Scenario 1: Diversion of All Canal Flows to Lake Merced During Tunnel Construction

As described above, the proposed agreement between Daly City and the SFPUC to route base flows and the first hour of some storm flows to the SFPUC combined sewer system is not yet in place, and the determination of the antecedent dry period that would ultimately be used under that agreement has also not yet been determined. In the event that the SFPUC combined sewer system is not available for one or more storms with a long antecedent dry period, all water flowing into the Canal during the Tunnel construction period would be diverted to Lake Merced. The long-term water quality impacts related to diverting stormwater flows to Lake Merced are assessed under Impact HYD-8, below. The water quality impacts assessed under Impact HYD-8 differ somewhat as compared to the analysis of the specific short-term limited water quality effects on Lake Merced receiving waters during the Tunnel construction period. Impact HYD-8 assesses water quality impacts under the defined operational protocols for the proposed Project (as described in Section 2.6.1). The operational protocols for the Project include diversion protocols for routing of stormflows directly to Lake Merced when the lake is below the target WSE, as would be the case during the Tunnel construction phase, but also include protocols for Canal flows to be routed through constructed treatment wetlands prior to diversion to Lake Merced or to be discharged via the Vista Grande Tunnel and Ocean Outlet. During Tunnel construction, the constructed treatment wetland would not yet be operational and all Canal flows would be diverted directly to the Lake. Therefore, the following analysis focuses on the temporary (17- to 37-month) Tunnel construction period diversion of Canal flows to Lake Merced to determine if such temporary diversions would result in an impact to water quality.

Canal water quality was assessed (see Section 3.9.1.3) as having characteristics typical of urban stormwater and authorized non-stormwater flows for a broad range of constituents (such as nutrients, metals, total suspended solids, biological and chemical oxygen demand, and bacteria). To assess the water quality impacts on Lake Merced from the direct diversion of stormwater from the Canal, Daly City and SFPUC conducted a six-year pilot Canal stormwater diversion project to the Lake during the wet seasons 2003/2004 through 2008/2009 (EOA, 2011). Results of the pilot stormwater diversion project are presented here for key constituents (bacteria, metals, and nutrients) and discussed in the context of potential water quality impacts to Lake Merced during the Tunnel construction period.

For bacteria and microorganism concentrations, EOA (2011) concluded that concentrations of E. coli and Enterococcus, which were elevated in the Canal stormwater during diversion events as compared to baseline concentrations in the Lake, did result in temporary short-term localized increases within Lake Merced receiving waters surrounding the diversion outlet. However, post diversion water quality monitoring demonstrated that localized increases in bacteria concentrations were typically reduced by approximately 99 percent (as measured near-shore and at a Lake background station) 48 to 72 hours after cessation of stormwater diversions. Other water quality constituents, such as metals, also elevated in Canal stormwater as compared to the Lake, were generally not elevated above background Lake concentrations when measured 48 to 72 hours following cessation of a diversion event. Stormwater temporarily directly diverted to Lake Merced during the short-term Tunnel construction period would contribute some annual average nutrient concentrations (mainly nitrogen) in excess of the concentrations described during the Project operational phase (discussed in Impact HYD-8, below) for a limited number of storm events. Such short-term temporary diversions for a limited number of rainfall events over a construction period of 17 to 37 months would not result in any substantial measurable increase of algae in the Lake (Horne, pers. comm. 2015). Such a short-term temporary and limited increase in annual nutrients would also not result in eutrophication and would not significantly change the temperature, DO, and pH profiles as compared to baseline. Additionally, any minor short-term increases in algae concentrations that result from the limited diversions of stormwater implemented during the construction period would not be discernible to the human eye and would subsequently decrease following completion of the constructed treatment wetland and implementation of the in-lake treatment measures (described in detail specifically in the context of long-term nutrient concentrations under Impact HYD-8, below). Therefore, the temporary direct diversion of all Canal flows to Lake Merced during the Tunnel construction period would not result in discernible increases of water quality constituent concentrations, such as bacteria, metals, and nutrients, above background Lake concentrations in a manner that would have discernible impacts on or directly degrade Lake Merced water quality. Also, such temporary construction-related stormwater diversions would be monitored and analyzed as part of the LMP (assessed in detail under Impact HYD-8).

Further, the water quality monitoring conducted in support of the proposed Project confirmed that the water quality of Canal flows varies considerably over the course of the wet season. Such variability was included in the water quality model analysis presented in the WQA (ESA, 2015). As described in the WQA, to address such water quality variability between storm events, loading of key water quality constituents to Lake Merced was estimated as a cumulative total for the five wet season months and the seven dry season months for both storm flows and base flows. These loading estimates for key water quality constituents were assessed in the context of Lake background concentrations and total Lake volume that these flows would be mixed with. As shown in Table 3.9-3, flows from the storm events monitored in 2012 each represented less than 1 percent of the Lake volume (5,625 acre-feet). Average base flow volume is estimated at 0.5 acre-feet per day and on a cumulative annual basis represents 0.01 to 0.02 percent of the Lake volume. Also, the model analysis presented in the WQA calculated the seasonal average concentrations of key water quality constituents in stormwater and in base flows to assess potential water quality impacts. Because such an assessment methodology considered and addressed considerable water quality variability in Canal flows, as well as the volume of storm events as compared to overall Lake volume, and because of the short-term nature of the Tunnel construction period, the proposed diversions during the Tunnel construction period do not significantly deviate from the range of water quality variability or the cumulative seasonal concentrations considered under the WQA. Therefore, the addition of all Canal flows to Lake Merced during the temporary Tunnel construction period would not substantially alter the conclusions relating to long-term water quality impacts assessed using model analysis and described in detail in the WQA (discussed under Impact HYD-8, below), which demonstrate that long-term temperature, DO, and pH profiles in Lake Merced are not predicted to change significantly and beneficial uses associated with water quality are also not predicted to be adversely affected.

Scenario 2: SFPUC Diversion Scenario

With agreement between Daly City and SFPUC, following installation of a temporary diversion pipeline, base flows and the first hour of storm flows following a defined antecedent dry period would be routed to the SFPUC combined sewer system. Daly City and SFPUC would identify and define an antecedent dry period that would afford the maximum protection to Lake Merced receiving waters while not contributing flow that exceeds the conveyance or treatment capacity of the SFPUC combined sewer system. While that antecedent dry period has not yet been defined, the impacts analysis considers the range of antecedent dry periods (maximum and minimum) within which the actual defined antecedent dry period will be selected. Based on a 55-year historical record of rain from the National Climactic Data Center’s San Francisco Oceanside, and considering rain events of at least 0.15 inches with an inter-event duration of at least 6 hours, there would be approximately nine annual events with a 7-day antecedent dry period, five annual events with a 14-day antecedent period, and three annual events with a 28-day antecedent period. Thus, the range of frequency of such diversions would be between nine and three events diverted per year covering an antecedent dry period range of between 7 and 28 days. The first hour of such storm flows would not be diverted to Lake Merced but would be routed through the Canal, retained, and conveyed into the SFPUC combined stormwater sewer system for treatment and disposal via the Lake Merced Transport overflow structure. During these storm events, Canal flow would accumulate behind a temporary dam located just upstream of the tunnel portal, and accumulated storm flow would be simultaneously pumped at a rate of 20 cfs into SFPUC's system. If storm flows exceed the pumping rate, the main Canal control gates at the diversion structure would be closed when the Canal has filled to the defined upper level, retaining up to 1.5 million gallons (MG). The remaining retained water in the Canal from the initial diversion and retention would continue to be conveyed to the SFPUC system (with a maximum retained volume of approximately 1.5 MG, an additional 2.75 hours of pumping may occur) (Brown and Caldwell, 2015). Newly arriving stormwater after the control gates have been closed would flow into Impound Lake via the Lake Merced outlet structure. Because the debris screening device would be in place prior to the start of Tunnel construction, all flows including those going to the SFPUC combined sewer system and those going to Lake Merced would be screened through this device. The screening device would remove trash and constituents associated with larger particles (5 mm screen) in the stormwater. Diverting stormflows that follow a long antecedent dry period to the SFPUC combined sewer system for treatment and disposal would further reduce temporary short-term localized increases of sediment concentrations in Lake Merced receiving waters near the outlet structure from diverted stormflows, as described above, as well as the concentrations of associated pollutants such as bacteria, metals, and nutrients.

Impact Summary: Stormwater Runoff during Tunnel Construction

The direct diversion of all construction period stormwater to Lake Merced would cause short-term localized increases in bacterial, metals, and nutrients concentrations in the receiving waters in the immediate vicinity of the diversion outlet (sub-surface), but monitoring conducted by Daly City and SFPUC (EOA, 2011) demonstrates that concentrations typically rapidly equilibrate with the background levels in the Lake within 48 to 72 hours following a diversion event. Such temporary diversions would result in an estimated increase of algae in summer in the Lake, but only equal to a level that would be at the lower range of that which would be analytically detectable from background over a few years and would subsequently decrease following completion of the constructed treatment wetland and implementation of the in-lake treatment measures (discussed in detail under Impact HYD-8, below). Therefore, the short-term direct diversion of Canal flows to Lake Merced would not have discernible impacts on the nutrient concentrations of Lake Merced and would not result in discernible long-term increases of water quality constituent concentrations, such as bacteria, metals, and nutrients, above background Lake concentrations in a manner that would have discernible impacts on or directly degrade Lake Merced water quality. With successful agreement between Daly City and the SFPUC to route base flows and the initial hour of stormflows (up to a maximum diversion rate of 20 cfs) with a long antecedent dry period to the SFPUC combined stormwater sewer system for treatment and disposal, this diversion would reduce any such projected temporary short-term localized increases of sediment, metals, nutrients, and bacteria in the Lake. Therefore, short-term construction-related stormwater diversions to Lake Merced would not violate water quality standards, waste discharge requirements, provide substantial additional sources of polluted runoff or otherwise substantially degrade water quality in Lake Merced. Additionally, long-term temperature, DO, and pH profiles in Lake Merced are not predicted to change significantly (based on model analysis presented in the WQA) as a result of Tunnel construction period stormwater diversions and beneficial uses associated with water quality are also not predicted to be adversely affected. The impact would be *less than significant.*

HYD-1e: Lake Management Plan Implementation

In addition to the Project components to be constructed during Project initiation (and analyzed above), as described in Section 2.6.4, the Project includes a Lake Management Plan that includes an initial operational plan for the diversion of stormwater from the Canal to Lake Merced, a Lake monitoring plan to assess trends in hydrology and water quality, and a prioritized suite of best management practices (BMPs), that may be implemented by Daly City and SFPUC, in conjunction with regulatory adjustments to reflect site-specific conditions. The need to implement BMPs, such as detention and filtration systems, catch basin screens, and habitat enhancements around Lake Merced, would be determined during the project operations; however, the potential impacts of construction of such improvements is identified here to the extent possible (whereas the potential effects of operating such BMPs are assessed under Impact HYD-8, below). Further, operation of Lake Merced at the selected water level elevation could require that SFPUC implement facility improvements, such as to boat docks or other recreation areas (see Section 2.6.4, Lake Level Management).

In addition to the potential actions identified in the list of proposed BMPs, a measure involving the potential installation of an aeration system within the Lake by SFPUC is included in the Lake Management Plan. Aeration mixing could be achieved by installing a bubbler device (air lines and bubble diffusers) near the lake bottom and an air compressor(s) on shore to create a mixing force that causes circulation of lake waters so the lower layer of low-DO water is mixed with upper waters with higher DO concentration to reduce or eliminate anoxic conditions. Construction of an aeration system could require construction of an on-shore pump station to house the air compressors and placement of the bubbler devices on the lake bed.

The impacts of constructing physical improvements, such as detention and filtration systems, catch basin screens, habitat enhancements around Lake Merced, facility improvements associated with lake level increases, and installation of an aeration system, would likely result in minor construction-related water quality impacts similar to those described for Project facilities, above. Implementation of construction site stormwater requirements developed to comply with the CGP and other municipal stormwater regulations, as well as construction-related dewatering permit requirements, would ensure that water quality impacts related to stormwater runoff and dewatering activities during construction of the potential improvements within the Vista Grande Basin storm drain system upstream of the Vista Grande Canal and/or around Lake Merced would be *less than significant*. However, implementation of the improvements described in the LMP or facility improvements associated with lake level increases could require additional CEQA and/or NEPA review prior to implementation (see Section 1.2, Intended Use of the EIR/EIS and Agency Roles, Permits, and Decisions).

b) Impact HYD-2: The Project could deplete groundwater supplies or interfere substantially with groundwater recharge. (Less than Significant)

The Project would not lower the groundwater table as a result of groundwater extraction or through a substantive reduction in groundwater recharge. Project impacts relating to groundwater supplies and groundwater recharge are assessed below for both the construction phase and the operation phase.

Construction

Excavation during Project construction could intercept the shallow groundwater table and could require dewatering. As discussed in detail in Section 3.6.1.2, *Geology*, groundwater depths vary across the Project site. Groundwater in the vicinity of the Canal improvement components of the Project is approximately 21 feet below ground surface (bgs) or 5.6 feet City Datum. Groundwater in the vicinity of the Tunnel and associated structures is about 172 feet bgs, or -0.6 feet City Datum. Project construction-related subsurface excavation may encounter groundwater. As described in Section 2.5.7.3, if water were to accumulate in an open excavation as a result of groundwater seepage, dewatering could be required to maintain a dry working environment so that construction activities may proceed. Such dewatering could be required during excavations for the box culvert, diversion structure, east portal, and tunnel. At the box culvert, diversion structure, and Lake Merced (east) portal excavations, inflows are anticipated to be low because groundwater levels are no more than a few feet above the bottom of the excavations. Based on inflows to the existing Tunnel, inflows during Tunnel construction are anticipated to be less than approximately 50 gallons per minute (gpm).

Dewatering of open excavations, when necessary, would involve pumping water out of the excavated area and discharging it as discussed in detail under Impact HYD-1, above. The affected groundwater for the majority of Project excavations (with the exception of the Tunnel) would be from the shallow aquifer, which is not used as a source of municipal drinking water. For Tunnel dewatering, water would be pumped out of the Tunnel through the shaft via discharge lines leading to holding tanks within the shaft staging area for treatment and discharge. Such dewatering activities would be minimal and temporary in nature and would not substantially affect local groundwater levels. Additionally, any impact to groundwater during construction would be confined to the immediate vicinity of the excavation. Groundwater levels would return to pre-Project conditions once construction is completed.

Operation

No long-term groundwater dewatering would be required as part of Project operation. The Project would not involve long-term groundwater extraction as part of operations and would not involve the addition of substantial new impervious surfaces that would impede groundwater recharge. If implemented, the Project would result in a net increase in Lake Merced water levels as well as an overall increase in associated recharge of the Shallow Aquifer (described in Section 3.9.1.2, above).

The Project would not substantially deplete groundwater supplies or interfere with groundwater recharge; the impact would be *less than significant*.

Mitigation: None required.

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c) Impact HYD-3: The Project could alter existing drainage patterns, causing downstream erosion or siltation. (Less than Significant)

During construction of the various Project components, soil disturbance associated with grading and earthmoving operations could expose soils to stormwater runoff, which could result in on-site erosion and sediments being transported in stormwater runoff, subsequently resulting in downstream siltation. During operation, stormwater runoff volumes and rates generated from undeveloped, unpaved areas can increase significantly when drainage patterns are substantially altered, a site is paved, the impervious surface area is increased, and the ability of surface water to infiltrate the ground surface is reduced or eliminated. The addition of impervious surfaces or the alteration of drainage patterns (such as through grading) can increase peak stormwater flows, causing erosion or siltation on-site or downstream. The Project would not involve the addition of substantial new impervious surfaces. Impacts related to erosion and siltation from soil disturbance during construction and from altered drainage patterns during Project operations are addressed below.

Construction

As discussed in detail above (Impact HYD-1 and Regulatory Setting), Project construction would be subject to the CGP requirements, which include preparation of a SWPPP as well as additional local requirements governing management of construction stormwater and the use of established BMPs for the management of erosion during construction activities. As described in Impact HYD-1, preparation and approval of the SWPPP associated with the CGP and implementation of construction site stormwater requirements developed to comply with San Francisco ordinances would include site-specific erosion and sedimentation control practices. Incorporation of these guidelines, ordinances, and permit requirements would ensure the implementation of BMPs and specific measures for the protection of water quality effective in minimizing the potential for erosion or siltation as a result of altered drainage patterns. Therefore, construction activities associated with Project implementation would not alter drainage patterns in a manner that causes downstream erosion or siltation, and the impact would be *less than significant*.

Operation

Implementation of the proposed Project would reduce the frequency of uncontrolled discharges to Lake Merced that cause flooding and erosion hazards during extreme storm events that exceed the capacity of the Canal and Tunnel. Operation of the Vista Grande Canal and Tunnel, the collection box and box culvert, the debris screening device, the constructed treatment wetland, the Lake Merced overflow structure, the treated effluent gravity line, the Lake Merced Portal, and the Avalon Canyon access road would not substantially alter the existing drainage pattern as compared to baseline in a manner that causes erosion or siltation on-site or downstream. Stormwater runoff would continue to be collected by the existing storm drains within the Basin and there would be no substantial change above the current baseline in runoff volume generated for conveyance through the system following implementation of the proposed Project elements. Stormwater runoff would continue to be conveyed through the Vista Grande Canal and Tunnel for discharge to the ocean. In addition, if stormwater flows from the Vista Grande watershed exceed the increased capacity (post-Project) of the Canal and Tunnel, flows could overtop the Canal and flow across John Muir Drive to Lake Merced, as currently occurs under baseline conditions. Flows would continue to cross the existing hardscape areas (riprap) between John Muir Drive and South Lake and erosion and siltation rates would not increase above baseline conditions. However, due to the increased capacity for stormwater conveyance, such events are likely to be reduced in frequency as compared to baseline conditions, representing a benefit of the Project.

Project implementation could, however, alter existing drainage patterns in a manner that causes downstream erosion or siltation within Impound Lake from operation of the Lake Merced outlet structure.

Flows that are directed into Lake Merced would be conveyed into the lake via an outlet structure on the western bank of Impound Lake. The diversion structure would be sized to accommodate peak flows generated by the 25-year/4-hour design storm, which is approximately 1,070 cfs. The mouth of the outlet at Impound Lake would be below the normal low WSE of 5 feet City Datum. As described in Section 2.6, a submerged layer of riprap (below elevation -1.4 feet City Datum) would be installed specifically to protect against erosion of the lake bed by water flowing into Impound Lake. The submerged rip rap would be designed to ensure that the diversion of flows up to 1,070 cfs would not result in localized erosion of Impound Lake bed and bank material as a result of concentrated flows detaching and transporting local soils in the vicinity of the Lake Merced outlet structure causing siltation in the receiving waters. Therefore, the diversion of flows into Impound Lake would not alter drainage patterns in a manner that causes downstream erosion or siltation and the impact would be *less than significant*.

Mitigation: None required.

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h) Impact HYD-4: The Project would not place within a 100-year flood hazard area structures that would impede or redirect flood flows. (Less than Significant)

As described in Section 3.9.1.2, above, the only Project component located within a SFHA is the Ocean Outlet structure located on the beach below Fort Funston. The existing outlet structure and the force main segment are currently fully exposed to the surf and waves and currently impede and/or redirect flows associated with wave action in a manner which has contributed to the ongoing erosion of the bluff face (altered drainage and erosion rates are assessed under Impact HYD-5, below). As described in Section 2.4.2, the Project would reconfigure these structures to provide protection from the surf and waves. The existing Daly City Ocean Outlet structure would be removed and replaced with a low-profile outlet structure set nearer to the existing bluff face, and would be maintained over time to remove protruding portions as the bluff continues to erode. The existing 27-inch force main may be abandoned in place, with the exposed portion that is currently protruding from the bluff face removed back to the bluff face. An existing wing wall that extends south from San Francisco's outlet against the bluff face would be extended by 70 feet to connect to the rehabilitated Daly City Ocean Outlet and an additional 100 feet to the south of the outlet to protect the bluff face. The removal of the existing outlet structure on the beach would reduce the potential to impede or redirect flood flows from waves in a manner that creates a flood hazard risk as compared to baseline conditions. Further, the Ocean Outlet is not a habitable structure for human occupancy. Additionally, construction of the proposed Ocean Outlet within the SFHA would be unlikely to displace floodwaters, raise flood elevations, create new flooding impacts (e.g., by causing flooding of existing facilities or structures that previously would not have been inundated), and/or exacerbate existing flooding problems (e.g., by increasing the severity or frequency of flooding relative to pre-Project conditions). Therefore, it is unlikely that the Project would substantially impede or redirect flood flows within a 100-year flood hazard area and the impact would be *less than significant*.

Mitigation: None required.

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d, e, i) Impact HYD-5: The Project could alter existing drainage patterns and increase the potential for flooding and could expose people or structures to a significant risk of loss, injury or death involving flooding or could result in increased stormwater runoff which would exceed the capacity of existing or planned stormwater drainage systems. (Less than Significant)

During construction of the various Project components, grading and earthmoving could alter local drainage patterns and redirect or concentrate stormflows, which could result in increased risks related to on-site and/or downstream (off-site) flooding, especially if stormwater conveyance capacity is exceeded in existing or planned stormwater systems. During the operation phase, stormwater runoff volumes and rates can increase significantly when drainage patterns are substantially altered or when the impervious surface area is increased. The Project would not involve the addition of substantial new impervious surfaces. Impacts related to flooding and stormwater conveyance resulting from the alteration of drainage patterns during Project construction and operation are addressed below.

Construction

Construction of the various Project elements, including construction activities themselves, would not result in the alteration of drainage patterns in a manner that would impede flows on the floodplain, increase the 100-year base flood elevation, or result in increased flooding or flood risks on- or off-site. Although some minor alteration to local drainage patterns could occur during the construction phase, such alterations would be temporary in nature, confined to a relatively small area, and would not result in a *significant* impact related to flooding or flood risk. Construction of the proposed Canal improvements and diversion structure would be performed during the dry season. Non-storm Canal base flow (averaging approximately 0.25 cfs) would be diverted (pumped through bypass pipeline) around the construction area to the Tunnel for discharge via the Ocean Outlet, as occurs under existing conditions. Upon completion of the diversion structure, Tunnel construction would commence (estimated to be 17 to 37 months, depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling). As described above in detail under *HYD-1d: Stormwater Diversions to Lake Merced during Tunnel Construction*, Daly City and the SFPUC are considering an agreement under which all base flows and the initial hour of storm flows in the Canal following an extended antecedent dry period would be conveyed into the SFPUC combined stormwater sewer system at a rate of 20 cfs for treatment and disposal via the Lake Merced Transport overflow structure during the 17- to 37-month Tunnel construction phase. Following the initial hour of diversion and retention, any remaining retained stormwater would continue to be conveyed to the SFPUC system (for a maximum retained volume of approximately 1.5 million gallons, representing an additional 2.75 hours of pumping at a rate of 20 cfs). Successive storm flows in the Canal following the first hour would be diverted to Lake Merced through the proposed diversion structure which has been designed to accommodate peak flows generated by the 25-year/4-hour design storm (approximately 1,070 cfs), representing an increase in stormwater conveyance capacity over existing conditions. However, discharge of base flows and some storm flows during the Tunnel construction period to SFPUC's combined sewer system could contribute to combined sewer overflows.

Because the Project site is not currently served by SFPUC's combined sewer system, any runoff to the system would result in an increase of flows in that system. Increased base flow and stormwater runoff from the Project area could potentially contribute to combined sewer overflows during the dry and wet season. As detailed below, construction of the proposed Project would not create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems and would not increase the frequency of combined sewer overflows.

Canal Base Flows

As described above, during the Tunnel construction period of 17 to 37 months, up to 0.5 cfs of base flow may be diverted into the SFPUC combined stormwater sewer system. This increase would result in an overall increase in volume of up to a maximum of 0.3 mgd. Dry weather flows to the OWPCP are currently 14 mgd, and the treatment plant has the capacity to treat up to 43 mgd to a secondary level. The increased diversion of base flows from the Project would represent a small portion of the existing dry weather flows to the OWPCP and are well within the capacity of the treatment plant. Therefore, the impact of increased flows would be *less than significant.*

Canal Storm Flows

During wet weather (typically October–May), there is a wide variation in volume of flow to the SFPUC combined system because of the addition of stormwater discharges to the sewer system. The volume of wet weather flows is directly related to the rainfall intensity, and treatment of the wet weather flows varies depending on the characteristics of any individual rainstorm. Modeling conducted by Brown and Caldwell (2015) using a simulation of the design event (intensity of 0.2 inches per hour, depth of 0.75 inches, and duration of 4 hours) concluded that the Canal would contain about 16 percent of the total volume of this event and would capture flow for just over one hour after the start of the event. Assuming a pumping rate of 20 cfs, approximately 72,000 cubic feet (0.54 MG) of storm flow would be pumped to SFPUC's stormwater system during the first hour of stormwater flow. When the Canal fills to capacity in approximately one hour, the diversion gates to Impound Lake would be opened and the Canal gates closed so that subsequent flow is diverted to Impound Lake. The remaining 1.5 MG of initial storm flow stored between the Canal gates and the temporary dam would either continue to be pumped to SFPUC's stormwater system immediately, or could be delayed as needed to allow for SFPUC's required stormflow capacity. Systemwide, flows in excess of 175 mgd (about 13 percent of the total wet weather flows) are discharged at the shoreline through one of seven Combined Sewer Overflow (CSO) structures located along the ocean coast. These overflow facilities are designed for a long-term average of eight overflows per year. As a worst case, proposed diversions to the SFPUC system during Tunnel construction would increase the volume of wet weather discharges to the combined sewer during rainfall events by an estimated 0.54 MG per event over 17 to 37 months. This increase would not result in an increase in the number of CSO discharges, and would have a negligible impact on the volume duration of the discharges. Because the worst case increased volume of stormwater discharged to the combined sewer would not increase the frequency of CSO discharges and would only minimally increase the duration of CSO discharges, and because discharges to the combined sewer system would cease following the completion of the 17- to 37-month Tunnel construction period the impact of the proposed Project on the frequency, volume, and duration of combined sewer overflows and exceeding the capacity of existing or planned stormwater drainage systems would be *less than significant*. Additionally, impacts related to flooding as a result of altered drainage patterns during construction would be *less than significant.*

Operation

The Project would not alter the existing drainage patterns, as compared to existing conditions, in a manner that would increase the potential for flooding on- or off-site. Also, the Project would not result in an increase in impervious surfaces in a manner that results in an increased volume of stormwater runoff. Rather, implementing the various Canal improvements, including the treatment wetland, and increasing the Tunnel dimensions would increase the conveyance capacity of the elements during large storm events. As described under Section 3.9.1.2, *Flooding*, the existing Tunnel, with a capacity of 170 cfs, does not have adequate hydraulic capacity to convey peak Canal storm flows (500 cfs capacity). Flows in excess of the capacity of the Canal and the Tunnel have resulted in flooding in nearby low-lying residential areas and in overflows across John Muir Drive into Lake Merced, causing property damage, bank erosion, traffic nuisances, and public safety issues. The proposed Project is specifically designed to correct this condition, improving flood safety in the vicinity of Vista Grande Canal. The Project would address local storm-related flooding issues by increasing the capacity of the Tunnel and by increasing operational flexibility relating to the routing of high-volume storm flows. As described in Section 2.6, the collection box, box culvert, gross solids screening device, and diversion structure would be sized to accommodate peak flows generated by the 25-year/4-hour design storm, which is approximately 1,070 cfs. The box culvert under John Muir Drive would also be designed to accommodate the full capacity of 1,070 cfs. The segment of the Canal between the diversion structure and the Lake Merced portal would remain unimproved, as this segment currently has an existing capacity of approximately 500 cfs. The improved Tunnel would be designed with a capacity of at least 500 cfs.

With implementation of the Project, a portion of stormwater and authorized non-storm flows in the Canal would be diverted to the Lake. These flows would pass through a debris screening device and enter a diversion structure, which would enable all or only portions of the Canal flow to be directed through a proposed constructed treatment wetland and then to the Lake, be routed directly to the Lake from the Canal, or be allowed to continue through the Canal and Tunnel to the Ocean Outlet. Additionally, as described in Section 2.6, the Project could be operated such that high-volume storm flows could be routed to Lake Merced to temporarily raise lake levels above the target WSE and subsequently back to the tunnel as capacity is available via the Lake Merced overflow structure, providing short-term storage during extreme storm events to reduce flooding and flood risks in the Vista Grande Basin.

Project operation would not impede flows on the floodplain or increase the 100-year base flood elevation or result in increased flooding on- or off-site. Overall, Project operation would decrease flood hazards to people and structures in the Project area, representing a beneficial impact, with the exception of potential localized flooding related to the proposed Lake Merced outlet structure in Impound Lake, as discussed below.

Impound Lake

The increased conveyance capacity and overall operation of the Project would largely reduce existing flood hazards and improve stormwater conveyance capacity within the vicinity of the Project area. Impound Lake and South Lake become hydraulically connected when the lake WSE reaches 5 feet City Datum (ESA, 2014a). Water then flows from Impound Lake into South Lake. If inflow to Impound Lake exceeds the capacity for outflow from Impound Lake to South Lake through the constrained hydrologic connection (described in Section 3.9.1.2) between the two water bodies for a sufficient duration the water level in Impound Lake would rise. Theoretically, water levels in Impound lake could exceed the lake bank height, causing overtopping and local flood impacts and resulting in increased flood risks to people and structures in the vicinity of Impound Lake; a potentially *significant* flood-related impact of the Project. However, under existing conditions, there is sufficient open area under the SFPUC sewer line and a pedestrian walkway (the constrained hydrologic connection) such that a water surface differential between Impound Lake and South Lake of only approximately 0.5 foot would occur at the projected peak 25-year/4-hour design storm flow of 1,070 cfs. Survey data collected in support of the Project (ESA, 2014a) allow for the calculation of the open area (potential hydrologic connection) between Impound Lake and South Lake and the characterization of flood risk during peak discharge events. Those data document an area of approximately 350 square feet available for the conveyance of stormflow to South Lake. If that area is reduced by 20 percent to reflect the observed obstructions to flow resulting from the piles supporting the SFPUC sewer line and pedestrian walkway, the net open area is approximately 280 square foot on the Impound Lake side. The opening, and available hydrologic connection, is far larger on the South Lake side, more than 50 percent greater (ESA, 2014a). Therefore, the risk of peak flows generated by the 25-year/4-hour design storm (1,070 cfs) causing the water level in Impound Lake to rise and exceed the lake bank height is minimal. Impacts related to flooding as a result of altered drainage patterns during operations would be *less than significant.*

Mitigation: None required.

a, e, f) Impact HYD-6: Project maintenance could violate water quality standards and/or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality in Lake Merced. (Less than Significant)

The maintenance requirements of the Project elements are described in detail in Section 2.6.5. Removal of sediments accumulated within the Canal would continue in a manner similar to existing conditions, but the frequency is likely to be reduced under the Project due to reduced sediment loads as a result of the gross solid screening device. Maintenance actions required under the proposed Project are also similar to existing activities and include periodic inspections of the Canal and Tunnel, the Daly City Ocean Outlet structure, the Lake Merced outlet structure, and the diversion structure. Maintenance inspections are designed to ensure Project components are maintained in good repair to ensure continued successful operations. Such routine maintenance inspections would have no impact relating to water quality. Also, long-term water quality monitoring would be conducted as part of the LMP to inform adaptive management of the Project. Such long-term monitoring would be completed through the collection of periodic water quality samples and the installation and use of scientific monitoring instrumentation (such as water quality data loggers). As with the routine inspection of the Project components, standard data collection efforts such as those described in the LMP would have no impact on water quality. The primary maintenance actions related to Project implementation that could result in the degradation of water quality involve cleaning of the gross solid screening device and those actions required for the upkeep of the constructed treatment wetlands. These two maintenance actions are assessed in more detail as follows.

Maintenance actions related to the gross solid screening device would require removal of up to 100 cubic yards of debris by use of a vacuum truck for disposal in landfill. Maintenance of the constructed treatment wetlands would be implemented in accordance with a treatment wetlands management plan that would be required as part of the RWQCB permit issued in accordance with Section 402 Policy on the Use of Constructed Wetlands for Urban Runoff (RWQCB Resolution No. 94-102) (see Section 2.10, Regulatory Requirements, Permits, and Approvals, and Section 3.9.2.1, Federal and State Regulations). Wetland maintenance activities would include mosquito control using bacterial methods that infect and kill mosquito larvae. These bacteria are highly selective, killing only mosquitoes and their close relatives like gnats and black flies, and do not harm other kinds of insects, fish, birds, or mammals. Additionally, wetland maintenance would include trash removal on an annual basis, the harvesting of bio mass approximately every 5 years, and the removal of silt and other organic material every 10 to 20 years.

The maintenance activities described above would be largely completed by hand and would affect only a highly localized area specific to the targeted action. It is unlikely that such specific actions would impact water quality. Maintenance of the Project components would not violate water quality standards, waste discharge requirements, provide substantial additional sources of polluted runoff or otherwise substantially degrade water quality in Lake Merced. The impact related to maintenance would be *less than significant*.

Mitigation: None required.

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j) Impact HYD-7: The Project would not expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow. (Less than Significant)

The proposed Project is not located in an area that would be subject to seiche or an area with geologic conditions that would generate mudflow (landslide hazards are assessed in Section 3.6, Geology and Soils). Any seiche risk associated with Lake Merced that currently exists would not be increased following Project implementation in a manner that would increase the risk of injury or death. The only Project component proposed within an enclosed body of water is the Lake Merced outlet structure within Impound Lake, a small and shallow water body not subject to seiche events. As described in Section 3.9.1.2, above, the only Project component located within a tsunami inundation zone is the Ocean Outlet structure. As noted in Section 3.9.1.2, historically, the run-ups from tsunami run-up events in the Bay Area have been only a few inches. Under the Project, the existing Ocean Outlet structure would be removed and replaced with a low-profile outlet structure set nearer to the existing bluff face, reducing the potential for the structure to be damaged during a tsunami event as compared to the existing risks under baseline conditions. As summarized in Table 2-2, construction activities related to the Ocean Outlet component would occur over approximately 5.5 months, resulting in a very short-term exposure to risk, and the likelihood of a tsunami occurring during such a period is very low. In addition, historic wave run-ups from documented events would be insufficient to cause damage or risk of injury or death during construction activities. Impacts related to risk of loss, injury, or death involving seiche, tsunami, or mudflow as a result of construction and operation of the Project would be *less than significant*.

Mitigation: None required.

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a, e, f) Impact HYD-8: Project operation could violate water quality standards, waste discharge requirements, provide substantial additional sources of polluted runoff or otherwise substantially degrade water quality in Lake Merced. (Less than Significant)

Operation of the Project would capture a portion of the existing Basin stormwater and authorized non-storm runoff that is currently conveyed to the Pacific Ocean and beneficially re-use it over the long-term to augment water levels in Lake Merced. Canal stormwater and authorized non-storm runoff would pass through a debris screening device and enter a diversion structure, which would enable all or only portions of the Canal flow to be 1) directed through the proposed constructed treatment wetland and then to the Lake, 2) be routed directly to the Lake from the Canal, or 3) be allowed to continue through the Canal and Tunnel to the Ocean Outlet as occurs under existing conditions. As described in detail in Section 2.6, Daly City and SFPUC diversion criteria and other operational protocols have been developed to determine when flows would be diverted so as to maximize beneficial reuse while attaining and maintaining Lake Merced water quality and the selected WSE. Further, the Project would reconnect a significant portion of the historic Lake Merced Watershed to the Lake, as described in Section 3.9.1.2.

As discussed in the detailed analysis below, Project operation as proposed (including use of the constructed treatment wetlands and in-lake treatments) would result in an overall water quality improvement. Operation of the Project would not violate water quality standards or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality in Lake Merced. Based on the findings of the analyses completed as part of the impact assessment, the overall effect of the Project would be an improvement in water quality that would be progressive with increases in depth. Further, operation of the in-lake management actions proposed as part of the Project would likely further improve water quality within Lake Merced.

In order to comprehensively assess and describe the water quality effects related to Project operation, including all proposed Project components, Project management and operational protocols, and potential future actions associated with adaptive management, Impact HYD-8 is structured as follows:

- **Approach to Analysis**: the approach to analysis provides context for the manner in which hydrologic changes that would occur under the Project could influence the magnitude, frequency, and duration of changes to Lake Merced water quality. In this section, the various hydrologic and water quality analyses completed in support of the Project are described.

- **Impact Assessment:** operational effects to Lake Merced water quality are first assessed in this section for the primary proposed action of the diversion of Canal flows to Lake Merced both with and without the use of a constructed treatment wetland. To assess how the diversion of Canal flows may influence the magnitude, frequency, and duration of predicted changes to Lake Merced water quality, data from the various multi-season monitoring programs (described in Sections 3.9.1.2 and 3.9.1.3) were utilized in the development of three predictive models related to changes in Lake Merced water depth, contributions of nutrients from Canal flows, and potential temperature effects of increased Lake depths. These model analyses are presented, including methodology and results, and discussed in the context of key Lake Merced water quality parameters (such as dissolved oxygen, pH, temperature, and algal concentrations). Following the model analyses, the direct impacts to Lake Merced water quality from contributions of various additional water quality constituents from Canal flows (such as nutrients, bacteria, and metals) as a result of Project operations are assessed.

- **In-Lake Treatment:** the two in-lake management actions (direct algae filtration of Lake Merced surface waters using the constructed treatment wetlands and the controlled overflow of Lake waters to the Tunnel using the siphon) for improving water quality proposed for implementation as part of the Project are assessed for predicted changes to Lake Merced water quality.

- **Impact Conclusion:** a summary analysis and impact conclusion is provided that characterizes the results of Project operation, including in-lake treatment actions as well as regulatory considerations and requirements, on Lake Merced water quality and overall Lake limnological and ecological health over the course of long-term operations.

- **Lake Management Plan:** following the analysis of long-term water quality effects from operation of the proposed Project, potential future actions that may be implemented as part of adaptive management under the LMP are assessed for direct and indirect water quality effects to Lake Merced. The LMP would ensure that adequate field monitoring is conducted to inform diversion criteria and the adaptive management framework for the Project.

- **Summary:** Following the comprehensive analysis of all the proposed Project components and operational actions, assessed independently and in concert, a summary analysis is provided that characterizes the entire range of results for the full Project, including potential future actions related to adaptive management that may be implemented under the LMP. An impact statement and conclusion is provided in the context of the relevant described CEQA significance criteria.

Approach to Analysis

This impact analysis evaluates whether Project operation would result in significant changes in water quality that could affect the beneficial uses of Lake Merced. The impact analysis is based on the relationship of lake levels to water quality. In order to assess water quality impacts related to Project operation, it was necessary to first analyze the hydrologic changes that would occur under the Project. Such hydrologic assessment is critical to the assessment of water quality-related impacts from Project operations as it provides context for the predicted frequency and duration of depth increases as well as the relative volume of Canal flows potentially diverted to Lake Merced directly or through the constructed treatment wetlands as compared to overall Lake volume.

The description of the hydrologic context and the model results of the operational hydrology is presented first, followed by the approach for assessing the magnitude, frequency, and duration of predicted changes to Lake Merced water quality resulting from the Project. The assessment of potential operational water quality impacts to Lake Merced were analyzed as part of the project-specific WQA (ESA, 2015). The approach to analyze the potential Project-related changes to existing Lake Merced water quality conditions involved predictive water quality modeling for a range of dynamic variables, described in detail below following the description of the hydrologic context for the Project.

Hydrologic Context and Lake-Level Modeling

Table 3.9-6 presents baseline sources of inflow and outflow to Lake Merced during dry (1976), wet (1965), and average (1953 to 2008, exclusive) years. As shown, inflow from stormwater and precipitation and outflow from evaporation and transpiration vary across the years. Thus, for this analysis, inflow and outflow from groundwater are assumed to be constant at 69 acre-feet and 171 acre-feet, respectively. This information was used to produce the estimates of Lake filling scenarios described below.

TABLE 3.9-6
LAKE MERCED SOURCES OF INFLOW AND OUTFLOW

Year Type	Inflow (acre-feet)			Outflow (acre-feet)			Balance
	Stormwater	Precipitation	Groundwater	Groundwater	Evaporation	Transpiration	
Dry (1976)	45	238	69	-171	-755	-134	-708
Wet (1965)	1,183	514	69	-171	-562	-128	905
Average (1953 – 2008)	218	499	69	-171	-635	-135	-155

SOURCE: ESA, 2015

WSE Scenarios

The range of potential annual mean WSE scenarios considered for the purposes of operational water quality impact analysis includes annual mean WSEs of 6.5 to 8.5 feet, with corresponding maximum high WSEs of 7.5 to 9.5 feet (see Figure 2-5, Representative Lake Level Operational Scenarios, in Chapter 2, Project Description). **Table 3.9-7** presents the estimated maximum volume of Lake Merced (all four Lakes) under the three operational scenarios. The maximum Lake volume is projected to range from 6,074 acre-feet under a target maximum WSE of 7.5 feet to 6,685 acre-feet under a target maximum WSE of 9.5 feet. The maximum change in Lake volume under each scenario was conservatively calculated by comparing projected Lake volumes under each operational scenario to the average baseline annual low water surface elevation. Lake volume could increase by as much as 1,265 acre-feet under a target maximum WSE of 9.5 feet when compared to the average annual low WSE of 5.3 feet.

TABLE 3.9-7
LAKE VOLUMES UNDER OPERATIONAL SCENARIOS WITH MAXIMUM CHANGE IN VOLUME

Water Surface Elevation (feet, City Datum)	Volume (acre-feet)	Maximum Change in Volume (acre-feet)
Average Annual Low (5.3)[a]	5,420	N/A
7.5	6,074	655
8.5	6,378	958
9.5	6,685	1,265

NOTE:
a Based on SFPUC WSE data from 2006 to 2011. The average annual low water surface elevation was chosen as the baseline in order to provide the maximum change in volume for use in the water quality analysis.

SOURCE: ESA, 2015

Analysis of Diversion Thresholds

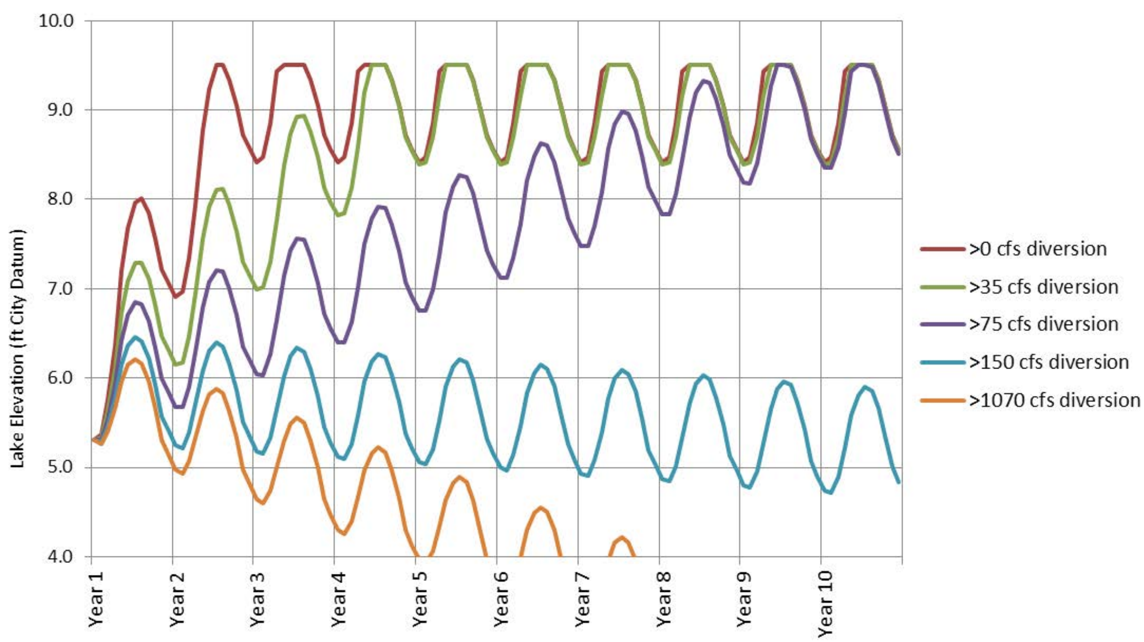
Five diversion thresholds were analyzed to estimate the potential contribution of stormwater flows diverted to Lake Merced. These diversion thresholds were developed to analyze a range of potential diversions. The diversion thresholds are structured such that all flows over a certain flow threshold would be diverted into Lake Merced. The thresholds are: >0 cfs (i.e., all flows would be diverted to the Lake), >35 cfs (i.e., flows greater than 35 cfs would be diverted to the Lake), >75 cfs, >150 cfs, and >1,070 cfs. The maximum predicted runoff reaching the Canal is approximately 1,070 cfs,[11] so this threshold represents a scenario under which no stormwater is diverted to Lake Merced. Hydrologic monitoring conducted in support of the Project documented that typical storm events in the Basin generate a volume equivalent to a fraction of 1 percent of the total Lake storage volume (Table 3.9-2). The design hydrograph (i.e., peak storm event) for the Project is a 25-year recurrence interval, 4-hour event generating a maximum peak flow of 1,070 cfs. Assuming 100 percent diversion of the design storm flow, the maximum volume of contribution from the Canal to Lake Merced during a single 25-year, 4-hour storm event would be

11 Maximum predicted runoff based on a design storm event with a 4-hour duration and a 25-year recurrence interval.

approximately 190 acre-feet, representing a maximum of approximately 3 percent of the total volume of Lake Merced (5,625 acre-feet).

The amount of time required to fill Lake Merced to the target WSEs is dependent upon the diversion thresholds. The lower non-zero diversion thresholds (i.e., >35 and >75 cfs) require multiple seasons to reach target WSE, during which time a large volume of water is lost to evaporation and transpiration (see Table 3.9-6). Additionally, a portion of the average annual storm flow (that portion >35 cfs or >75 cfs) would not be routed to the Lake. Accordingly, under these scenarios, base flows would constitute a greater percentage of the total Lake Merced contributions compared to the >0 cfs threshold, and thus a greater percentage of the total Lake Merced contributions would flow through the constructed treatment wetland compared to the >0 cfs threshold. Due to evaporation and transpiration, the highest diversion thresholds (i.e., >150 cfs and >1,070 cfs) would never achieve the target WSEs included in this assessment, even considering the year-round contribution of base flows.

Figure 3.9-13 illustrates the annual average contribution patterns under the five diversion thresholds for the 9.5-foot maximum WSE operational target. Because Figure 3.9-13 is based on the average year, it does not account for annual variability (see Table 3.9-6). The 9.5-foot target maximum WSE could be reached in a minimum of approximately 1.5 years under the >0 cfs diversion threshold, 3.5 years under the >35 cfs threshold, and 8.5 years under the >75 cfs threshold. As described above and shown in Figure 3.9-13, the 9.5-foot target maximum WSE would not be achieved under the >150 cfs and >1,070 cfs diversion thresholds.



SOURCE: ESA, 2015

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Figure 3.9-13
Lake Filling Scenarios, 9.5-Foot Target Maximum Water Surface Elevation

The time to reach target elevation and required filling period contributions under the different diversion thresholds are summarized in **Table 3.9-8**. The inflows shown in Figure 3.9-13 are based on the average water year (1953 to 2008 data) and provide a comparative estimate only. Under the average year assumptions, the >150 cfs and >1,070 cfs diversion thresholds would not provide an adequate volume of water to offset the Lake outflows and meet the target WSE. Therefore, these two thresholds were excluded from subsequent evaluation. As shown in Table 3.9-8, as the filling period is extended, the base flow contribution via the constructed treatment wetland to Lake level management is increased in relation to the contribution of stormwater, which would not pass through the treatment wetland. Therefore, the analysis presented subsequently in the WQA uses the >35 cfs threshold for modeling estimated effects to Lake water quality from the Project.

TABLE 3.9-8
FILLING PERIOD CONTRIBUTIONS

Flow Diversion Threshold[a] (cfs)	Time to Reach Target Elevation (months)[b]	Total Filling Period Contributions (acre-feet)			Annual Filling Period Contributions (acre-feet/year)		
		Canal via Wetland	Direct from Canal	Total	Canal via Wetland[c]	Direct from Canal	Total
7.5-foot maximum water surface elevation							
>0	6	146	529	675	146	529	675
>35	17	404	629	1,033	285	444	729
>75	31	725	611	1,336	281	236	517
8.5-foot maximum water surface elevation							
>0	17	404	1,033	1,437	285	729	1,014
>35	30	699	1,017	1,716	280	407	687
>75	67	1,554	1,225	2,779	278	219	497
9.5-foot maximum water surface elevation							
>0	19	422	1,128	1,550	267	712	979
>35	42	949	1,362	2,311	271	389	660
>75	102	2,332	1,828	4,160	274	215	489

NOTES:
a All flows greater than the flow diversion threshold would be diverted into Lake Merced.
b Filling period based on average water year.
c The annualized contribution of the wetland varies slightly due to summer/winter variance in Vista Grande Canal base flows.

SOURCE: ESA, 2015

Once the Lake is raised to the target WSE, smaller annual contributions of flow from the Canal would be required to maintain the Lake within the target WSE range. **Table 3.9-9** lists the total annual volume of water contributions required from the Canal via the constructed treatment wetland and directly from the Canal to maintain the desired target WSE. Because the surface area of the Lake changes only slightly in the 6.5 to 8.5 foot WSE range, the maintenance contributions would be approximately the same for all operational scenarios (6.5, 7.5, and 8.5 foot target annual normal mean WSE). Contributions from the treatment wetland and the Canal, ranging from 403 acre-feet per year (>75 cfs threshold) to 474 acre-feet per year (>0 cfs threshold), in addition to smaller contributions from precipitation and groundwater inflow, would maintain the Lake level. The relative contribution conveyed through the constructed treatment wetland varies according to the stormwater diversion threshold, but is estimated to be between 45 to 60 percent.

TABLE 3.9-9
ANNUAL MAINTENANCE CONTRIBUTIONS REQUIRED FOR ALL TARGET WATER SURFACE ELEVATIONS

Flow Diversion Threshold (cfs)	Maintenance Contributions (acre-feet/year)[a]				
	Wetland	Canal	Wetland + Canal	Precipitation and Groundwater Inflow	Grand Total
>0	216	259	474	87	561
>35	230	211	441	120	561
>75	244	159	403	158	561

NOTES:
[a] Based on average water year.

SOURCE: ESA, 2015

Lake Level Modeling

Based on the >35 cfs diversion threshold, Kennedy/Jenks (2014) assessed Lake Merced lake levels to further support technical analyses and provide more detailed hydrologic context for Project operation. A Lake Merced Lake Level Model (Model) was constructed to analyze the effects of the >35 cfs flow diversion from the Canal on Lake Merced WSEs. Lake Merced's South, North and East Lakes are hydraulically connected resulting in the diverted storm and non-storm water raising the entire WSE of Lake Merced. The Model was run through a representative period of historical climatic conditions, including two major droughts in 1976/1977 and 1989 through 1991, to evaluate future lake levels in Lake Merced both with and without Project diversions. Model results are best reviewed relative to a baseline condition, hence the model analyses of future lake levels without the Project. The key variable conditions for the model are summarized in **Table 3.9-10**. The results of the lake level model analysis are discussed below.

TABLE 3.9-10
SUMMARY OF LAKE MERCED LAKE LEVEL MODEL VARIABLES

Project Scenario	Model Variable	
	Vista Grande Canal Diversions	Groundwater-Surface Water Interactions
No Project	Contributions from the Canal occur only as a result of flooding from short-term storm events when surface water flow in the Cana; exceeds its discharge capacity causing water to flow across John Muir Drive into Lake Merced in an uncontrolled manner. The Lake Merced spillway is set at the existing elevation of 13 feet (City Datum).	Groundwater-surface water interactions are obtained from the regional MODFLOW model. Groundwater-surface water interactions approximated by applying the monthly average for dry, normal and wet rainfall conditions where data gaps exist.
Project	Flows above 35 cfs are diverted into Lake Merced. A portion of flows below 35 cfs diverted to Lake Merced through the constructed treatment wetland. Flood flows accounted for under the No Project scenario are removed. The Lake Merced spillway is operated at an elevation of 9.5 feet (City Datum), equivalent to the maximum lake level operational scenario under consideration.	Same as used in the No Project Scenario.

SOURCE: Kennedy/Jenks, 2014

No Project Scenario

The simulated lake levels for the No Project Scenario are shown in comparison to Project simulations on **Figure 3.9-14**. The No Project Scenario trends are generally controlled by long-term precipitation showing the effects of extended wet periods and droughts on lake levels. In general, lake levels vary between 11.0 and 0.0 feet (City Datum). The rises and declines are controlled by climatic events representing wet periods and droughts. Lake level declines at lower lake levels are more accentuated because the area of the lake is smaller so that volumetric changes result in larger lake level change. Lake levels can recover several feet in a single year in the highest rainfall years.

Project Scenario

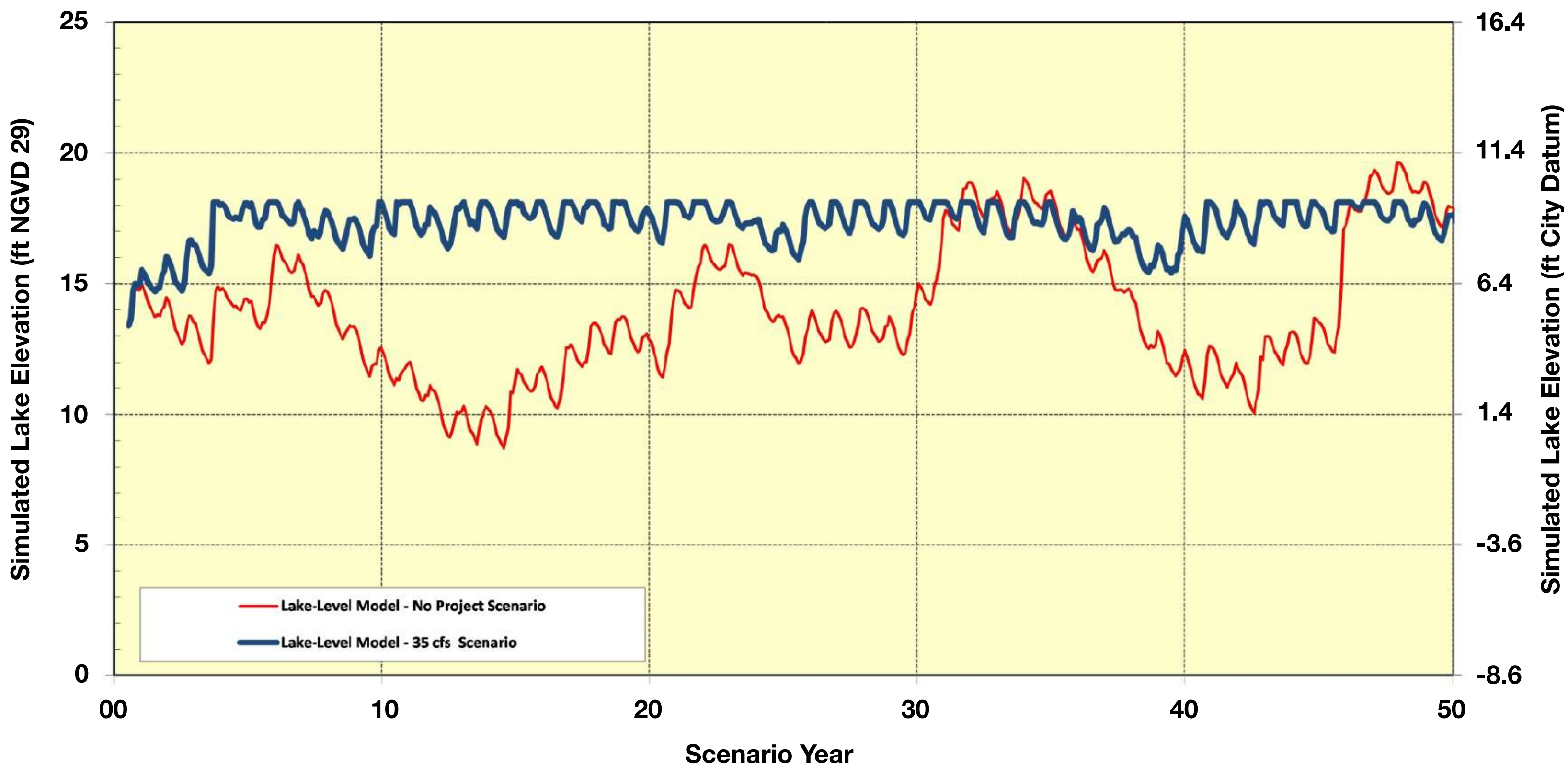
The simulated lake levels for the Project Scenario are shown on Figure 3.9-14 and **Figure 3.9-15**. The results show that, in general, lake levels vary within a narrow range of about 1 foot during the year and would regularly include flow over the Lake Merced overflow, and that the lake levels are generally several feet higher than under the No Project Scenario, the only exception being during very wet periods when lake levels in the No Project Scenario rise above the Project Scenario overflow elevation of 9.5 feet (City Datum). It takes about 5 years before lake levels reach the Project overflow elevation. After that, lake levels reach the overflow elevation of 9.5 feet (City Datum) every winter and drop below this elevation every summer. The exceptions to this observation occur during four simulated distinct drought periods where lake levels decline by up to about 3 feet below the overflow and don't recover to the overflow elevation in the winter. Recovery of lake levels back to the overflow elevation after a drought period generally takes only one or two years.

Water Quality Assessment

To assess the direct and indirect long-term impacts of Project operations on Lake Merced water quality, a detailed Project-specific WQA was developed (ESA, 2015). The WQA presents analysis of the potential changes to Lake Merced existing conditions as a result of Project operations and incorporates the hydrologic context of Project operations, such as the relative volume of Canal flows as compared to overall lake volume. Additionally, as part of the analysis of potential water quality effects to Lake Merced, the water quality of Canal flows were considered within the context of proposed physical and operational Project elements (such as the screening device, the treatment wetlands, and the diversion protocols), as well as regulatory controls[12] to urban runoff water quality.

The analysis of the potential changes to existing Lake Merced water quality conditions resulting from Project operations is based largely on predictive modeling. In evaluating how Project operations may influence future stratification and eutrophication conditions in Lake Merced, the WQA predictive model approach put particular focus on the effects of depth and TIN levels on the two key indicators of Lake "health" relating to water quality: algal concentration (chlorophyll a)

12 As discussed in detail in the WQA and in Section 3.9.2, the existing and proposed diversions of flows from the Vista Grande Canal to Lake Merced are covered under the existing MS4 NPDES permit, called the MRP, RWQCB Order No. R2-2009-0074. No additional NPDES permits are needed for Project operation. The operational protocols and the use of in-lake management actions and BMPs proposed as part of the Project are described in Section 2.6.1 and 2.6.2, respectively.



SOURCE: Kennedy/Jenks, 2014

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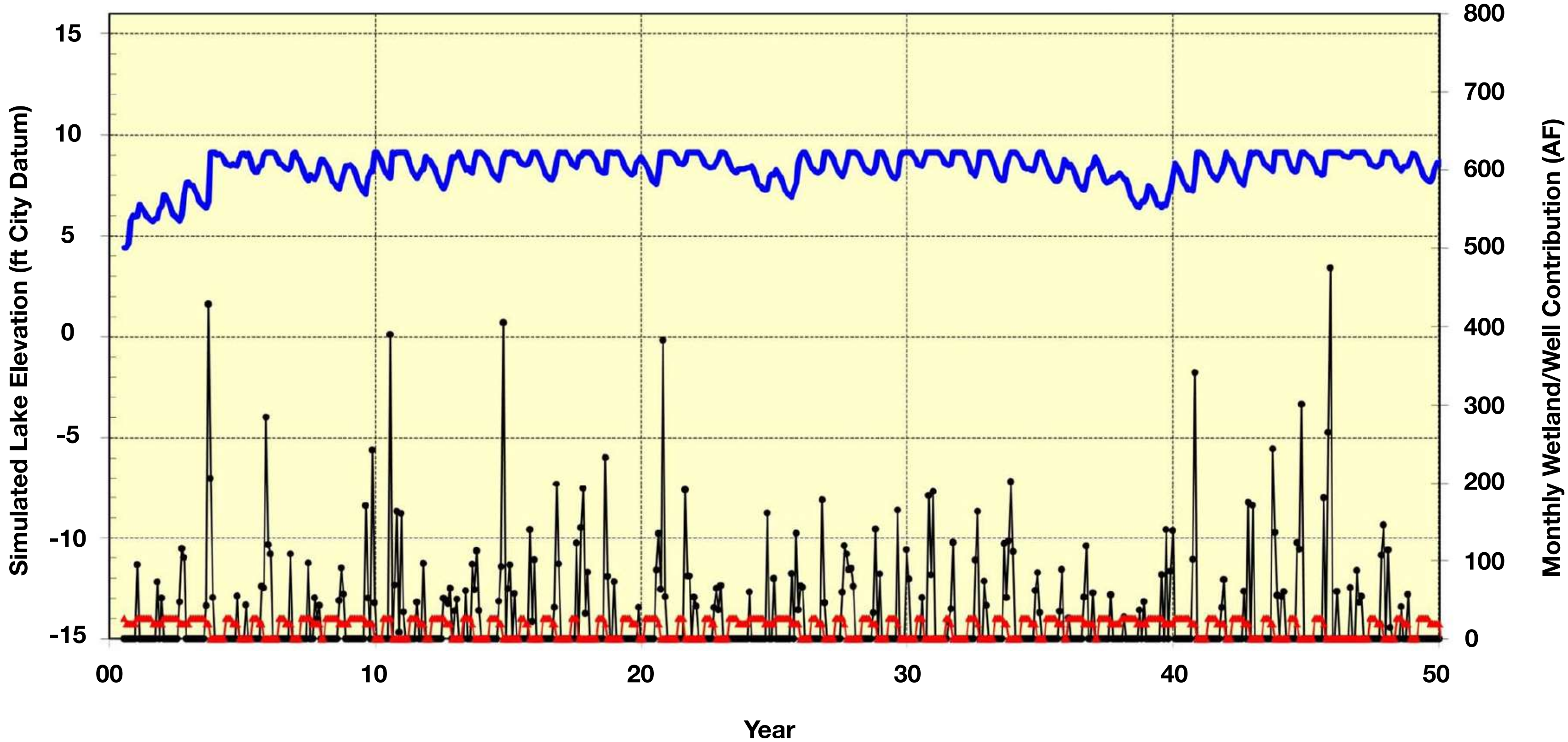
Figure 3.9-14
Comparison of No Project and Project (35 cfs) Scenarios



SOURCE: Kennedy/Jenks, 2014

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Figure 3.9-15
Project Scenario Showing Lake Level with Contributions from Wetlands and Canal

and Lake clarity (Secchi depth) as well as the primary factors (e.g., stratification, mixing frequency, TIN levels, and design of constructed wetland treatment) that can influence them. Specifically, modeling analysis assessed the water quality effects of increasing the mean depth of Lake Merced through use of stormflows and base flows from the Canal based on the >35 cfs diversion scenario described above.

The predictive model assessments presented in the WQA analyzed how Project operations could directly impact pH and DO levels in Lake Merced as well as other variables and water quality constituents (e.g., algae, nutrients, water clarity) that control these key water quality parameters. Also assessed were the direct impacts to future stratification and eutrophication conditions from Project operations as well as potential changes to beneficial uses. Additionally, the numerous processes and variables within a Lake that can affect water quality, such as thermal and chemical stratification and nutrient dynamics, were evaluated in the context of indirect impacts of the proposed Project against the baseline water quality data. These processes were analyzed and assessed to more fully understand the implications of the Project on the overall water quality (and ecological function) of the Lake and to identify the potential for water quality impacts that could affect beneficial uses.

Impact Analysis

As described in detail in the WQA (ESA, 2015) and as summarized in Sections 3.9.1.2 and 3.9.1.3, a multi-season monitoring program was designed and implemented by Daly City to characterize baseline water quality within Lake Merced and the Canal and to quantify Canal flows in support of the proposed Project. These data provide the most comprehensive available baseline assessment of the quantity and quality of stormwater that could be diverted to Lake Merced under the proposed Project. The water quality monitoring conducted within the Canal confirmed that concentrations of key water quality constituents were generally in the ranges expected for urban stormwater and non-storm runoff. Monitored constituents included those typically present in urban stormwater and non-storm runoff (nutrients, metals, and bacteria). The data also precisely documented the seasonal, spatial, and temporal variations in DO and pH in South Lake relative to the 303(d) listing. The majority of Lake data was collected at a location used by the SFPUC for long-term monitoring of water quality in South Lake since 1997, allowing comparison of the Daly City monitoring data collected in 2011 and 2012 to the larger historic record.

Predictive Water Quality Models

Following detailed documentation of baseline conditions, the monitoring data was used to analyze the manner and extent to which Project operation would affect the water quality or beneficial uses of Lake Merced. As described in the approach to analysis for the WQA, above, operational water quality impact analyses largely involved the development of predictive models. Two key variables were modeled, combined with a quantitative mass balance approach.

- The first model was based on mixing depth and assessed the effects on chlorophyll a and Secchi depth due to changes in sediment stirring from mixing, and the resultant release of nutrients from the sediments to the water column.

- The second model assessed the water quality effects of Project Canal base flow and stormwater contributions on the Lake (at the various proposed WSEs), and modeled effects both with and without Canal nutrients reduced by use of either a basic or an advanced constructed treatment wetland (detailed treatment wetland design has not been finalized).

The WQA also assessed the potential effects of increased Lake depths on temperature in the upper mixed layer of the Lake to evaluate the potential for impacts on aquatic life beneficial uses (i.e., fisheries) from water quality alterations. The results of the various model analyses presented in the WQA are summarized below (and presented in detail in Chapter 6 of the WQA [ESA, 2015]).

Water Depth Model: Water Quality and Increased Lake Depth

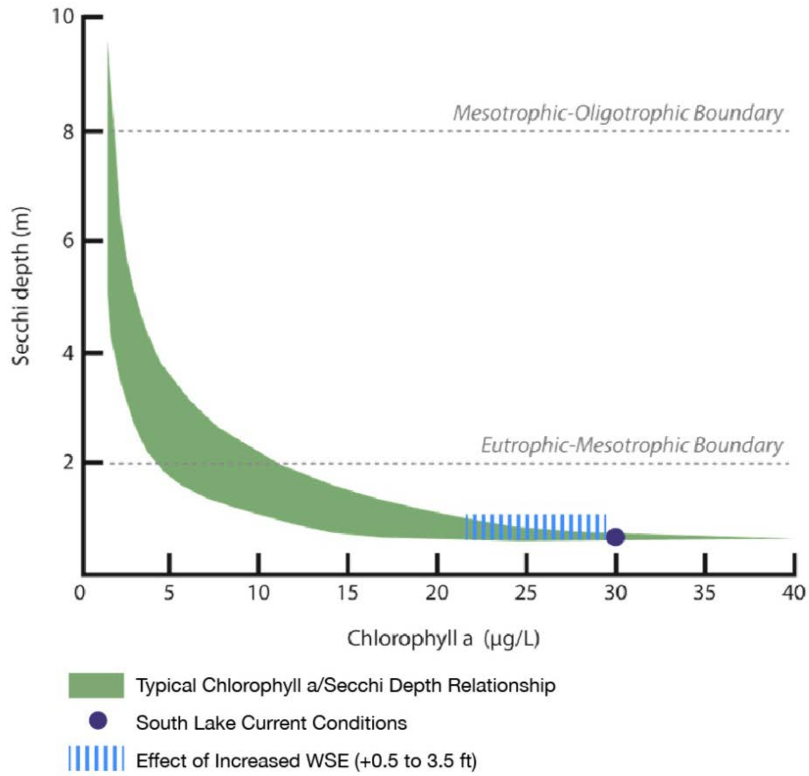
A simple lake model based on mixing depth and the chlorophyll-water transparency relationship was used to estimate the water quality changes that could occur at the range of proposed depth increases. Based on the model results, increased thermal stratification duration due to increased depth is expected to produce an overall improvement in water quality that would be progressive with depth increases. The effects of increasing the depth of the Lake on lake mixing are shown in **Table 3.9-11**. As the Lake depth increases, the mixing frequency decreases (increased duration of thermal stratification), resulting in a decrease in the top-to-bottom water column mixing frequency from every 11 days (existing conditions) to up to 25.5 days (+3.5 feet WSE scenario). The less frequent mixing in the deeper Lake would result in relatively less nutrients stirred up from the bottom and consequently less algae growth and eutrophication. With less frequent mixing, the modeled range of depth increases produced estimated chlorophyll a reductions of up to 7 µg/L (about 23 percent; **Figure 3.9-16** and **Table 3.9-12**). A maximum decrease of 23 percent in algae would result in a small decrease in algae-related BOD in the sediments, and while some long-term reduction in oxygen depletion in the bottom waters is therefore likely, periods of anoxia would remain during stratified conditions. There would be no likely visible change in water clarity with a predicted Secchi depth increase of from 2 to 2.3 feet (i.e., a potential increase in clarity of only 0.3 feet) because of the flat shape of the chlorophyll-water transparency relationship at these levels (Figure 3.9-16).

TABLE 3.9-11
MODELED EFFECT OF INCREASING THE DEPTH ON THE FREQUENCY OF MIXING IN SOUTH LAKE

	Present	Scenario A mean	Scenario B mean	Scenario C mean	Scenario C maximum
Depth increase (ft)	**0**	**0.5**	**1.5**	**2.5**	**3.5**
WSE (ft., City Datum)	6.0	6.5	7.5	8.5	9.5
Water depth (ft)	24	24.5	25.5	26.5	27.5
Depth increase (%)	0	2.1	6.3	10.4	14.6
Mixing frequency (days)	11	12.5	15.0	19.7	25.5
Mixing regime	Polymictic	Polymictic	Polymictic	Polymictic	Moderately polymictic

NOTE: Scenarios A, B, C, and C maximum refer to mean WSE scenarios of 6.5, 7.5, 8.5, and 9.5 feet respectively.
Polymictic indicates thermal stratification is not present and waters are mixed from top to bottom.

SOURCE: ESA, 2015



SOURCE: ESA, 2015

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Figure 3.9-16
Relationship of Algae as Chlorophyll and Water Clarity as Secchi Depth for Lake Merced at Proposed Depth Increases

TABLE 3.9-12
ESTIMATES OF EFFECTS OF INCREASED DEPTHS ON CHLOROPHYLL FOR LAKE MERCED

Elevation/Scenario	Water depth (ft)[a]	Polymictic Index (2011 = 100)	Estimated TIN in mixed water column (µg/L)	TIN decrease (µg/L)	Estimated chl *a* at surface (µg/L)	Chl *a* decrease (µg/L)
Surface	0		90	0	30	
Bottom, Present	24	100	90	0	30	0
Bottom, Scenario A mean (+0.5 ft)	24.5	88	79	11	28.5	1.5
Bottom, Scenario B mean (+1.5 ft)	25.5	73	66	24	26.7	3.3
Bottom, Scenario C mean (+2.5 ft)	26.5	56	50	40	24.5	5.5
Bottom, Scenario C max (+ 3.5 ft)	27.5	43	39	51	23.0	7.0

NOTE: The mean Secchi depth for Lake Merced in 2009 was approximately 2 feet and corresponded to a dry season algal chlorophyll *a* value of 30 µg/L (2000 to 2003 data). This is similar to the long-term data set [chlorophyll *a* 27 µg/L and Secchi depth 1.8 ft (1997 to 2008)]. The TIN in summer is 90 µg/L.

SOURCE: ESA, 2015

Nutrient Loading Model: Stormwater Inputs and Algae Growth

Nutrient effects during the winter (5-month) and summer (7-month) periods were analyzed individually and then combined to assess how inputs of nutrients in storm and base flows could affect algal growth in Lake Merced, with and without two types of proposed constructed treatment wetland under three different filling schedules. In general, the higher the diversion threshold selected, the longer it would take to fill the Lake to the desired WSE and reach a steady state elevation condition.

Algae can use either nitrate or ammonia, so TIN is a convenient summary of the eutrophication effects of added stormwater. Without the constructed treatment wetland, the net result is that at all rates of filling there would be an estimated increase of TIN above the current baseline of 90 µg/L (**Table 3.9-14**) of 59 to 80 µg/L available for algal growth (**Table 3.9-14**). Depending on the details of the design and operation of the wetland, the proposed flows would likely result in minor increases or decreases in the TIN concentration in the Lake (**Figure 3.9-17**, with changes ranging from an estimated increase of 11 µg/L to an estimated decrease of up to 21 µg/L (Table 3.9-14).

TABLE 3.9-13
ESTIMATED NET EFFECTS ON WINTER TIN DURING FILLING PERIOD

Max WSE (ft)	Flow Diversion Threshold (cfs)	Average Filling Time (Months)	Winter Nitrate or TIN (µg/L)						
			In Base Flow	In Storm Flow	Current in Lake Winter	After Storms inc Base + Storm Flows	Winter Increase	Depth Reduction Effect	Net Winter Increase
No wetland									
7.5	>35	17	3700	610	90	175	85	-24	61
8.5	>35	30	3700	610	90	185	95	-40	55
9.5	>35	42	3700	610	90	182	92	-51	41
Basic wetland									
7.5	>35	17	1000	610	90	125	35	-24	11
8.5	>35	30	1000	610	90	138	48	-40	8
9.5	>35	42	1000	610	90	136	46	-51	-5
Advanced wetland									
7.5	>35	17	500	610	90	116	26	-24	2
8.5	>35	30	500	610	90	129	39	-40	-1
9.5	>35	42	500	610	90	128	38	-51	-13

SOURCE: ESA, 2015

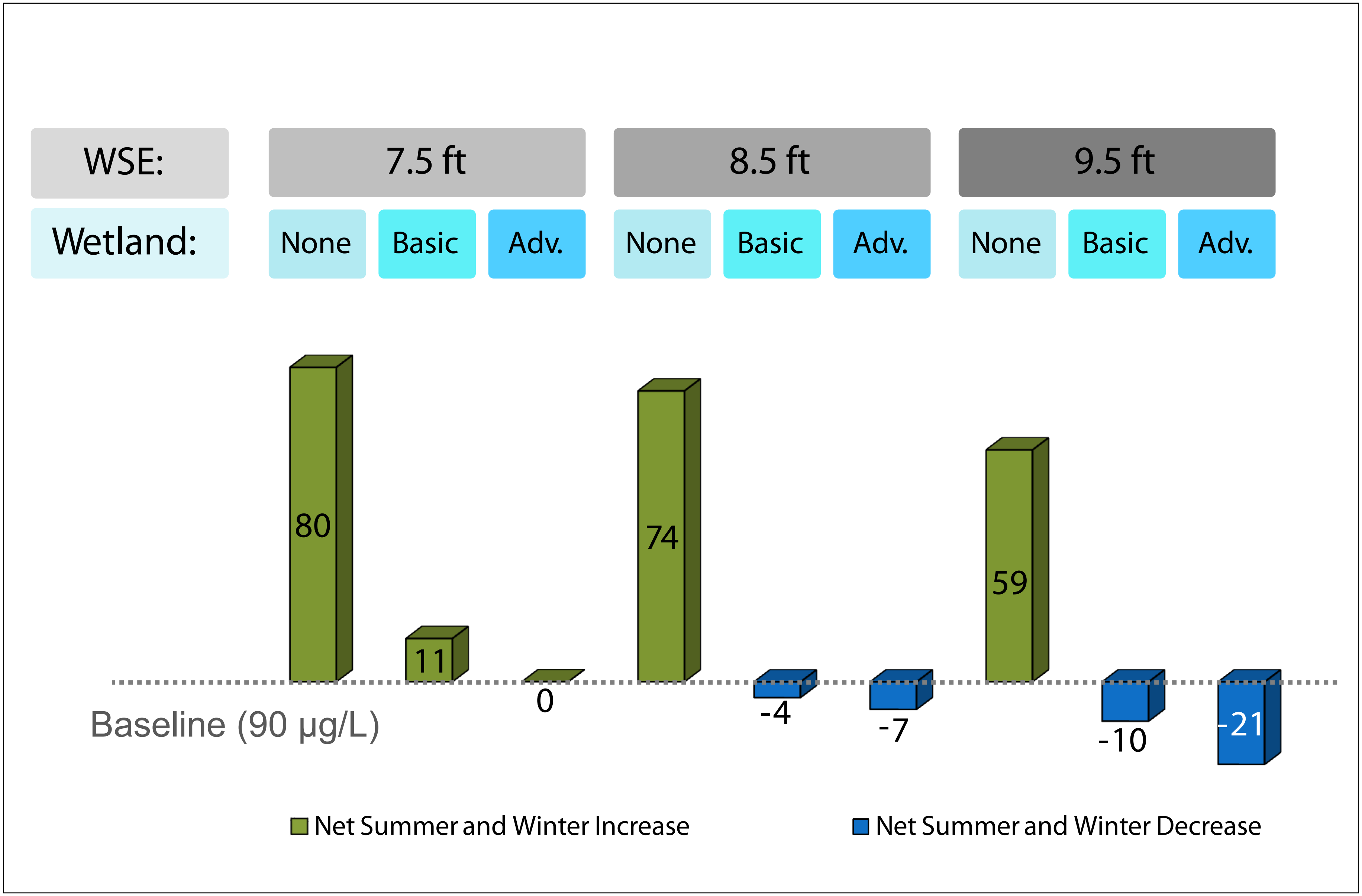
TABLE 3.9-14
ESTIMATED NET EFFECTS ON SUMMER TIN, COMBINED SUMMER AND WINTER TIN, AND ALGAL CONCENTRATIONS DURING FILLING PERIOD

	SUMMER: Nitrate or TIN (µg N/L)				Summer and Winter (µg N/L)	Algae (µg Chl/L)		
Max WSE (ft)	Increase in Base Flow	Depth Reduction Effect	Usable Over Summer Baseline	Mean Usable For 5 Blooms	Net Increase	Net Effect	Conc. in Lake	Change (%)
No wetland								
7.5	96	n/a	96	19	80	11.0	41	37
8.5	95	n/a	95	19	74	10.1	40.1	34
9.5	92	n/a	92	18	59	8.1	38.1	27
Basic wetland								
7.5	25	-24	1	0	11	1.5	31.5	5
8.5	25	-40	-15	-3	-4	-0.5	29.5	-2
9.5	24	-51	-27	-5	-10	-1.4	28.6	-5
Advanced wetland								
7.5	12	-24	-12	-2	0	-0.1	29.9	0
8.5	12	-40	-28	-6	-7	-0.9	29.9	-3
9.5	12	-51	-39	-8	-21	-2.8	27.2	-9

NOTE: No depth reduction allowance was made for the no-wetland option in summer since the out-flowing water would be warm and thus not sink to the bottom as would cool wetland outflow.

SOURCE: ESA, 2015

The net effects on algal concentrations from inputs of nutrients in storm and base flows would depend largely on the details of the design and operation of the treatment wetland. Without the constructed treatment wetland (worst case scenario), the net result is that at all rates of filling, there would be an estimated increase of 8.1 to 11 µg/L of chlorophyll a in summer in the Lake to give mean summer values of 38 to 41 µg/L (as compared with the current mean of 30 µg/L). The average of 32 percent increase in algae is about that which would be analytically detectable from background over a few years. The chlorophyll increase would likely have an effect on the bottom DO concentrations – probably by making periods of low DO longer than at present. With operation of the proposed constructed treatment wetland, the proposed flows would likely result in minor increases or decreases in the chlorophyll concentration of the Lake. Depending on the details of the design and operation of the wetland, the changes would range from an estimated increase of about 1.5 µg/L (5 percent increase) to an estimated decrease of up to 2.8 µg/L (9 percent decline) in the Lake chlorophyll concentration (Table 3.9-14) (**Figure 3.9-18**). After the Lake reaches the target WSE at the end of the filling period, without the proposed treatment wetland, it is estimated that there would be an increase of about 6 µg/L in algal chlorophyll (19 percent increase). With the constructed treatment wetland, it is estimated that there would be a slight decrease in algal chlorophyll of 1.8 to 3.0 µg/L (**Figure 3.9-19**) (6 to 10 percent decrease) depending on the wetland design (**Table 3.9-15**).



SOURCE: ESA

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Figure 3.9-17
Filling Period Summer and Winter TIN (µg/L)

TABLE 3.9-15
ESTIMATED NET EFFECTS ON WINTER, SUMMER, AND YEAR-ROUND TIN AND ON ALGAL CONCENTRATION AT STEADY STATE

TIN (µg N/L)									Algae (µg Chl/L)	
Winter Inflow	Winter Increase	Winter Depth Reduc-tion Effect	Winter Net Increase	Summer Net Increase	Summer Depth Reduc-tion Effect	Summer Usable Over Back-ground	Mean Sum Over Back-ground for 5 Blooms	All Year Increase	All Year Net Increase	All Year Value In Lake
No wetland										
158	68	-40	28	74	0	74	15	43	5.9	35.9
Basic wetland										
121	31	-40	-9	20	-40	-20	-4	-13	-1.8	28.2
Advanced wetland										
114	24	-40	-16	9	-40	-31	-6	-22	-3.0	27.0

SOURCE: ESA, 2015

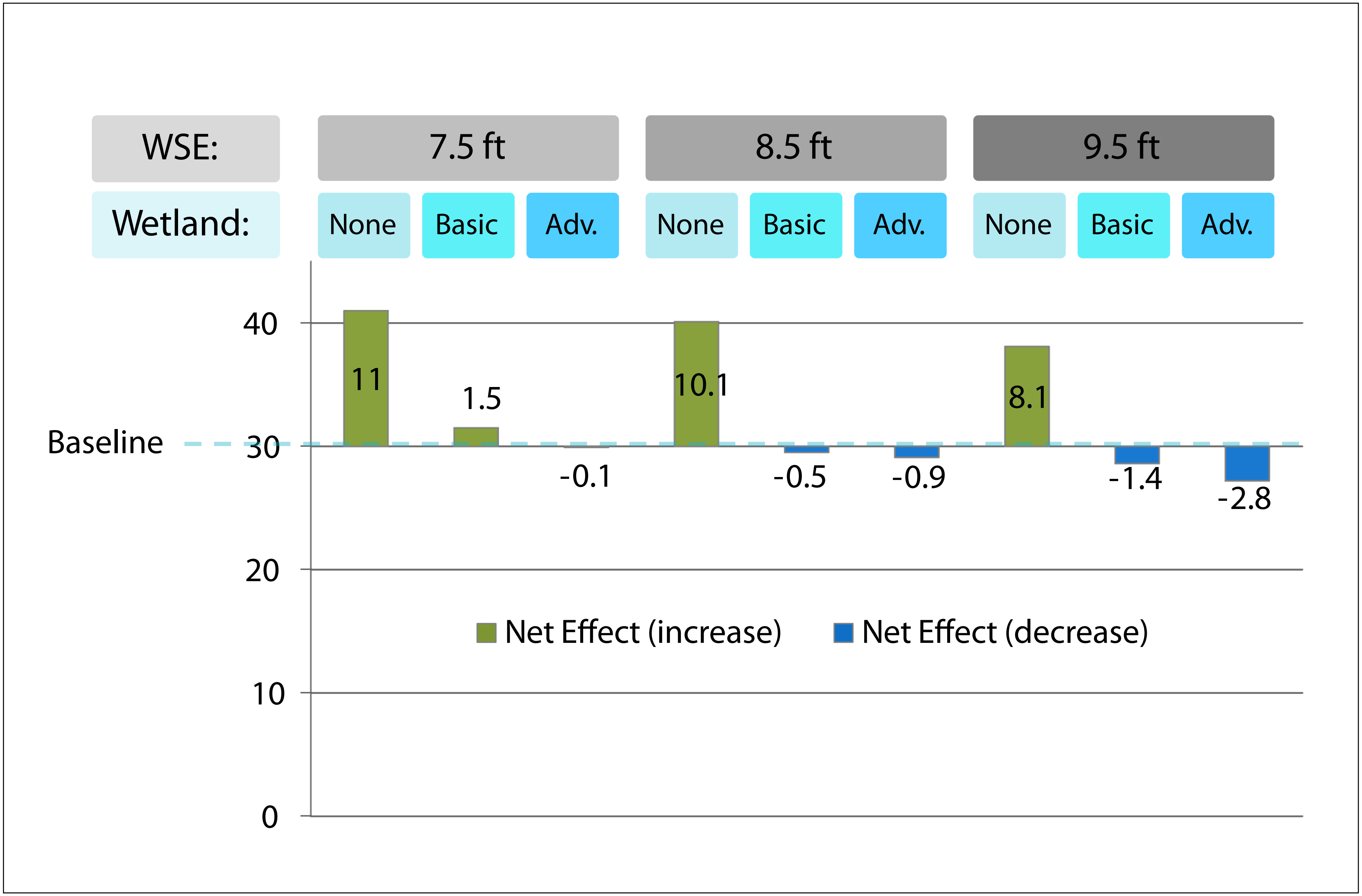
Temperature Model: Thermal Stratification

Compared to the baseline data collected, the increased WSE would have the effect of prolonging the periods of dry-season thermal stratification. For each of the WSE increase scenarios modeled (0.5 ft, 1.5 ft, and 2.5 ft), **Figure 3.9-20** compares temperature exceedance curves. With an increase in WSE of 2.5 ft, there would be a reduction in the annual duration of surface layer temperature exceedances of 20 °C (68 °F) and the additional depth may allow the upper mixed layer to partially buffer temperature fluctuations.

Summary of Model Analyses

The modeling assessment indicated that, over the range of proposed Lake elevations, the range of additional TIN, and the inclusion of a constructed treatment wetland, the changes in Lake algal concentrations would be minimal. Any predicted changes (increases or decreases) would not be discernible to the human eye and would take many years of monitoring to detect. Algal concentrations could either slightly increase or decrease depending on the design and operation of the treatment wetland. No impacts to water quality or on beneficial uses as compared to existing conditions were projected based on the additions of Canal water, the increases in Lake elevations, and the associated minor changes in extent of stratification and frequency of mixing events.

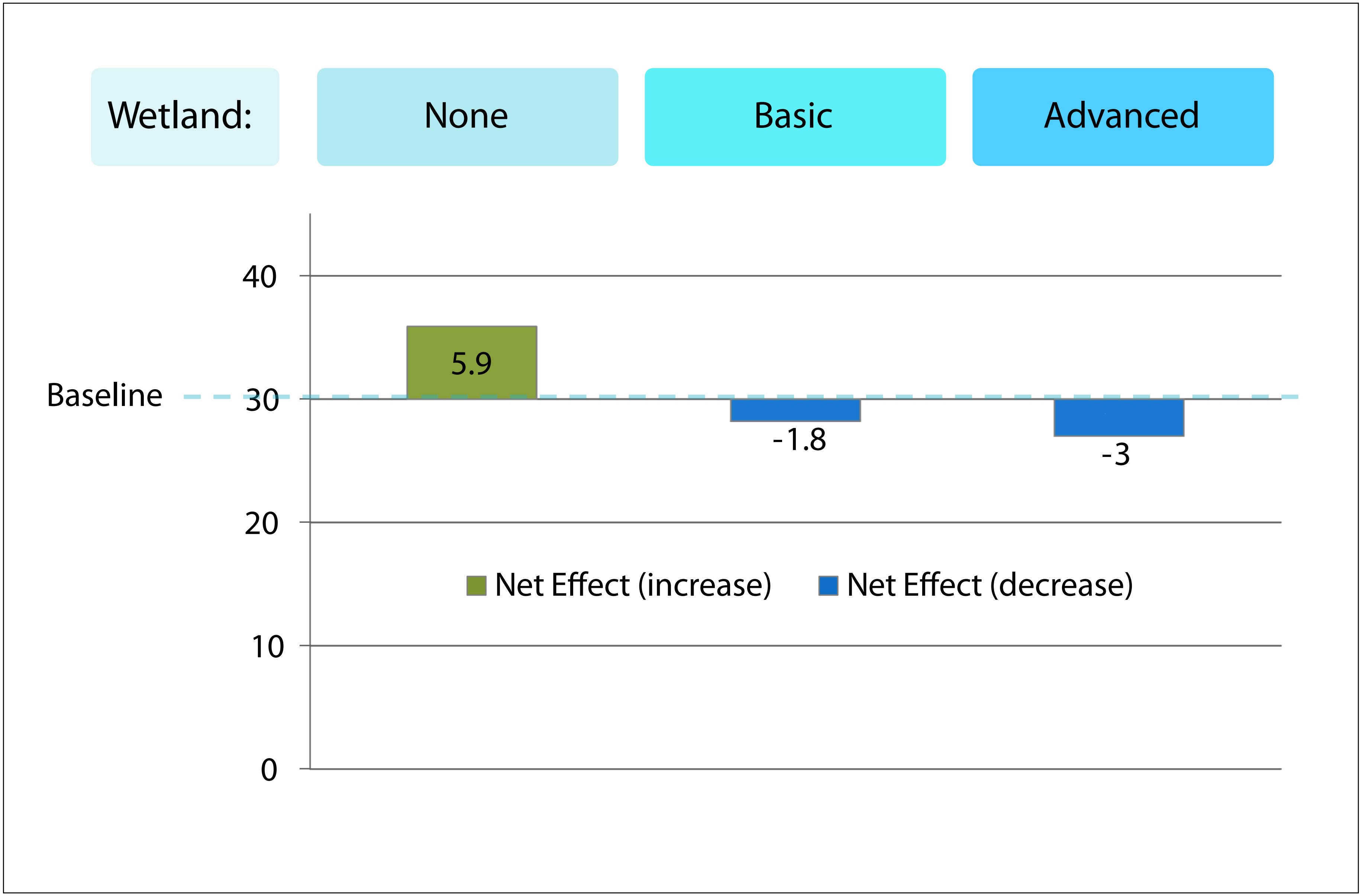
Lake depth has an effect on DO content by influencing the frequency and duration of stratification. Stratification contributes to low levels of DO in the deeper waters, where algal respiration and decaying organic matter remove oxygen, which is not replenished by mixing with more oxygen-rich water higher in the water column. Historical measurements show that increased depth reduces DO in deep water due to less frequent mixing, so it is expected that operating the Lake under any of the WSE scenarios would result in increases in the frequency and duration of stratification periods and therefore of excursions below the current DO WQO in the Basin Plan in the lower portion of the Lake. However, because the WSE would increase, a greater Lake volume (increased mid water column depth) would be provided that is expected to have DO concentrations



SOURCE: ESA

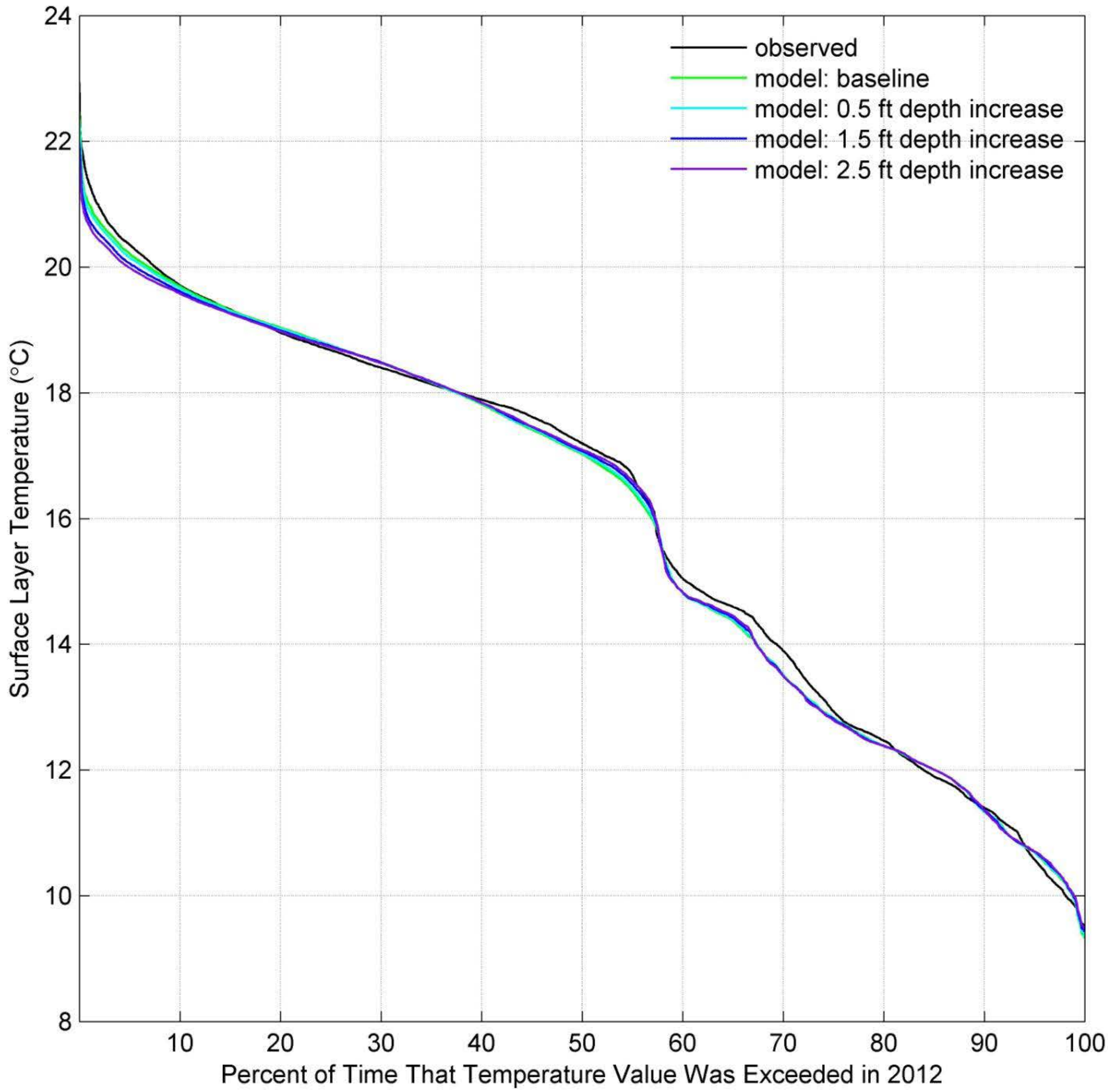
Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-18
Filling Period Algae (µg Chl/L)



SOURCE: ESA

Figure 3.9-19
Maintenance Period Algae (µg Chl/L)



SOURCE: ESA sonde data and ESA temperature model

Vista Grande Drainage Basin Improvement Project . D207036.01

Figure 3.9-20
2012 temperature exceedance curves resulting from observations and modeled conditions in Lake Merced

above the Basin Plan WQO of 5 mg/L. As a result, increasing the Lake levels is expected to result in an overall improvement in water quality relevant to aquatic habitat beneficial uses. While the bottom layer of the Lake would likely continue to experience periodic reduced DO levels, as occurs under existing conditions, the volume of water with higher DO concentrations would increase over existing conditions.

Relative to pH, as discussed in Section 3.9.1.3 above, Lake Merced has relatively high alkalinity with an estimated equilibrium pH of about 8.5. Under current conditions, the pH level frequently peaks above 8.5 during sunny afternoons as a result of algal photosynthesis. Under the proposed Project, once the steady state is achieved, there would be a slight decrease of 6 to 10 percent in algal concentrations. However, it is expected that the pH of the upper mixed layer (epilimnion) of the Lake would continue to exceed the upper pH WQO of 8.5. The lower mixed layer (hypolimnion) pH is expected to remain relatively unchanged, with values below 8.5.

Additional Water Quality Constituents

Canal water quality generally had characteristics typical of urban stormwater and authorized non-stormwater flows for a broad range of constituents (such as nutrients, metals, total suspended solids, biological and chemical oxygen demand, and bacteria). Concentrations of these constituents were generally in the ranges expected for urban stormwater and non-stormwater runoff. As analyzed and discussed in Section 5.2.3 of the WQA (ESA, 2015), Canal water is unlikely to have discernible water quality effects on the Lake, especially when considering the relative contribution of storm flows as compared to overall lake volume, the use of treatment wetlands, and the proposed operating model designed to ensure the protection of water quality. Additionally, stormwater flows would be conveyed through a 5 mm screening device prior to diversion to the Lake. The screening process would remove trash and constituents associated with larger particles in the stormwater. The concentrations of nutrients, bacteria, and selected metals in Canal flows and the impacts to Lake Merced water quality as a result of Project operations are summarized as follows:

Nutrients

As described in detail above, the most important constituent of potential concern monitored in the Canal was TIN, which is the limiting nutrient in the Lake relative to algal growth, based on review of available information and the analysis presented in the WQA. While individual and median TIN concentrations are evaluated and described in detail under the model analysis above, it is important to note that the assessment of TIN impacts on algal concentrations is based on annual average TIN concentrations. This is because the majority of Canal TIN inputs would occur during the winter via storm flows, which is characterized as having seasonally low light and low temperature months that result in low algal growth rate. The peak algal growth period does not occur until the late spring, summer, and early fall months. Therefore, it is the accumulated mass of TIN retained within the Lake that controls algal growth, not the input from an individual stormwater diversion event.

The median dry season base flow TIN concentration was 4.3 mg/L TIN (nitrate, 4.2 mg/L, ammonia, 0.08 mg/L) (Table 3.9-5). The median wet season base flow TIN concentration was 3.8 mg/L. (nitrate, 3.6 mg/L; ammonia, 0.2 mg/L). Nonetheless, the concentration of nutrients in winter is very variable with periods of higher nutrient concentrations occurring when rains follow a few weeks of dry winter conditions. The median storm flow TIN concentration was considerably lower than the dry and wet season base flow TIN values at approximately 0.5 mg/L (nitrate 0.31 mg/L, ammonia 0.15 mg/L). Rain contains an estimated 0.2 mg/L TIN, diluting the base flow TIN. Potential sources of nitrogen within the watershed include atmospheric deposition, fertilizer in residential irrigation runoff, and illicit animal waste.

Lake Merced is already characterized as a eutrophic lake based on long-term algae (chlorophyll a) concentrations in the 23 to 26 µg/L range (WQA Table 4-4, ESA, 2015). The water quality modeling indicated that over the range of Lake elevations under consideration, and with the inclusion of a constructed treatment wetland, the changes in algal concentrations and associated impacts on DO and pH as a result of nutrient deliveries to Lake Merced via direct diversion of Canal stormflows would be minimal and would not impact Lake's beneficial uses.

Bacteria/Microorganisms

As described in Section 3.9.1.3, the bacterial organisms Total Coliform, Fecal Coliform, E. coli, and Enterococcus (Table 3.9-5) were analyzed as indicators of the presence of pathogens. Overall, the bacterial and related results indicate that water quality conditions in the Canal are similar to what would be expected in stormwater and authorized non-storm flows from a highly urbanized area. Daly City and SFPUC conducted a pilot Canal stormwater diversion project to the Lake during the wet seasons 2003/2004 through 2008/2009 (EOA, 2011) that found that concentrations of E. coli and Enterococcus were typically reduced by approximately 99 percent (as measured near-shore and at the Lake background station) 48 to 72 hours after cessation of stormwater diversions. Further, Lake Merced is managed for both recreation and emergency water supply, to be used for sanitary and firefighting purposes, and subject to a boil water order. To protect this latter use, full body contact recreation is not allowed in the Lake. Full body contact recreation such as swimming with head immersion, is the primary pathway whereby humans can be significantly exposed to pathogenic waterborne organisms.

As also described in Section 3.9.1.3, sampling was also conducted for the pathogenic protozoans *Giardia* and *Cryptosporidium*. Neither organism was detected in any of the Lake samples. *Cryptosporidium* was detected only once in the Canal and *Giardia* was detected during 3 out of 11 Canal sampling events. Further, General Bacteroidales were detected in all 15 of the Canal samples and in all 15 of the Lake samples. Human Bacteroidales were detected in 10 of the 15 Canal samples but in only 1 of the 15 Lake samples. The results indicate that there appears to be widespread presence of fecal-related material in the Canal as compared to a more limited presence in the Lake.

The potential for levels of bacteria and microorganisms to increase in Lake Merced during sustained rainfall events where diversions are more continual and the potential for microorganism levels to be sustained due to a lack of die off is low and not considered to be a risk of the Project. Die-off of microorganisms, such as that observed during the pilot stormwater diversion project (EOA, 2011), is continuous. Further, most pollutants, including microorganisms, tend to be associated with particulates, and as such the processes of physical settling would represent an on-going removal process during sustained (multi day) diversion events. Other natural process, such as UV inactivation and predation, would also act to reduce microorganism levels. Additionally, the concentration of bacteria and microorganisms in stormwater typically diminishes over time due to street washoff of accumulated sources, representing a diminishing source within the Basin over time during a sustained event. Water quality sampling conducted in 2011 through 2012 (WQA [ESA, 2015]) included a multi-day storm event in 2012. Rainfall on March 13, 14, and 16 of 2012 was 0.38, 1.02, and 1.09 inches, respectively (WQA Table 5-2 [ESA, 2015]). During this period, total coliform decreased from 400,000 to 40,000 to 10,000 cfu/100 mL (WQA Table 5-2 [ESA, 2015]). Enterococcus decreased from 18,000 to 7,000 to 4,000 cfu/100 mL. Additionally, the indicator parameter of TSS decreased from 24 to 12 to 4 mg/L during the multi-day storm event, showing the same trend as bacteria levels.

The potential impacts related to microbiological organisms from introducing Canal flows into the Lake are considered minimal because 1) the base flows would be treated through the constructed treatment wetlands prior to being introduced into the Lake, 2) the flows would be introduced near-shore and sub-surface in the Lake where there is limited potential for full body contact exposure, and 3) the various microbiological organisms in additional flows are subject to natural die-off, mixing, and dispersion throughout the Lake thereby rapidly reducing any temporarily elevated levels to background conditions.

Metals

As a result of the observed metals concentrations described in Section 3.9.1.3, metals concentrations would be expected to be low during operations-based Canal diversions and, along with other constituents discussed above, would be further reduced in the Canal water that would receive further treatment in the constructed treatment wetland (see Appendix B of the WQA [ESA, 2015]). It is unlikely that the low levels of metals in Canal water would have adverse impacts on Lake Merced water quality or beneficial uses. Further, as described for bacteria and other microorganisms above, the Lake Merced Pilot Stormwater Enhancement Project (see WQA Appendix B [ESA, 2015]), also monitored total metals concentrations in the Canal water and in the Lake following pilot scale diversion events (EOA, 2011). In general, concentrations of total copper that were elevated in the Canal stormwater during diversion events as compared to concentrations in the Lake did not result in copper concentrations in the Lake above background levels (generally non-detect) measured 48 to 72 hours following cessation of a diversion event.

In-Lake Treatment

As described in detail above, Lake Merced currently does not meet the generally applicable Basin Plan WQOs for DO and pH due to naturally occurring stratification as well as due to excess algae growth in the Lake. The reduction of algae in Lake Merced achieved by increasing water depth using Canal flows, in conjunction with reducing nutrient inflows through use of a constructed treatment wetland, are expected to produce a general improvement of water quality that could continue over time. In the short term, following Project implementation, diversions would result in only a small decrease in algae, and corresponding water quality improvement. While not required to maintain or improve water quality in Lake Merced from the direct diversion of stormwater to increase target WSEs, in-lake management actions (or treatments) proposed as part of the Project could produce more immediate short-term water quality improvements relating to algae, pH, and DO levels (but require an increased degree of regular active management) and further improve overall Lake Merced limnological health over the long-term. Two in-lake management actions for improving water quality are proposed for implementation as part of the Project:

- Direct algae filtration of Lake Merced surface waters using the constructed treatment wetlands; and,
- The controlled overflow of Lake waters to the Tunnel.

These in-lake management actions are further described below and assessed as part of the Project for potential water quality effects.

Recirculation of Lake Water for Wetland Maintenance and Algae Control

As described in Section 2.4.1.3, during periods of very low or no flow, a recirculating pump would draw water from Lake Merced to maintain the wetland. This expanded use of the proposed wetlands would be adaptively managed to maximize the filtration and removal of algae, skimmed directly from the lake surface and pumped to the wetlands. The skimmer would have a floating structure with some wind protection that draws water from the upper few inches of the lake surface. If the maintenance inflow were withdrawn only from Impound Lake, there would not be a high enough concentration of algae treated to beneficially influence lake water quality. Thus, the Project proposes to install a piped connection (flexible hose) from areas of natural or facilitated algae concentration site(s) within South Lake into the constructed treatment wetlands.

Nuisance blue-green algae could be reduced in Lake surface waters if they are skimmed from areas where concentration factors are high (over 1,000 times background epilimnion levels), such as in coves or along the shore where light winds tend to concentrate naturally buoyant algae on the water surface (ESA, 2015). The wetlands would likely be designed such that the summer minimum Canal base flow of 0.1 cfs (0.2 acre-feet/day) would be sufficient to ensure that the wetlands plants are maintained. Calculations developed for determining the feasibility of utilizing the wetlands as a sustainable filter for removal of blue-green algae from the lake surface determined that a 2-day hydraulic residence time would be needed (see WQA, Section 6.4.1 [ESA, 2015], for details). The proposed constructed treatment wetlands would be sized such that they could accommodate a maximum flow rate of 1.4 cfs, to achieve the 2-day hydraulic residence time for the successful removal of blue-green algae from re-circulated lake water. The skimmer would be adaptively managed as part of the LMP to allow operators to target areas of highest algal concentrations during summer months. Further, additional operational or adaptive management approaches as well as physical interventions could be incorporated into this in-lake treatment measure to maximize the efficacy of algal removal from Lake Merced. Additional measures may include the use of temporarily placed floating booms to take advantage of specific times and conditions that occur that result in areas of high accumulation of algae (e.g., when algae are buoyant and when winds naturally concentrate algae) to artificially concentrate algae for uptake by the skimmer. Additionally, studies could be conducted as part of adaptive management under the LMP to assess periods and locations of highest concentrations of algae in Lake Merced to guide the timing and physical placement of the skimmer. The direct removal of concentrated surface algae by skimming would effectively achieve substantial decreases in chlorophyll, to the extent that concentrated, localized surface scums exist in the lake.

Controlled Overflow of Lake to Tunnel

As described in Section 2.4.2.1, the Project would replace a portion of the existing Lake Merced overflow with an adjustable-height weir that would be used to control the lake level and allow water from Lake Merced to be diverted back into the Vista Grande Canal just upstream of the tunnel to flow to the Ocean Outlet. Once Lake Merced reaches the target WSE, continued operation would result in water levels exceeding the target WSE with overflows at the weir being diverted back to the Canal. Further, the Project would include a siphon that would allow lake water from the hypolimnion to be diverted via the weir back to the Canal to improve lake water quality by flushing higher alkalinity water from near the lake bottom.

Overfilling and thereby flushing the Lake with low-alkalinity stormwater could reduce its background pH by diluting salts and displacing higher alkalinity water resulting in a general improvement of Lake Merced water quality. The elevated pH level in Lake Merced is likely due to the historical accumulation of alkaline minerals because it is now a terminal lake (i.e., no outflow to other water bodies). The heavier, higher TDS and higher alkalinity water would tend to be in the bottom layer when low-salinity stormwater flows into the top layer in winter (ESA, 2015). Therefore, using a siphon would allow the higher TDS and higher salinity bottom water to be displaced, increasing the benefit of flushing water out of the lake. However, during the winter wet season when Lake levels are high enough that this option could be implemented, the Lake tends to be more fully mixed, so there may be only minimal additional benefits from attempting to divert bottom waters. However, lakes that have been mixed as a result of wind action, and are characterized by isothermal conditions, are often chemically stratified because the wind-induced heat transfer rate may not be sufficient to provide sufficient energy to disrupt density layers induced by dissolved chemicals. Therefore, there would likely be a water quality benefit to operation of a siphon under various mixing regimes since bottom water generally contains more nutrients, sunken zooplankton fecal pellets, amorphous particulate matter, as well as more saline water. Operation and management of controlled overflow of the Lake to the Tunnel to improve Lake water quality would be implemented through the adaptive management of the Project through the LMP. As discussed in the LMP, the siphon would be operated to the maximum extent practicable based on available water supply, without compromising maintenance of target water surface elevations.

Summary of In-Lake Treatment Measures

Operation of the in-lake management actions proposed as part of the Project would generally further improve water quality within Lake Merced as compared to operation of the Project without such active in-lake treatment measures through the removal of algae and the flushing of the Lake with low-alkalinity stormwater to reduce the elevated background pH by diluting salts and displacing higher alkalinity water.

Impact Conclusion

Project diversions of urban stormwater and non-storm runoff from the Canal are unlikely to have discernible impacts on the water quality or beneficial uses of Lake Merced. The Project could result in an overall, long-term, water quality improvement for key lake water quality parameters and constituents, such as DO and pH. Lake Merced currently does not meet the generally applicable Basin Plan WQOs for DO and pH because the Basin Plan does not acknowledge the existing effects of naturally occurring diurnal and/or seasonal stratification in a lake environment nor of the effects of natural conditions, such as eutrophication, on ambient DO and pH. The DO and pH WQOs are also assumed to apply throughout the water column, at all locations within the Lake, and at all times, diurnally and seasonally. Temperature, DO, and pH profiles are not expected to change significantly based on Project operations and resultant increased WSEs. Although periods of weak stratification may last slightly longer (on the order of a few days at most), the range of temperature, DO, and pH conditions is not expected to change significantly.

Reduced annual average algal concentrations are expected following the filling period when the steady state WSE is reached, and as lake water containing algae is recirculated through the treatment wetland. This would improve Lake eutrophication conditions. Once the Lake is raised to the target WSE, smaller annual contributions of flow from the Canal would be required to maintain the Lake within the target WSE range. Contributions from the treatment wetland and the Canal, ranging from 403 acre-feet per year to 474 acre-feet per year, in addition to smaller contributions from precipitation and groundwater inflow, would maintain the Lake level. Following the filling period, the relative annual contribution conveyed through the constructed treatment wetland would become substantial (45 to 60 percent) as compared to the filling period. Additionally, it is possible that the Lake eutrophication conditions would further improve over time as the reduced annual average algal concentrations result in reduced algal related organic matter loading to the sediments, reduced oxygen depletion in the bottom waters, and reduced internal loading of nutrients.

The Canal base flows are identified in and are regulated under Provision C.15 of the MRP; the MRP specifies required BMPs and monitoring and reporting requirements for these various discharges. The MRP requires that pollutant concentrations in these various discharges be controlled via implementation of applicable BMPs to the MEP. Daly City has an effective stormwater and non-stormwater management program in compliance with the MRP. Further, the constructed treatment wetland is expected to reduce bacteria, metals, and nutrients concentrations in base flows and low-volume stormwater flows through settling, natural die-off, adsorption, solar irradiation, oxidation, competition, and predation such that it is unlikely that Lake concentrations would increase to a significant degree and result in substantial water quality impacts as a result of contributions of base flows and low-volume storm flows. The direct diversion of higher volume stormwater (i.e., not routed through the constructed treatment wetland), which is also subject to BMPs to the MEP via the MRP, to Lake Merced may cause short-term increases in bacterial and nutrients concentrations in the receiving waters in the immediate vicinity of the Lake Merced outlet. However, based on monitoring data and analyses associated with the Daly City and SFPUC pilot Canal stormwater diversion project, concentrations would likely rapidly equilibrate with the background levels in the Lake within several days (24 to 72 hours) following a diversion event.

Based on the findings of the various model analyses completed as part of the WQA, the overall effect of the Project, with the diversion protocols and treatment wetland proposed as part of the Project to ensure the protection of water quality in Lake Merced, would be an improvement in water quality that would be progressive with increases in depth. Operation of the in-lake management actions proposed as part of the Project would likely further improve water quality within Lake Merced through the removal of algae and the flushing of the Lake to reduce the elevated background pH. Therefore, it is likely that operation of the Project with the proposed stormwater diversions to Lake Merced, use of the constructed treatment wetlands, and in-lake treatments would improve overall Lake Merced water quality over the duration of operations and would have a less-than-significant impact on Lake Merced water quality.

Lake Management Plan

The proposed Project includes the LMP (Appendix A). The analyses of long-term water quality effects to Lake Merced from Project operations assessed in the WQA and presented above are based largely on predictive modeling results that assume a range of conditions, lake processes, and lake dynamics. As discussed above, the analysis of long-term water quality effects demonstrates that impacts to Lake Merced water quality from Project operation would be less than significant. The LMP would ensure that field monitoring is conducted to inform diversion criteria and the adaptive management framework for the Project during project operation. The monitoring plan that forms a portion of the LMP would require Daly City and SFPUC to assess trends in hydrology and water quality and to provide data to support adaptive management decision making. Such adaptive management decision making could include increases, decreases, or temporary curtailment of stormwater diversions or changes to the operation or management of the constructed treatment wetland depending on the outcomes of water quality and hydrologic trend analyses, in order to maximize the expected water quality improvements, while avoiding any substantial impact on water quality.

If long-term LMP monitoring and evaluation conclude that stormwater contributions are resulting in a trend of deviations from baseline Lake Merced water quality or anticipated water quality improvements that was not anticipated in the WQA assessment, or as a result of activities within the San Francisco watershed tributary to the Lake, appropriate BMPs identified in Section 5.1 of the LMP would be implemented (impacts relating to the construction of physical changes associated with the LMP are addressed under Impact HYD-1, above). BMPs that could be implemented through the LMP include the following measures and projected water quality improvements (discussed in more detail in Appendix A, including potential physical sites and opportunities for implementation of education or management related BMPs):

- **Detention and filtration:** This BMP would involve building infrastructure for stormwater filtration, such as bioretention/rain gardens, vegetated filter strips, sand filters, and vegetated swales throughout the Basin. Such measures may reduce levels of sediment, nutrients, trash, metals, bacteria, oil and grease, organics, and oxygen-demanding substances in source water. This BMP would also reduce particulate-bound nutrient levels in storm flows that could potentially stimulate additional algal growth.

- **Pet waste management:** This BMP would involve Daly City implementing an education program and providing facilities (such as compostable clean-up bag stations and trash receptacles) to reduce pet wastes within the Basin. This BMP would reduce levels of nutrients, bacteria, and oxygen-demanding substances in source water. Reduction in levels of oxygen-demanding substances and nutrients present in pet wastes would reduce the potential for stormwater to stimulate algal growth in the lake and degrade DO levels.

- **Green infrastructure education programs:** This BMP could be combined with the detention and retention BMP described above to further improve stormwater quality in the Basin. "Green infrastructure" describes systems and practices that use or mimic natural processes to promote the infiltration, evapotranspiration (the return of water to the atmosphere either through evaporation or by plants), or reuse of stormwater or runoff on the site where it is generated.[13] These include but are not limited to green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains. Green infrastructure education programs could include public workshops, school programs, and curriculum development to engage students at various grade levels and the public on how to conserve water and prevent water pollution.

- **Habitat enhancement:** This BMP would involve SFPUC implementing Lake Merced habitat enhancements. Enhancing the wetland and riparian habitat around the edges of Lake Merced could provide a moderate beneficial effect on DO and pH by assisting with filtration of and uptake of nutrients from direct stormwater runoff to the lake.

- **Separating stormwater:** The goal of this BMP would be to separate stormwater from SFPUC's combined stormwater and sewer system and "daylight" streams within the historic Lake Merced watershed, restoring a portion of the lake's historic drainage area. Separating stormwater would have a minor influence on DO and pH by increasing the volume of stormwater runoff to the lake, while having a negligible impact on nutrient concentrations in the lake. The SFPUC's Sewer System Improvement Program (SSIP) is considering some daylighting creek projects, including those that could connect to receiving water such as Lake Merced. However, there are no current plans to implement such plans in the short term. One non-SSIP option, the Parkmerced project, includes the consideration of routing stormwater to the lake.

- **Reduce nutrient sources:** This BMP would involve Daly City implementing an inventory of nutrient sources in the Basin to target the largest contributors of nutrient sources from regions upland of Lake Merced in an educational program. The largest nutrient contributors likely include parks and public agencies that maintain green space where fertilizer and irrigation (which, if not properly managed, can contribute to nutrient-rich runoff) may be used. Education efforts would encourage the use of alternative maintenance measures, such as the use of woodchips, restriction of lawn fertilizers, and minimization of irrigation runoff through planting (e.g., lawns, shrubs, medians) and inspection and repair of sprinklers contributing to incidental runoff. This BMP would have a potentially moderate beneficial influence on DO and pH in the Lake by reducing the concentration of nutrients in stormwater runoff that could stimulate algal growth in the Lake.

- **Catch basin screening:** This BMP would involve Daly City implementing a pilot program to test the efficacy of installing storm drain catch basin screens at targeted locations in Daly City that would screen out large trash. Such a measure would potentially reduce nutrient levels in stormflows to Lake Merced, which would reduce the potential for stormwater to stimulate additional algal growth in the Lake.

Following the implementation of the selected BMPs, water quality would continue to be monitored as described in the LMP and the BMPs that were implemented would be tracked alongside the

[13] The proposed Project is a significant green infrastructure effort that would capture and divert large volumes of stormwater to Lake Merced that would otherwise be "wasted" by continued conveyance to the ocean.

results of the water quality monitoring and analysis. The BMP management action assessment and adaptation program (described in the LMP, Appendix A) would help identify the effectiveness of a given BMP.

Aeration mixing is also considered as a potential Lake Management action and could be achieved by installing a bubbler device (air lines and bubble diffusers) near the lake bottom and an air compressor(s) on shore (construction impacts related to implementation of aeration discussed under Impact HYD-1) to create a mixing force that causes circulation of lake waters so the lower layer of low-DO water is mixed with upper waters with higher DO concentration to reduce or eliminate anoxic conditions. Circulation could also create conditions that allow for growth of non-blue green phytoplankton, thereby creating a potentially more sustaining food web for fisheries. Additionally, aeration could have a minor direct influence on DO and pH, but a moderate to major indirect effect due to the transport of surface DO to the lower waters. There is also a potential to reduce algae-related pH levels by reducing algae exposure to sunlight, which would reduce algal production. To the extent that mixing driven by aeration allowed for a greater oxidized layer to be maintained at the surface of the sediments, there could be a potential reduction in the amount of internal nutrient loading from the sediments. However, due to the high background pH of the lake, the effect on pH would be limited.

Implementation of the monitoring program would have no direct impact on Lake Merced water quality. Further, implementation of the hydrologic and water quality monitoring under the LMP within Lake Merced and the implementation of BMPs associated with the LMP analysis and reporting requirements would not cause secondary impacts that could degrade water quality in Lake Merced.

Summary

Implementation of the Project would likely present a long-term, incremental improvement of water quality in Lake Merced. The model analyses completed as part of the WQA demonstrate that the overall effect of the Project, which includes the diversion protocols to ensure the protection of water quality in Lake Merced and the constructed treatment wetland to treat Canal base flows and low-volume storm flows, would be an improvement in water quality that would be progressive with increases in depth. Additionally, following the filling period when the steady state WSE is reached, the relative annual contribution conveyed through the constructed treatment wetland, which would reduce bacteria, metals, and nutrients concentrations in base flows and low-volume stormwater flows through settling, natural die-off, adsorption, solar irradiation, oxidation, competition, and predation, would be substantial (45 to 60 percent of overall flows to the lake). Operation of the in-lake management actions proposed as part of the Project would remove algae in lake waters through use of the constructed treatment wetlands and would reduce the elevated background pH through use of the siphon. Such in-lake treatments would generally further improve water quality within Lake Merced as compared to operation of the Project without such active in-lake treatment measures. Analysis and reporting under the LMP would also require ongoing assessment of lake hydrologic and water quality monitoring data within the context of the lake's conceptual and numeric models to reduce uncertainty relating to long-term water quality trends; and adjust operational protocols, and potentially implement BMPs to maximize anticipated water quality conditions and improvements.

Implementation of the Project, including the in-lake treatment measures and the LMP's BMPs and adaptive management process, would not violate water quality standards or waste discharge requirements, provide substantial additional sources of polluted runoff, or otherwise substantially degrade water quality in Lake Merced. The impact would be *less than significant.*

Mitigation: None required.

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k) Impact HYD-9: The Project could conflict with plans, policies, or regulations related to alteration of coastal landforms or processes adopted for the purpose of avoiding or mitigating an environmental effect. (Significant and Unavoidable)

As part of the proposed Project, the Ocean Outlet structures would be reconfigured and/or replaced. An existing 27-inch force main would be abandoned in place, with the exposed portion that is currently protruding from the bluff face (drop structure) removed back to the bluff face. The new portion of submarine outfall pipeline would be supported by new subsurface concrete support piers to protect it from erosion and extend its operating life. This replacement pipe would be supported by four 3-foot by 3-foot concrete piers embedded in the consolidated sand beneath the beach sand. The elevation of the effluent pipeline would be the same as the existing pipeline. The existing Daly City Ocean Outlet structure would be removed and replaced with a low-profile outlet structure set nearer to the existing bluff face to improve beach access. High-volume storm flows would discharge through the west-facing flap gates in the proposed Ocean Outlet structure and would flow across the beach. The new Ocean Outlet structure would also include wing walls against the bluff face that would extend north 70 feet to connect to the wing wall extending south from the existing SFPUC outlet, and extend 100 feet south of the rehabilitated Daly City Ocean Outlet.

As described in Section 3.9.1.2, Project Hydrologic Setting, erosion of the bluff at Fort Funston is existing and ongoing. As a result, over time, the bluff will continue to retreat and the proposed Ocean Outlet structure and Tunnel would become exposed on the beach. To address this, Daly City would periodically remove the portion of this infrastructure that protrudes from the bluff and reconstruct the Ocean Outlet structure and wing walls. This removal and reconstruction is estimated to occur at approximately 25-year intervals, but would be a function of the actual rate of bluff retreat, which will be influenced by future sea level rise as well as storms and beach dynamics (discussed below). The methods for demolition and construction would be similar to those described for the proposed initial Ocean Outlet rehabilitation.

The Project's construction and operation could alter the existing natural beach dynamics and the coastal environment, thereby resulting in altered bluff erosion rates and patterns. Coastal development in California is regulated by the California Coastal Commission pursuant to the California Coastal Act. For the purposes of CEQA, the impact threshold is defined by conformance to the Coastal Act policies, and related conformance to NPS Management Policies, described in Section 3.9.2.1.

The Coastal Act directs that new development that could alter natural shoreline processes shall be permitted when required to serve coastal dependent uses, protect existing structures, and only when designed to eliminate or mitigate adverse impacts on local shoreline sand supply (Public Resources Code Section 30235). The statute also states that new development shall "[a]ssure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs" (Public Resources Code Section 30253(b)). Evaluated here is whether the construction of the Ocean Outlet structures would be consistent with these Coastal Act policies, which have the dual goals of assuring structural integrity and stability while minimizing the physical effects of shoreline development on coastal processes.

Moffatt and Nichol prepared a Project-specific Preliminary Coastal Engineering Study (Study) for Daly City, which included evaluation of relevant coastal engineering parameters, wave transformation analysis, beach profile variability analysis, beach and bluff toe retreat analysis, and analysis and recommendations related to potential effects of, and strategies to mitigate, sea level rise (Moffatt and Nichol, 2013). The Study was based on early design concepts that did not include the wing wall component. As described in Section 3.9.1.2, coastal analysis has confirmed considerable uncertainty about the future bluff and shoreline recession rate in the vicinity of the proposed Ocean Outlet with the notable exception of the relatively stable promontory that has developed behind the nearby SFPUC outlet and wing walls. The Study (Moffatt and Nichol, 2013) concluded that the bluff promontory associated with the SFPUC outlet is likely due to the presence of the structure itself and the associated existing low-height wing walls, which provide protection from wave attack, rather than an anomaly in the bluff material producing greater resistance to bluff recession. As a result of the Study's findings, wing walls were added to the proposed Project design to emulate the reduced bluff recession rates associated with the SFPUC outlet, and reduce the potential for outflanking of the outlet structure. Further, the wing walls were added to address the force of high tides and associated wave action, and other identified contributing coastal processes, including sea level rise, on local beach and bluff erosion rates. However, the Study did not assess the potential impacts of the recommended wing walls on local coastal processes, such as sediment supply, beach profile alterations, or beach and bluff toe retreat. The following subsections present a conservative assessment of the Project's potential effects, based upon the most current technical studies available and professional opinion. A discussion of the Project's consistency with applicable Coastal Act policies follows. Final Project engineering design drawings would be prepared subsequent to Project approval, to account for changes made during the environmental review process and in response to input from the public and responsible agencies.

Bluff Erosion Impacts and Sea Level Rise

The proposed Ocean Outlet structure would be located above the highest tide level, but within reach of wave runup on the beach. The Study (Moffatt and Nichol, 2013) documented the relatively stable promontory that has developed behind the SFPUC's outlet structure in the context of local erosion rates. This promontory is important because it indicates that the existing wing walls associated with the SFPUC outlet structure have sheltered the toe of the bluff from wave run-up and have reduced local erosion relative to the surrounding unprotected bluff areas. The proposed Project wing walls would extend the Ocean Outlet structure's operating life and improve the structure's stability by providing erosion protection for the bluff toe (bluff sheltering) to reduce the severity of wave run-up and erosion at the base of the bluff (as described above) (Moffatt and Nichol, 2013). Protecting the bluff toe from further wave run-up and erosion would serve to reduce the rate of local erosion in a manner similar to that described for the SFPUC's beach outlet structure.

Future erosion rates along unprotected coastal bluffs at Fort Funston are expected to be at least equal to, and most likely will exceed, the documented historical rates of 1+ feet per year of annualized long-term average bluff retreat (PWA, 2007; Moffatt and Nichol, 2013). As described in Section 3.9.1.2, Future Shoreline Conditions, the projected recession of the bluff is estimated to range from 116 feet to 234 feet by 2060. A similar future erosion rate range (1.4 to 4.5 feet per year) was calculated for the site by PWA (2007) with a long-term future erosion rate of 3 feet per year proposed for design purposes. However, as described in Section 3.9.1.2, episodic bluff erosion during extreme events has resulted in localized bluff failures and recession of the bluff top of up to 80 feet in a single episode as well as shoreline changes in excess of 100 feet during a single year.

Similar to conditions at the SFPUC outfall, construction of wing walls would reduce erosion rates behind the proposed wing walls by protecting the bluff from erosion. However, erosion rates and patterns beyond the project site could become substantially altered as compared to existing average rates of erosion under the baseline condition. Installation of the proposed wing wall structure could increase reflected wave energy resulting in increased local scour and subsequent reduction of the beach vertical profile as compared to existing conditions (as described in detail below). The bluffs adjacent to the site would continue to recede due to erosion over the next 50 years, which could result in development of a promontory similar to that backing the San Francisco outlet structure. Such a promontory could protrude as much as 150 feet beyond the adjacent bluffs (PWA, 2007) and has the potential for episodic erosion at some point in the future due to the combined erosive effects of waves causing erosion as a result of flanking the promontory and freshwater runoff from storm precipitation at the bluff top. Such erosion of the promontory, which could occur rapidly at some point in the future in the form of slumping or landsliding, represents a potential hazard. Additionally, continued bluff retreat behind the wing walls as a result of precipitation runoff could occur. Further, as the unprotected adjacent bluffs continue to retreat landward over time, increased exposure to wave run-up and bluff erosion, coupled with higher baseline water levels due to sea level rise, would increase the potential for storm damage to the wing wall structure. Locally, the bluff sheltering effect of the wing walls may decrease the sediment availability at the site due to diminished supply from the presently eroding bluffs. Bluff fall material following episodic erosion events, called talus, is gradually transported by wave action away from the area of bluff failure. Reducing such sediment transport mechanisms (talus transport) and decreasing local sediment supply could cause erosion of the beach seaward of the wing wall and result in narrowing of the beach. At some point in the future, with projected sea level rise and continued narrowing of the beach, the shoreline could be located adjacent to the wing wall, reducing the effectiveness of the wing wall in protecting the toe of the bluff from wave runup and overtopping.

Seasonal Wave Action and Beach Profile Impacts

Given the movement of beach sediment in the littoral zone, analysis of beach profiles indicates a vertical range in beach sand level of at least 5 feet. As described above, the proposed submarine outfall pipeline elevation would be the same as the existing pipeline. As a result of seasonal variation of sand migration and the beach profile, the existing outfall pipeline is completely or partially buried during summer months and becomes exposed during winter months. With implementation of the proposed Project, which includes shoreline armoring in the form of the proposed wing wall extension, it is possible that a localized increase in reflected wave energy could occur, resulting in increased scour of the beach and increased alterations to the seasonal beach profile as compared to baseline conditions. Therefore, the submarine outfall pipeline could be exposed more often and more extensively as compared to existing conditions. Such an effect could become exacerbated over time as sea level rise results in increased wave run-up at the Project site and could result in more of the pipe becoming periodically exposed as compared to baseline conditions.

Consistency with Coastal Act Policies

As described in Section 3.9.2, Regulatory Setting, the California Coastal Act directs that new coastal development, such as the Ocean Outlet structure, be designed to ensure that impacts on local shoreline sand supply are eliminated or mitigated (Section 30235) and that the Project not create or contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (Section 30253(b)). Further, the CCC’s 2015 Sea Level Rise Policy Guidance outlines a process for evaluating and expands upon the factors (e.g., avoidance, alternatives, and adaptation) that the CCC will consider in determining whether a proposed shoreline development project is consistent with the Coastal Act (CCC, 2015).

The Project involves replacement of the existing Ocean Outlet as well as development of new wing walls at the base of the coastal bluff up- and down-coast of the Ocean Outlet. While the Project is coastal-dependent, it also involves additional development that includes wing walls in an area subject to sea level rise impacts. As explained in the preceding paragraphs, the wing walls are proposed to promote the stability and structural integrity of the Ocean Outlet structure, reduce erosion directly behind the wing walls, and extend the operating life of the Ocean Outlet. However, the wing walls would potentially result in alterations to coastal processes in a manner that could result in a reduced local sediment supply, an altered seasonal beach profile due to increased scour, and/or increased episodic bluff erosion (described above). The wing walls thus constitute a protective device that has the potential to substantially alter natural landforms along bluffs and cliffs in the Project vicinity. For these reasons, elements of the Project may conflict with Coastal Act Sections 30235 and 30253(b) and CCC’s Sea Level Rise Policy Guidance.

Impact Summary and Conclusion

Based on the available technical studies, professional opinion, and current projections of sea level rise and coastal erosion, the Project could have substantial adverse effects on local shoreline sand supply and shoreline processes and localized rates of erosion, and would continue to preclude the bluffs and shoreline from eroding naturally. Were the Project to result in such effects, it could conflict with California Coastal Act Sections 30235 and 30253 (described in Section 3.9.2.1) which require that adverse effects on shoreline processes and natural landforms be minimized. The impact would be *significant*. The CCC's 2015 Sea-Level Rise Policy Guidance (described in Section 3.9.2.1) outlines the types of information, analysis, and design considerations the agency's staff requires in order to determine whether shoreline projects conform to the above-listed Coastal Act policies. Implementation of **Mitigation Measure 3.9-2, Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies**, would require the final Project engineering design minimize conflicts with the applicable Coastal Act requirements that new development: 1) be designed to eliminate or mitigate adverse effects on local shoreline sand supply and 2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (California Coastal Act Sections 30235 and 30253). The measure requires Daly City to complete a Project-specific coastal engineering study for the final Project design, consistent with the California Coastal Commission's 2015 Sea-Level Rise Policy Guidance and implement study recommendations in the Project's final design and construction, operation, and maintenance. Implementation of **Mitigation Measure 3.9-2** would reduce potential adverse effects of the Project on these coastal resources as follows.

The analysis required as part of **Mitigation Measure 3.9-2** would include evaluation of engineering design options in a manner consistent with the California Coastal Commission's 2015 Sea-Level Rise Policy Guidance, such as but not limited to no armoring of the coast line (no new wing walls) or reduced armoring associated with the installation of wing walls (e.g., modifying proposed wing wall design to be reduced in extent), and with future modification of the Tunnel and Ocean Outlet structure as the bluff continues to recede. The design compliance required by **Mitigation Measure 3.9-2** and the recommendations developed during the investigation shall be presented in a report, which shall be reviewed, signed, and stamped by the professional engineer in charge. Based on the site's defined baseline condition (including but not limited to bluff erosion rates, seasonal changes to beach profile, sand supply, and wave height as documented here and described in detail in Moffatt and Nichol, 2013) and future projections incorporating consideration of sea level rise, the report shall include recommendations for design, construction methods, and materials for all aspects of the Ocean Outlet site development, including the site preparation, building foundations, and design, to remedy to the extent feasible identified coastal process-related impacts in a manner consistent with the advisory guidance of the CCC's 2015 Sea-Level Rise Policy Guidance. Once finalized, the report and final design shall be submitted to the NPS for review and comment.

Implementation of **Mitigation Measure 3.9-2** would also address Project conformity with NPS Management Policies. As described in Section 3.9.2, Regulatory Setting, NPS Management

Policies indicate that new developments will not be placed in areas subject to wave erosion or active shoreline processes unless the listed requirements are met. The GGNRA/Muir Woods National Monument Final General Management Plan/EIS indicates that the purpose of the GGNRA is to offer national park experiences to a large and diverse urban population while preserving and interpreting the outstanding natural, historic, scenic, and recreational values of the park lands (NPS, 2014). Implementation of the proposed Project includes the objective of improving recreational access and reducing litter transfer and deposition along the beach below Fort Funston, which would be accomplished by removal of the existing outlet structure from the beach and inclusion of a debris screening device, and would improve natural, scenic, and recreational values in this area. The proposed Ocean Outlet structure would replace the existing structure; therefore, an alternative location would not be practicable or necessary. Implementation of **Mitigation Measure 3.9-2** would ensure that the Project conforms with NPS Management Policies requiring that the design is reasonably assured of surviving its planned life span without the need for shoreline control measures and that steps to minimize safety hazards and harm to property and natural resources are implemented.

However, even with implementation of **Mitigation Measure 3.9-2**, elements of the Project necessary to ensure structural integrity may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes. Therefore, even with implementation of **Mitigation Measure 3.9-2**, certain Project features associated with the Ocean Outlet structures may still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act Sections 30235 and 30253. As a result, **Impact HYD-9** could remain *significant and unavoidable* even after the incorporation of available and feasible mitigation. This finding is due in part to the inherent inconsistency between the policies requiring structural integrity with the policy concerning avoidance of shoreline protective devices that would substantially alter natural landforms along bluffs and cliffs. There are Project design features, in particular the wing walls, that may be required in final design for purposes of structural integrity, but by slowing the rate of erosion the wing walls may substantially alter natural landforms along the bluff face.

Mitigation Measure 3.9-2: Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies

The final design of the Ocean Outlet structures must minimize conflicts with the applicable Coastal Act requirements that new development: 1) be designed to eliminate or mitigate adverse effects on local shoreline sand supply (Section 30235); and 2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (Section 30253). In order to minimize conflicts with these policies, Daly City shall undertake the following steps when developing final engineering designs of the Ocean Outlet structures:

1) A California licensed engineer shall prepare a study consistent with the methods for assessing sea level rise in Coastal Development Permits detailed in the California Coastal Commission's Sea Level Rise Policy Guidance (California Coastal

Commission, 2015). The study shall identify Project design elements that may conflict with California Coastal Act Policies (Sections 30235 and 30253) and recommend revisions to bring the final design into conformity with these guidelines and policies (Study). At a minimum, the Study shall:

a) Use the range of projections recommended by the CCC's 2015 Sea Level Rise Policy Guidance in evaluating potential sea level rise effects over the Project planning horizon.

b) Incorporate, and update as necessary, information concerning baseline conditions at the Ocean Outlet, and future projections (both with and without sea level rise) concerning:

   i) Bluff erosion rates and patterns;

   ii) Sand supply sequestering as a result of Project design;

   iii) Storm effects relating to coastal hazards (e.g., scour, wave runup, flooding;

   iv) Potential for exposure of Project infrastructure over the Project lifetime, and

   v) Potential cumulative effects of the Project on the identified coastal process elements above with applicable existing or future projects.

c) Include recommendations for final engineering design, construction methods and materials for all aspects of the Ocean Outlet development, including the site preparation, building foundations, and design, to remedy any identified coastal process or coastal resource related impacts. Also the Study shall identify final engineering design recommendations and alternatives to minimize identified risks relating to hazards, such as geologic instability. Design recommendations and alternatives shall be protective of coastal resources throughout the expected life of the Project and include recommendations to minimize hazard exposure where avoidance is infeasible, including steps to relocate or modify the development as needed to prevent risks to the Project structures or to coastal resources. Such alternatives could include, but would not be limited to, alteration of the proposed wing walls or other outlet structure components to ensure final Project design is consistent with the following California Coastal Act policies to the extent feasible:

   a. **Section 30235 Consistency:** Construction of Project features that alter natural shoreline processes shall be approved only if it is determined by the CCC that such a design is required to serve a coastal dependent use or to protect existing structures or public beaches in danger from erosion, and that final design minimizes adverse impacts on local shoreline sand supply as compared to current and future baseline conditions.

   b. **Section 30253 Consistency:** Final design shall be approved only if it is determined that such a design minimizes contribution to erosion, geologic instability, or destruction of the site or surrounding area, and if the Project's necessary protective devices minimize the alteration of natural landforms.

2) The Study's findings shall be presented in a report, which shall be reviewed, signed, and stamped by the professional engineer in charge. The report shall be subject to technical review by Daly City, the NPS, SFPUC, and the CCC staff.

3) The report and final design shall be submitted to the NPS and CCC for review and approval to ensure any inconsistencies with NPS and CCC policy requirements are resolved. Recommendations in the approved study shall be incorporated into the design and construction specifications and shall be implemented during construction and operation and maintenance of the Project as applicable.

Significance after Mitigation: Significant and Unavoidable.

None of the other Project components are close enough to the coast to be vulnerable to coastal retreat. Therefore, there would be no impact related to those components.

NEPA Analysis

The following analysis of the proposed Project assesses the context, duration, and intensity of impacts relating to water quality and surface water hydrology (floodplains) against the NEPA impact thresholds defined in Section 3.9.3.2. Additionally, the following analysis describes the potential environmental consequences of the Project on local coastal processes in the vicinity of Fort Funston. While no NEPA threshold for such an issue is included in the NPS DO-12 Handbook, a discussion is warranted in order to fully disclose the full range of potential adverse effects of the Project.

Water Quality

As described in the CEQA analysis, construction activities would result in exposing areas of loose soil that could be subject to erosion by stormwater runoff or dewatering activities. However, adherence to the CGP, which includes implementation of BMPs and a SWPPP, as well as other local permit requirements, would ensure that the Project would result in minor effects on water quality during construction activities. Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake and the Lake Merced overflow structure in South Lake could result in discharges of pollutants (sediment) to Lake Merced directly. **Mitigation Measure 3.4-2** requires the installation of a cofferdam around Lake Merced in-water work areas as well as dewatering of the isolated work areas to avoid impacts to sensitive species. Waters isolated within cofferdam areas have a high potential of containing high concentrations of sediment as a result of the level of ground disturbance within the isolated work area. The direct discharge of such waters from the cofferdam areas to Lake Merced could result in localized increases in suspended sediment and turbidity that persist for the duration of dewatering activities. Further, the dewatering discharge from the Lake Merced outlet structure cofferdam area would be directed to Impound Lake, a relatively small water body with little capacity to dilute or disperse such turbidity increases. If the water from the isolated work areas were discharged directly to Lake Merced, these discharges could violate water quality standards, resulting in short-term, moderate, adverse impacts on water quality. Implementation of **Mitigation Measure 3.9-1, Implement Dewatering BMPs for In-Water Work** would reduce this potential impact on water quality by requiring the implementation of standard BMPs to remove sediment from the dewatering discharge direct to receiving waters and to control the rate of discharge such that adverse effects related to runoff, flooding, and damage to adjacent structures would not occur. Therefore, with implementation of mitigation, Project construction would result in short-term, minor effects to water quality as defined in Section 3.9.3.2, NEPA Impact Thresholds.

As described in the CEQA analysis, the overall effect of Project operation and maintenance, with the controls proposed as part of the Project to ensure the protection of water quality in Lake Merced, would result in an improvement in water quality that would be progressive with increases in depth. Operation of the in-lake management actions proposed as part of the Project would likely further improve water quality within Lake Merced through the removal of algae and flushing of the Lake to reduce the elevated background pH. Analysis and reporting under the LMP would also require ongoing assessment of lake hydrologic and water quality monitoring data within the context of the lake's conceptual and numeric models to reduce uncertainty relating to long-term water quality trends; and adjust operational protocols, and potentially implement BMPs to maximize anticipated water quality conditions and improvements Therefore, it is likely that operation of the Project with the proposed stormwater diversions to Lake Merced, use of the constructed treatment wetlands, and in-lake treatments would result in long-term, minor to moderate beneficial changes to water quality (including chemical, physical, and biological effects), such as potentially improving Lake Merced water quality within the context of historical and/or desired water quality conditions, as defined in Section 3.9.3.2, NEPA Impact Thresholds.

Floodplains

The CEQA analysis above described in detail the potential for the Project to result in a change in the ability of a floodplain to convey or store floodwaters. Implementation of the Project would not impede flows on the floodplain or increase the 100-year base flood elevation. Overall, Project operation would decrease local flood hazards in the Project area in a quantifiable manner by increasing the stormwater conveyance capacity of the Canal and Tunnel and through adaptively managing the Lake Merced overflow structure to temporarily store peak stormflows by temporarily raising the WSE above defined target maximums, representing a long-term, moderate beneficial impact. The Project would not contribute to a flood.

Coastal Processes

As described in the CEQA analysis, the proposed Project could result in an adverse effect related to alterations of coastal landforms and coastal processes, such as bluff retreat and alterations to the beach profile. Also, the proposed Project could conflict with California Coastal Act Sections 30235 and 30253 (described in Section 3.9.2.1) should bluff erosion rates and patterns alter as a result of the proposed Project, including a local decrease of the sediment availability at the site due to diminished sand supply. These alterations would be readily apparent and long-term, with substantial, noticeable changes in risks to the public and the environment in the area surrounding the Ocean Outlet structure. This would be a moderate to major impact in the absence of mitigation measures in that the alterations of coastal landforms and/or physical coastal processes that potentially result from implementation of the Project would be readily apparent and long-term, with substantial, noticeable changes in risks to the public and the environment over an area local to the project site that may not be able to be successfully mitigated in full. **Mitigation Measure 3.9-2, Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies**, would reduce any Project-related effects to coastal processes. The measure ensures that the final Project design avoids or minimizes, to the extent feasible, any potential conflicts with the applicable Coastal Act requirements that new development: minimize conflicts with the applicable Coastal Act requirements that new development: 1) be designed to eliminate or mitigate adverse effects on local shoreline sand supply (Section 30235); and 2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (Section 30253). The measure would achieve these goals by requiring Daly City to complete a Project-specific coastal engineering study consistent with the California Coastal Commission's 2015 Sea-Level Rise Policy Guidance; subjecting the study to review and approval by CCC and NPS staffs; incorporating the study's CCC- and other agency-approved recommendations into final Project design; and ensuring that the final Project design implements such recommendations through in construction, operation, and maintenance. The analysis required as part of **Mitigation Measure 3.9-2** would include evaluation of alternatives to the outlet structure components, and with future modification of the Tunnel and Ocean Outlet structure as the bluff continues to recede. Pursuant to the measure, the selected alternative shall meet the performance standards set forth in Coastal Act policies 30235 and 30253(b) and NPS Management Policies, as outlined above. Explicit in these policies is the requirement that adverse effects on shoreline processes and natural landforms be minimized. Adherence to these policies would likely reduce potential adverse effects of the Project on these coastal resources from a moderate to a minor level as Mitigation Measure 3.9-2 would ensure that alterations of coastal landforms and physical coastal processes, such as bluff erosion and sediment supply, would be detectable but localized, and would not have an appreciable effect on resources or public safety. Implementation of Mitigation Measure 3.9-2 would also ensure that final Project design is substantially in conformance with NPS Management Policies regarding minimization of safety hazards and harm to property and natural resources. Further, removal of the existing structure from the beach and inclusion of a debris screening device would improve natural, scenic, and recreational values in this area. However, even with implementation of **Mitigation Measure 3.9-2**, elements of the Project may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes, and localized rates of erosion and/or with NPS Management Policies. Therefore, even with implementation of **Mitigation Measure 3.9-2**, certain Project features associated with the Ocean Outlet structure may still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act sections 30235 and 30253. As a result, impacts could remain **moderate to major** even after the incorporation of available and feasible mitigation.

3.9.5.2 Tunnel Alignment Alternative

The following describes the hydrology and water quality effects associated with construction and operation of an alternative tunnel alignment. As described in Section 2.7.2.1, the Tunnel Alignment Alternative would involve construction of an up-to 9-foot-diameter, 3,200-foot-long tunnel within a defined area south of the existing Tunnel, as shown on Figure 2-6, a rehabilitated or new outlet structure, and a different east portal. All other Project components under this alternative would be the same as described in Section 3.9.5.1, Proposed Project, or Section 3.9.5.3, Canal Configuration Alternative, depending on the option selected. Thus, impacts relating to hydrology or water quality as part of construction or operation and maintenance from implementation of the Tunnel Alignment Alternative would be as described in those sections. The CEQA and NEPA analyses presented below assess the impacts from construction and operation of the alternative tunnel alignment, including a new connection to the existing Canal at a point south (upstream) of the existing Lake Merced Portal.

CEQA Analysis

Construction

The Tunnel Alignment Alternative would have similar construction characteristics to those described for the Project in Section 3.9.5.1, Proposed Project. The construction methods and duration to construct this alternative would not substantially differ as compared to the Tunnel portion of the proposed Project, as described in Chapter 2. This alternative, like the proposed Project, is anticipated to take approximately 24 to 44 months to complete, with the Tunnel construction component lasting 17 to 37 months of this total construction period, depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. The details of the construction activities and methods for the Project, which are also applicable for the Tunnel Alignment Alternative, are summarized in Table 2-1, which includes demolition; Project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. The locations of construction associated with the Tunnel Alignment Alternative are illustrated in Figure 2-6. Additionally, work at Avalon Canyon access road would be the same as for the proposed Project.

As with the proposed Project, the Tunnel Alignment Alternative construction activities, including staging areas and other areas of potential disturbance, would result in exposing areas of loose soil that could be subject to erosion by stormwater runoff or dewatering activities. Adherence to the CGP, which includes implementation of BMPs and a SWPPP, as well as other local permit requirements, would ensure that water quality impacts related to stormwater runoff during construction would be minimized and/or avoided.

Under this alternative, the new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to connect to the existing Ocean Outlet location is selected, construction and long-term maintenance of the Ocean Outlet structure, including the use of a sheet pile cofferdam and periodic replacement of exposed portions of the tunnel and outlet, would be as described for the proposed Project in Section 3.9.5.1. If the option to construct a new outlet at a different location is selected, the construction and long-term maintenance methods would be similar to those described in Section 3.9.5.1, but would occur up to 50 feet south of the existing outlet location, depending on final tunnel alignment. Additionally, a new connection to the existing submarine outfall pipeline would be needed, and the portion that crosses the beach would be up to 50 feet longer than if the existing outlet location is used.

Under this alternative, a new tunnel would be constructed and would either meet the terminus of the existing tunnel at the current extent of the bluff face or would exit the bluff to the south at a new outlet location. Regardless of the outlet location selected, as the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed. The exposure of two structures in this manner could result in a significant impact related to alterations of coastal landforms and coastal processes, such as bluff retreat and alterations to the beach profile. Also, the exposure and rehabilitation of structures under this alternative could conflict with California Coastal Act Sections 30235 and 30253 (described in Section 3.9.2.1) should bluff erosion rates and patterns alter as a result of the Tunnel Alignment Alternative.

Mitigation Measure 3.9-2, Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies, would reduce potential Project-related impacts to coastal processes. The measure ensures that the final Project design avoids or minimizes, to the extent feasible, any potential conflicts with the applicable Coastal Act requirements that new development: minimize conflicts with the applicable Coastal Act requirements that new development: 1) be designed to eliminate or mitigate adverse effects on local shoreline sand supply (Section 30235); and 2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (Section 30253). The measure would achieve these goals by requiring Daly City to complete a Project-specific coastal engineering study consistent with the California Coastal Commission's 2015 Sea-Level Rise Policy Guidance; subjecting the study to review and approval by CCC and NPS staffs; incorporating the study's CCC- and other agency-approved recommendations into final Project design; and ensuring that the final Project design implements such recommendations through construction, operation, and maintenance. The analysis required as part of **Mitigation Measure 3.9-2** would include evaluation of alternative outlet structure designs, and with future modification of the Tunnel and Ocean Outfall structure as the bluff continues to recede. Pursuant to the measure, the selected alternative shall meet the performance standards set forth in Coastal Act policies 30235 and 30253(b) and NPS Management Policies, as outlined above. Explicit in these policies is the requirement that adverse effects on shoreline processes and natural landforms be minimized. However, even with implementation of **Mitigation Measure 3.9-2**, elements of the Project may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes, and localized rates of erosion. Therefore, even with implementation of **Mitigation Measure 3.9-2**, certain Project features associated with the Ocean Outlet structures may still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act sections 30235 and 30253. As a result, impacts could remain *Significant and Unavoidable* even after the incorporation of available and feasible mitigation.

Implementation of Mitigation Measure 3.9-2 would also ensure that NPS Management Policies regarding minimization of safety hazards and harm to property and natural resources are in conformity. Further, removal of the existing structure from the beach and inclusion of a debris screening device would improve natural, scenic, and recreational values in this area.

Operation

There would be no difference in operational hydrology or water quality related impacts under the Tunnel Alignment Alternative as compared to those described for the proposed Project.

NEPA Analysis

Water Quality

As described in the NEPA analysis for the proposed Project, activities relating to construction of the tunnel would result in exposing areas of loose soil that could be subject to erosion by stormwater runoff or dewatering activities. However, adherence to the CGP, which includes implementation of BMPs and a SWPPP, as well as other local permit requirements, would ensure that the Project would result in minor effects on water quality during construction activities as defined in Section 3.9.3.2, NEPA Impact Thresholds.

The Tunnel Alignment Alternative could be paired with either the proposed Project or with the Canal Configuration Alternative. The overall effect of operation and maintenance of the Tunnel Alignment Alternative, in conjunction with either the proposed Project or with the Canal Configuration Alternative, would be the overall improvement of Lake Merced water quality, as described in Section 3.9.5.1. Any improvement in Lake Merced water quality (depending on wetland design and treatment capacity) would be progressive with increases in depth. Therefore, operation and maintenance of the Tunnel Alignment Alternative would result in minor changes to existing water quality as defined in Section 3.9.3.2.

Floodplains

Because impacts relating to hydrology or water quality from construction or operation and maintenance of the Tunnel Alignment Alternative would be similar to those described for the proposed Project, the effects on floodplains would be similar to those described in the NEPA analysis for the proposed Project. The Tunnel Alignment Alternative would not impede flows on the floodplain or increase the 100-year base flood elevation. Overall, operation of the Tunnel Alignment Alternative would decrease local flood hazards in a quantifiable manner by increasing the stormwater conveyance capacity of the Tunnel and through adaptively managing the Lake Merced overflow structure to temporarily store peak stormflows by temporarily raising the WSE above defined target maximums, representing a long-term, moderate beneficial impact. The Tunnel Alignment Alternative would not contribute to a flood.

Coastal Processes

Under this alternative, a new tunnel would be constructed and would either meet the terminus of the existing tunnel at the current extent of the bluff face or would exit the bluff to the south at a new outlet location. Regardless of the outlet location selected, as the bluff recedes, both the existing abandoned-in-place tunnel and the new tunnel would become exposed. The exposure of two structures in this manner could result in an adverse effect related to alterations of coastal landforms and coastal processes, such as bluff retreat and alterations to the beach profile. The development of a new tunnel and potentially a new Ocean Outlet to the south of the existing structures may conflict with NPS management policies for coastal processes, described in Section 3.9.2.1, Federal and State

Regulations, by introducing new developments in an area subject to wave erosion or active shoreline processes when a practicable alternative (i.e., replacement of the existing Tunnel and Ocean Outlet structure at its current location) is available. Also, the Tunnel Alignment Alternative could conflict with California Coastal Act Sections 30235 and 30253 (described in Section 3.9.2.1) should bluff erosion rates and patterns alter as a result of this alternative. **Mitigation Measure 3.9-2, Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies**, would apply to the Tunnel Alignment Alternative and would reduce any Project-related effects to coastal processes. The measure ensures that the final Project design avoids or minimizes, to the extent feasible, any potential conflicts with the applicable Coastal Act requirements in Sections 30235 and 30253. The measure would achieve these goals by requiring Daly City to complete a Project-specific coastal engineering study consistent with the California Coastal Commission's 2015 Sea-Level Rise Policy Guidance; subjecting the study to review and approval by CCC and NPS staffs; incorporating the study's CCC- and other agency-approved recommendations into final Project design; and ensuring that the final Project design implements such recommendations through in construction, operation, and maintenance. The analysis required as part of **Mitigation Measure 3.9-2** would include evaluation of alternatives to the outlet structure components, and with future modification of the Tunnel and Ocean Outlet structure as the bluff continues to recede. Pursuant to the measure, the selected alternative shall meet the performance standards set forth in Coastal Act Sections 30235 and 30253(b) and NPS Management Policies, as outlined above. Explicit in these policies is the requirement that adverse effects on shoreline processes and natural landforms be minimized. Adherence to these policies would likely reduce potential adverse effects of the Project on these coastal resources from a moderate to a minor level as **Mitigation Measure 3.9-2** would ensure that alterations of coastal landforms and physical coastal processes, such as bluff erosion and sediment supply, would be detectable but localized, and would not have an appreciable effect on resources or public safety. However, even with implementation of **Mitigation Measure 3.9-2**, elements of the Project may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes, and localized rates of erosion. Therefore, even with implementation of **Mitigation Measure 3.9-2**, certain Project features associated with the Ocean Outlet structures may still result in inconsistency with policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act Sections 30235 and 30253. As a result, impacts could remain **moderate to major** even after the incorporation of available and feasible mitigation.

Further, removal of the existing structure from the beach and inclusion of a debris screening device would improve natural, scenic, and recreational values in this area. However, as noted above, the development of a new tunnel and potentially a new Ocean Outlet to the south of the existing structures may conflict with NPS management policies for coastal processes, described in Section 3.9.2.1, Federal and State Regulations, by introducing new developments in an area subject to wave erosion or active shoreline processes when a practicable alternative (i.e., replacement of the existing Tunnel and Ocean Outlet structure at its current location) is available.

3.9.5.3 Canal Configuration Alternative

The Canal Configuration Alternative would minimize changes to the existing Canal while allowing for some discharges to Lake Merced. The diversion structure described for the proposed Project would be relocated to the beginning of the Canal as shown in **Figure 2-7**. The John Muir Drive crossing also would be relocated close to the southern end of Impound Lake. The diversion structure would replace the first approximately 350 feet of the Canal, and the rest of the Canal would be unchanged except as needed for the Lake Merced Tunnel Portal, described above for the proposed Project. Only one wetland cell of approximately 1.7 acres would be constructed, allowing for a reduced water treatment capacity compared to the Project.

The following describes the hydrology and water quality effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.9.5.1, Proposed Project, or Section 3.9.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, hydrology and water quality effects for the tunnel portion would be as described in those sections.

The proposed operating model would be similar to the proposed Project. The principal diversion routing options are the same as the proposed Project described in Section 2.6.1, Management of Stormwater Flows, except that treated water from the constructed treatment wetland would drain into South Lake rather than Impound Lake, and the constructed treatment wetland would have a reduced capacity compared to the proposed Wetland Cells A and B under the proposed Project.

CEQA Analysis

Erosion, Hydrology, and Flooding Impacts

Impacts relating to surface and groundwater hydrology, coastal processes, erosion, flooding, and flood risks associated with construction, operation and maintenance of the Canal Configuration Alternative would be as described in Section 3.9.5.1, Proposed Project, or Section 3.9.5.2, Tunnel Alignment Alternative, depending on the option selected.

Water Quality Impacts

As with the proposed Project, the Canal Configuration Alternative construction activities, including staging areas, would result in exposing areas of loose soil that could be subject to erosion by stormwater runoff or dewatering activities. Adherence to the CGP, which includes implementation of BMPs and a SWPPP, as well as other local permit requirements, would reduce potential erosion impacts and other water quality impacts relating to construction activities to a *less-than-significant* level. As with the proposed Project, construction of the Lake Merced overflow structure in South Lake and the outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly. **Mitigation Measure 3.4-2** requires the installation of a cofferdam around Lake Merced in-water work areas as well as dewatering of the isolated work areas to avoid impacts to sensitive species. A temporary cofferdam would be constructed around the outlet structure construction area in order to protect the work area from ocean waves. Dewatering discharge from the isolated work areas could violate water quality standards, waste discharge requirements, provide substantial additional sources of polluted runoff or otherwise substantially degrade water quality, resulting in a potentially significant water quality impact. Implementation of **Mitigation Measure 3.9-1, Implement Dewatering BMPs for In-Water Work**, would reduce this potential impact on water quality to a *less-than-significant*-level by requiring the implementation of standard BMPs to remove sediment from the dewatering discharge direct to receiving waters and to control the rate of discharge such that adverse effects related to runoff, flooding, and damage to adjacent structures would not occur.

The impacts on the quality of Lake Merced water during operation of the Canal Configuration Alternative would be similar to those described for the proposed Project. The Canal Configuration Alternative would result in a reduced capacity for removal of water quality constituents from Canal base flow and low-volume storm flow compared to the Project (smaller constructed treatment wetland). Thus, while the overall long-term limnological health of Lake Merced would be improved with implementation of the Canal Configuration Alternative, it would likely take a longer period to realize some of the water quality improvements as compared to the proposed Project. For example, with a smaller treatment wetland, a smaller volume of Lake water could be recirculated through the treatment wetland during summer months while achieving a 2-day residence time for algae filtration of surface waters. Consequently, it would take a longer time period to measurably reduce Lake Merced algal concentrations as compared to the proposed Project. However, the overall water quality effect of the Canal Configuration Alternative would be within the range as that described for the Project. The reduced capacity would result in water quality effects on the Lake from Canal base flow and stormwater diversions similar to those presented in the WQA (ESA, 2015) for modeled scenarios involving either no removal of Canal nutrients by a constructed treatment wetland or a reduced level of nutrient removal through use of a basic (as compared to advanced) constructed treatment wetland. Under the Canal Configuration Alternative, the reduced treatment capacity of a 1.7-acre constructed treatment wetland would result in a reduced hydraulic residence time and, as such, a reduced potential for filtering of algae from recirculated surface waters from Lake Merced proposed as part of the in-lake management actions as compared to the Project. Operational water quality impact analyses conducted in support of the Project and Alternatives to assess the manner and extent to which Canal diversions would affect the water quality or beneficial uses of Lake Merced involved the development of predictive models (ESA, 2015). The model analyses included an assessment of the water quality effects of Canal base flow and stormwater contributions on the Lake (at each of the various proposed WSEs), and modeled the operational water quality effects both with and without Canal nutrients reduced by use of a constructed treatment wetland. Where the use of a constructed treatment wetland was included in the model analysis, both a basic and an advanced constructed treatment wetland were incorporated into the model analysis since detailed treatment wetland design has not been finalized. The model analyses concluded that without any constructed treatment wetland (worst case scenario), the net result of Canal diversions on Lake water quality would be an estimated increase of TIN of 59 to 80 µg/L (as compared with the current baseline of 90 µg/L) available for algal growth (**Table 3.9-14**). The net result of such an increase in TIN under a worst case condition is that there would be an estimated increase of 8.1 to 11 µg/L of chlorophyll a in summer in the Lake to give mean summer values of 38 to 41 µg/L (as compared with the current mean of 30 µg/L). Such an increase in algal concentrations (average of

32 percent increase) is approximately at the limit of that which would be analytically detectable from background over a few years, would not be discernible to the human eye, and would take many years of monitoring to detect. With operation of the reduced constructed treatment wetland (single wetland cell of 1.7 acres) under the Canal Configuration Alternative, Canal diversions would likely result in minor increases of chlorophyll a less than those predicted for the scenario where no treatment wetland is included (and therefore unlikely to be analytically detectable) or decreases in the chlorophyll concentration of the Lake over time (and thus result in an improvement of Lake water quality) as compared to baseline conditions.

As described for the proposed Project and in detail in the WQA, for modeled scenarios involving either no removal of Canal nutrients by a constructed treatment wetland or a reduced level of nutrient removal through use of a basic constructed treatment wetland, the Project would not violate water quality standards, waste discharge requirements, provide substantial additional sources of polluted runoff or otherwise substantially degrade water quality in Lake Merced. The impact would be *less than significant*.

NEPA Analysis

As described in the NEPA analysis for the proposed Project, construction activities would result in exposing areas of loose soil that could be subject to erosion by stormwater runoff or dewatering activities. However, adherence to the CGP, which includes implementation of BMPs and a SWPPP, as well as other local permit requirements, would ensure that the Project would result in minor effects on water quality during construction activities. Construction of the Lake Merced outlet structure on the bank and within waters of Impound Lake could result in discharges of pollutants to Lake Merced directly, and/or discharges from dewatering work areas isolated by a cofferdam into the Lake, potentially resulting in short-term, moderate, adverse impacts on water quality. Implementation of **Mitigation Measure 3.9-1, Implement Dewatering BMPs for In-Water Work**, would reduce this potential impact on water quality by requiring the implementation of standard BMPs to remove sediment from the dewatering discharge direct to receiving waters and to control the rate of discharge such that adverse effects related to runoff, flooding, and damage to adjacent structures would not occur. Therefore, with implementation of mitigation, construction of the Canal Configuration Alternative would result in minor changes to existing surface and groundwater hydrology and water quality as defined in Section 3.9.3.2.

For the reasons described in the CEQA analysis, impacts relating to surface and groundwater hydrology, erosion, and flooding and flood risks associated with operation and maintenance of the Canal Configuration Alternative would be minor.

As described in the CEQA analysis, the overall effect of Project operation, with the controls proposed as part of the Project to ensure the protection of water quality in Lake Merced, would be an improvement in water quality that would be progressive with increases in depth. Impacts relating to Lake Merced water quality from operation of the Canal Configuration Alternative would be similar to those described in the CEQA analysis. As described in detail in the CEQA analysis, the water treatment capacity of the constructed treatment wetland (single wetland cell of 1.7 acres) under the Canal Configuration Alternative, would likely result in either minor increases of chlorophyll a at a level unlikely to be analytically detectable as compared to baseline or decreases in the chlorophyll concentration of the Lake (and thus result in an improvement of Lake water quality) as compared to baseline conditions. As described in detail in the WQA (ESA, 2015), modeled scenarios involving either no removal of Canal nutrients by a constructed treatment wetland or a reduced level of nutrient removal through use of a basic constructed treatment wetland would result in long-term, minor beneficial changes to existing water quality as defined in Section 3.9.3.2.

3.9.5.4 No Project/No Action Alternative

Lake Merced Water Levels

SFPUC has committed to increasing the Lake Merced water levels, which have fallen over the years, and has been engaged in planning efforts to improve the lake. In 2001, California Trout, Inc. (Cal Trout) brought a petition to the SWRCB and other state agencies to raise Lake Merced water levels, by curtailing groundwater pumping from the Westside Basin (Cal Trout, 2001). The SFPUC and Daly City have cooperatively reduced local groundwater pumping through implementation of recycled water projects that provide irrigation supply to TPC Harding Park and Fleming Park, the Olympic Club, and the San Francisco and Lake Merced Golf Clubs, which formerly relied on municipal supplies and groundwater for irrigation needs. As a result of ongoing planning efforts related to the SFPUC's Water System Improvement Program (WSIP), as well as in response to the Cal Trout petition, SFPUC has been exploring alternatives for adding supplemental water to maintain Lake Merced water levels within a desired range, in addition to lake level improvements that resulted from implementation of the recycled water projects.

The "Lake Merced Project" (a part of the WSIP) was included as a component of the local water supply portfolio with an objective of raising the level of Lake Merced using a supplemental source of water, such as stormwater, recycled water, groundwater, or SFPUC system water, while allowing the SFPUC to achieve the addition of 10 mgd of alternative waters supply. However, it was determined that use of groundwater from the local aquifer the Lake is indirectly connected to would not result in substantial lake level increases due to the lake-aquifer connection. The SFPUC continued to explore opportunities to supplement lake levels with stormwater, recycled water, or SFPUC system water and the Vista Grande project was identified as a source of stormwater supply that could achieve the goals of the WSIP Lake Merced Project and respond favorably to the Cal Trout petition. However, should the Vista Grande project not proceed, or proceed without the lake level management project component, SFPUC would need to reinitiate consideration of alternate water supply options for improvement of lake levels in order to fulfill the WSIP local water supply commitments, implement the Lake Merced Project, and SFPUC and the City would need to address the Cal Trout petition.

In addition to the SFPUC's commitment to the Lake Merced Project through the WSIP, two other WSIP groundwater projects (described in Section 3.9.6, Cumulative Effects) were determined to have a potential effect on the lake levels, and mitigation measures adopted to minimize these effects call for correction of lake level impacts related to those projects through curtailment of groundwater pumping or use of supplemental water supply for maintenance of lake levels. Thus, the Vista

Grande project could also serve as a mitigation water supply for those projects. Under the No Project/No Action Alternative, the stormwater from the historic Lake Merced Watershed area that now drains into the Vista Grande stormwater system would continue to be disconnected from Lake Merced and stormwater would not be beneficially reused to aid the SFPUC in managing Lake Merced WSE.

Lake Merced Water Quality

As described in Section 3.9.2, Regulatory Setting, Lake Merced currently does not meet the generally applicable Basin Plan WQOs for DO and pH. As a result, the USEPA in 2003 included Lake Merced on the Clean Water Act Section 303(d) list of impaired waterbodies for these constituents. Together, the SFPUC and Daly City have been studying the potential effects of lake depth and diversions of stormwater to the lake on DO and pH levels as a means of addressing this listing (ESA, 2015). As presented in Section 3.9.5, Impact Analysis, based on the findings of the various model analyses completed as part of the WQA, the overall effect of the proposed Project, with the diversion protocols and treatment wetland proposed as part of the Project to ensure the protection of water quality in Lake Merced, would be an improvement in water quality that would likely be progressive with increases in depth and, following the filling period (while the lake is increasing to a target elevation to be determined by SFPUC) and in conjunction with the treatment wetlands, reduced annual average algal concentrations would be expected which in turn would improve lake eutrophication conditions. Operation of the in-lake management actions proposed as part of the Project would likely further improve water quality within Lake Merced through the removal of algae and the flushing of the Lake to reduce the elevated background pH. Under the No Project/No Action Alternative, any improvements to Lake Merced water quality achieved through raising and maintaining the Lake WSE through beneficially reusing stormwater from the Vista Grande Drainage Basin would not be realized.

Flooding and Flood Risks

As presented in Section 3.9.5, Impact Analysis, implementation of the proposed Project would decrease local flood hazards in the Project area in a quantifiable manner by increasing the stormwater conveyance capacity of the Canal and Tunnel and through adaptively managing the Lake Merced overflow structure to temporarily store peak stormflows by temporarily raising the WSE above defined target maximums, representing a long-term, benefit to local flooding and flood risk. Under the No Project/No Action Alternative, improvements that address the storm-related flooding in the Vista Grande Drainage Basin would not be implemented. The Basin would continue to flood during storm events, resulting in flooding of residential areas along John Muir Drive.

Coastal Processes

Under the No Project/No Action Alternative, Daly City would continue to use the existing Ocean Outlet structure at Fort Funston which would continue to contribute to erosion of the bluff face where it is located. Maintenance of the existing Ocean Outlet structure would have no new immediate impact on coastal processes. However, over time, the degree of exposure of the structure would increase as the bluff face recedes behind the structure. Increased exposure to wave run-up and bluff erosion, coupled with higher baseline water levels due to sea level rise, would increase the potential for storm damage to the structure. As a result, more frequent maintenance at the bluff face would be required in the future. Lateral access (along the beach) would likely be increasingly obstructed by the exposed structure (both the box and outfall pipe), especially during high tides. The wing walls on the San Francisco structure would likely be outflanked and the bluff would adjust rapidly by eroding (PWA, 2007). Such effects relating to the No Project/No Action Alternative are a concern, and differ from the concerns of the proposed Project relating to coastal processes, which can be mitigated to substantially minimize and avoid any identified adverse environmental consequences.

3.9.6 Cumulative Effects

3.9.6.1 Geographic Extent/Context

The geographic scope for the analysis of potential cumulative hydrology and water quality impacts consists of those areas within the area served by the SFPUC separate storm drain system at Lake Merced; areas that contribute runoff or other recharge to Lake Merced; and coastal areas where coastal development projects, shoreline alterations, or the placement of structures may affect coastal processes in a manner that intersect or exacerbate those identified for the proposed Project. The analysis of potential cumulative impacts on hydrology and water quality considers those cumulative projects listed in Table 3.1-1.

3.9.6.2 Past, Present, and Reasonably Foreseeable Projects

The existing conditions reflect the contributions of past projects. The following present and reasonably foreseeable projects are expected to occur within the geographic extent and/or context and time frame as the Project, which could result in cumulative localized impacts relating to hydrology and water quality. These projects are discussed in more detail in Table 3.1-1.

- San Francisco Westside Recycled Water Project (SFPUC)
- Regional Groundwater Storage and Recovery Project (SFPUC)
- Groundwater Supply Project (SFPUC)
- Ocean Beach Master Plan, San Francisco Planning and Urban Research Association (SPUR)
- Lake Merced Pump Station Essential Upgrade (SPFUC)
- Parkmerced (private developer)
- Pacific Rod and Gun Club Upland Soil Remediation Project (SFPUC)
- Fort Funston Site Improvement Project (NPS)
- Lake Merced Aeration System Demonstration Project (SFPUC)

3.9.6.3 Construction

As discussed in Impact HYD-1, construction activities associated with the proposed Project could result in the degradation of water quality from increased soil erosion and associated sedimentation of water bodies, as well as an accidental release of hazardous materials. All of the projects listed in Section 3.9.6.2 that could contribute stormwater runoff or dewatering discharge waters to the SFPUC separate storm drain system at Lake Merced, to Lake Merced directly, or to coastal areas adjacent to the proposed Ocean Outlet could also result in soil erosion, sedimentation, or a release of hazardous materials to the identified receiving waters.

Construction-Related Stormwater

While not expected to occur based on proposed construction schedules, the greatest potential for cumulative impacts with respect to water quality would occur if land disturbing activities of cumulative projects were to happen concurrently and contribute stormwater runoff to common receiving waters. However, construction of the proposed Project and all of the potentially cumulative projects listed in Section 3.9.6.2 would be required to comply, depending on location, with the CGP or the San Francisco's Green Building Ordinance and Article 4.1 of the San Francisco Public Works Code, described in Section 3.9.2, Regulatory Setting. Accordingly, and consistent with the SFPUC's Water Pollution Prevention Program, each project sponsor would be required to implement an erosion and sediment control plan or SWPPP for construction (depending on the area of soil disturbance at each construction site) specifying measures to prevent stormwater pollution and control site runoff. The erosion and sediment control plan or SWPPP would specify minimum BMPs related to housekeeping (storage of construction materials, waste management, vehicle storage and maintenance, landscape materials, pollutant control); non-stormwater management; erosion control; sediment control; and run-on and runoff control. Additional BMPs could be required for construction near a water body with higher risk for stormwater pollution based on its beneficial uses. Routine inspection of all BMPs would be conducted by the SFPUC, and the Erosion and Sediment Control Plan or SWPPP would contain a visual monitoring program and a chemical monitoring program for nonvisible pollutants at a minimum. Implementation of control measures in compliance with construction site stormwater requirements of the San Francisco's Green Building Code Ordinance and Article 4.1 of the San Francisco Public Works Code would ensure that cumulative water quality impacts related to stormwater runoff during construction would be *less than significant*, and the Project's or an alternative's contribution would not be cumulatively considerable.

Construction-Related Dewatering

As discussed in Impact HYD-1, construction dewatering could be required for construction of the proposed Project components. Many of the projects listed in Section 3.9.6.2 could also involve dewatering discharges to the San Francisco combined sewerage system, such as the Parkmerced Project and construction of new pipelines and facilities associated with the San Francisco Westside Recycled Water Project, and so would not occur within the geographic context of the proposed Project.

Of the projects within the location serviced by the SFPUC separate storm drain system at Lake Merced or adjacent and upgradient to Lake Merced directly, such as Pacific Rod and Gun Club Upland Soil Remediation Project, construction-related dewatering operations are not proposed. Therefore, there would not be significant cumulative water quality impacts related to these discharges, and the Project's or an alternative's contribution would not be cumulatively considerable.

3.9.6.4 Operation and Maintenance

Lake Merced

Three projects were identified as having the potential to cause impacts relating to hydrology and water quality within Lake Merced that could combine with those of the Project: the Regional Groundwater Storage and Recovery (GSR) Project, the Groundwater Supply Project (GSP), and SFPUC's aeration mixing demonstration project. The GSR Project is an aquifer storage and recovery project. During periods of excess surface water supply, pumping by SFPUC, Daly City, South San Francisco, and San Bruno are reduced. During periods of drought, the pumping is increased when all four entities pump their wells. The GSP includes groundwater pumping at six wells in western San Francisco by SFPUC including one well near Lake Merced. These wells are assumed to operate during every year. The aeration mixing demonstration project is addressed at the end of this subsection.

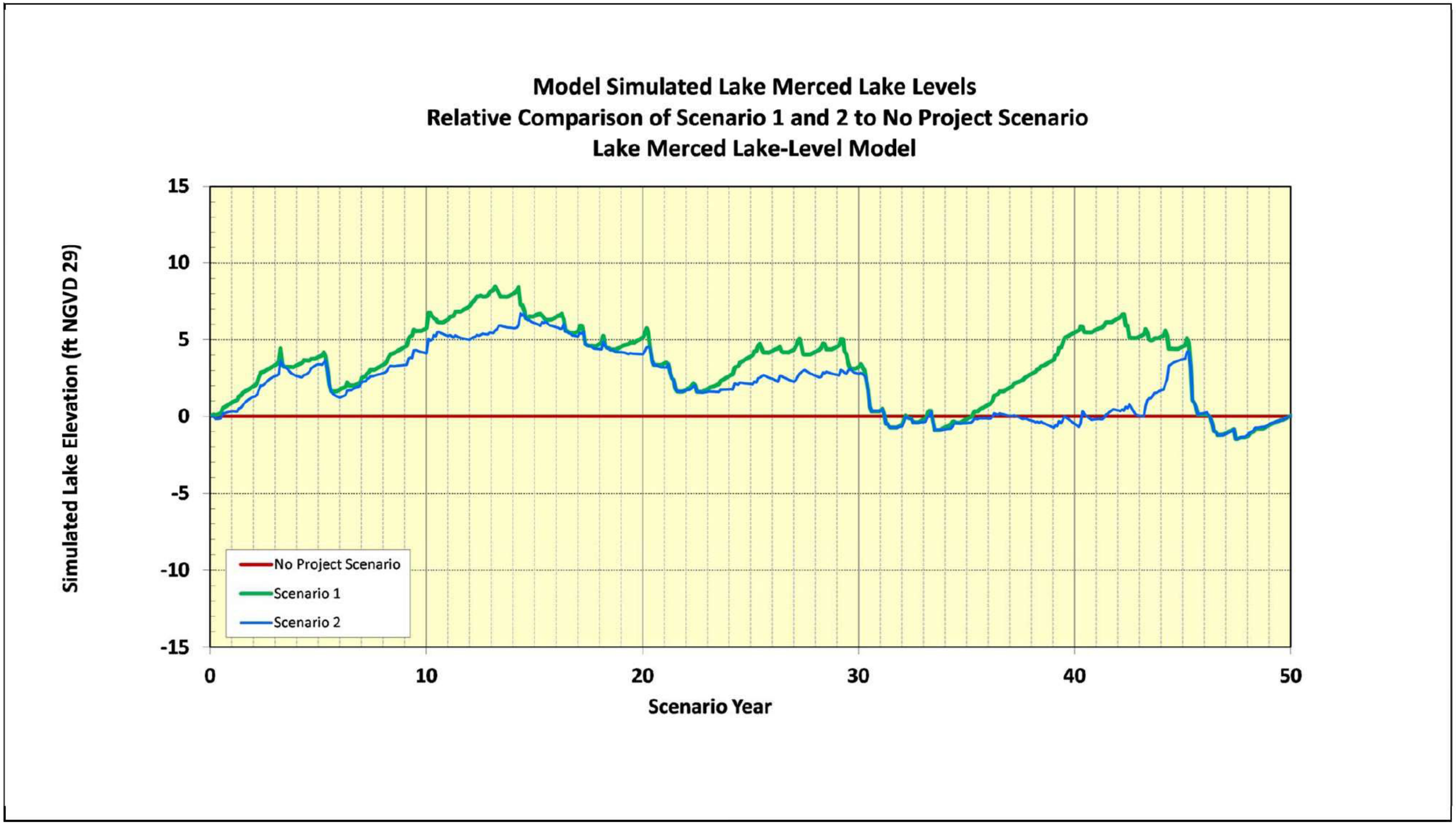
As described in detail under Impact HYD-8, above, Kennedy/Jenks (2014) assessed Lake Merced lake levels to support technical analyses and provide detailed hydrologic context for Project operation. The Model, constructed to analyze the effects of the >35 cfs flow diversion from the Canal on Lake Merced WSEs, assessed lake levels under a model scenario that included the hydrologic effects of the GSR Project and GSP in addition to the proposed Project to evaluate the cumulative effects of these three projects on lake levels. Other background hydrologic conditions remain the same as those summarized in Table 3.9-10. As was done for the proposed Project, the Model was run through a representative period of historical climatic conditions, including two major droughts in 1976/1977 and 1989 through 1991, to evaluate future lake levels in Lake Merced both with and without Project diversions under the cumulative scenario.

The results of the Model analysis for the cumulative scenario demonstrate the cumulative effects on lake levels of adding consistent pumping in western San Francisco and the in-lieu recharge and pumping of the GSR Project operations in Daly City area. The cumulative effect of the combined projects is generally lower lake levels than observed for the proposed Project alone, but generally higher than the No Project Scenario (Figure 3.9-14). During the first 35 years of the cumulative scenario, the lake levels range between 9.5 and 6.5 feet City Datum. During extended drought periods lake levels have declined to near 1.5 feet City Datum but have then recovered back to 9.5 feet. During the multi-year drought on record, the cumulative scenario lake levels closely approximate the No Project Scenario lake levels (Figure 3.9-14). Just prior to and following the drought, lake levels for the No Project Scenario are higher than the cumulative scenario because of the difference in overflow elevations between the scenarios (Table 3.9-10).

The Model analysis shows that the addition of the GSR Project and GSP (Cumulative Scenario) result in lower lake levels than the Project Scenario (**Figure 3.9-21**). The comparison between the Project scenario (described under Impact HYD-8 and summarized in Figure 3.9-14) and the cumulative scenario shows that lake levels for the Project Scenario and the Cumulative Scenario are generally higher than the No Project Scenario lake levels. The only exception being during very wet periods when lake levels in the No Project Scenario rise above the Project Scenario and Cumulative Scenario overflow elevation of 9.5 feet City Datum. The simulated lake levels for the Project Scenario range within a narrow band that would regularly include flow over the overflow so that the lake levels are generally several feet higher than the No Project Scenario. In the Cumulative Scenario, the lake levels are sustained through the shorter drought periods as a result of the proposed Project diversions, but drop to 1.5 feet City Datum during an extended drought period. However, the lake levels are nearly the same as the No Project Scenario during this period. Therefore, additions to Lake Merced as part of the proposed Project would result in an increase in mean lake levels relative to the modeled existing conditions and under the Cumulative Scenario.

As discussed in the San Francisco Groundwater Supply Project Final EIR (San Francisco, 2013), cumulative impacts on Lake Merced water levels as a result of the GSP could be significant because water level declines could occur as compared to the Project Scenario. These water level declines could cause increased eutrophication of the lake, and could also affect the pH and DO levels (the parameters responsible for the listing of Lake Merced as an impaired water body) as well as other water quality parameters, potentially resulting in significant cumulative water quality impacts. The proposed Project would not contribute to such water level declines, and would beneficially offset water level declines potentially occurring as a result of the GSP. Additionally, the GSP's potential water quality impact resulting from lowered lake levels would be further reduced with implementation of that project's Mitigation Measure M-HY-9, Lake-Level Management for Lake Merced (San Francisco, 2013), because, in accordance with this measure, the SFPUC would implement a lake level management program requiring implementation of the GSP in a stepwise manner to monitor for adverse effects before pumping at the full operational rate; continuation of lake level, lake water quality, and groundwater monitoring; additions of supplemental water, if available, should lake levels decline below the trigger levels specified in Mitigation Measure M-HY-9; and alteration or redistribution of pumping patterns should adverse effects on Lake Merced water levels be observed and no supplemental water source is available or is insufficient to maintain lake levels at the desired level.

In addition to lake level management efforts, SFPUC is considering a demonstration in-lake treatment project. The demonstration project would be implemented to determine whether substantial improvements to DO concentration, and corresponding reductions in anoxic conditions could be achieved by a full aeration mixing project, such as that described in the LMP included as part of the project. The improvements to Lake Merced long-term water quality and overall lake health from implementation of the Project could be further improved as a result of the SFPUC demonstration in-lake treatment project, should the demonstration project result in improvements in water quality. Therefore, there would not be *significant* cumulative water quality or hydrologic impacts related to implementation of the Project, and the Project's or an alternative's contribution would not be cumulatively considerable.



SOURCE: Kennedy/Jenks Consultants

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.9-21
Comparison of Scenario 1 and 2 Model Results Relative to No Project Condition

Coastal Erosion

One project was identified as having the potential to cause impacts relating to coastal processes and erosion that could combine with those of the Project: the Ocean Beach Master Plan. The Ocean Beach Master Plan presents recommendations for the management and protection of San Francisco's Ocean Beach, a 3.5-mile stretch of beach north of Fort Funston. The plan includes recommendations for rerouting the Great Highway behind the San Francisco Zoo via Sloat and Skyline Boulevards and restoring dunes through sand replenishment. As described under Impact HYD-3, the proposed Project could result in the alteration of coastal processes that would result in a potentially *significant* coastal erosion impact. Additionally, the proposed Project wing wall structure could increase reflected wave energy resulting in increased local scour and subsequent reduction of the beach vertical profile. The Project's contribution to this potentially *significant* cumulative impact would be cumulatively considerable because the Project could exacerbate the effects of coastal erosion as a result of alterations to the local shoreline proposed as part of the Ocean Beach Master Plan. However, **Mitigation Measure 3.9-2, Comprehensive Coastal Engineering Investigation and Implementation of Recommendations**, would reduce this potential impact to a *less-than-significant*-level by requiring Daly City to complete and implement the recommendations of a Project-specific coastal engineering study consistent with the requirements of California Coastal Commission draft policy guidance relating to sea-level rise as relevant to coastal development. Such a study would require a site-specific hazard analysis that includes assessment of the cumulative effects of the Project on coastal process elements, such as erosion and wave reflection, with applicable existing or future projects, including (at a minimum) the adjacent SFPUC structures, the Ocean Beach Master Plan, and other existing outfall structures in the area. With implementation of Mitigation Measure 3.9-2, the Project's contribution to the cumulative impact on coastal erosion would not be cumulatively considerable.

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3.10 Land Use and Planning

With respect to land use and planning, CEQA and NEPA primarily are concerned with a project's consistency with established land uses and plans, policies, and regulations governing land use in the project area. Accordingly, this section describes the existing and potential future land uses in the Project area and characterizes the regulatory setting within which the Project would occur. The impact analysis examines the potential impacts of the Project and alternatives on established land uses and plans, policies, and regulations governing land use within the Project area. Recreational land uses are discussed in Section 3.13, Recreation.

3.10.1 Affected Environment

The study area for the analysis of land use and planning impacts is located primarily in the southwestern portion of San Francisco, between Lake Merced and the Pacific Ocean. It also includes portions of Daly City and San Mateo County, as well as NPS-managed lands in Fort Funston. The study area generally extends east to Lake Merced Boulevard, south to Westlake Park's Lake Merced Boulevard entrance, west to the Pacific Ocean, and north to the intersection of John Muir Drive and California State Route 35 (Skyline Boulevard). An additional portion of the study area includes the Avalon Canyon access road, located in an area south of Fort Funston and adjacent to Thornton State Beach.

Lands in the study area primarily consist of public and private property used for recreational activities, including parks, golf courses, walking and bicycling paths, and specialized sporting clubs. The study area generally is bounded to the east by residential development. A small amount of residential development also occurs within the study area. General plan land use designations and zoning districts within the study area are discussed in Section 3.10.2, Regulatory Setting, below.

Notable features in the study area include Lake Merced and the 18-hole Olympic Club Golf Course. Fort Funston, a unit of the NPS-managed Golden Gate National Recreation Area (GGNRA) extends to the study area's western boundary. Residential areas within the study area include the Westlake neighborhood, southeast of the mouth of the Canal, and the 721-unit Lakewood Apartment Complex, situated above and north of the Tunnel. Other notable land uses include the San Francisco Police Pistol Range and Pacific Rod and Gun Club, located on the western bank of South Lake; the Jack Fleming 9-hole Golf Course, located across South Lake from John Muir Drive; and the Parkmerced Neighborhood and San Francisco Golf Club, located to the east of the study area.

3.10.2 Regulatory Setting

Consistent with the requirements of CEQA and NEPA, this section is concerned with and limited to laws, regulations, plans, and policies that were adopted for the purpose of avoiding or mitigating an environmental impact.

3.10.2.1 Federal

Coastal Zone Management Act

The authority to evaluate projects conducted, funded, or permitted by the federal government is granted to coastal states through the federal Coastal Zone Management Act (CZMA) of 1972, as amended in 1990 (16 USC §1451 et seq.). The CZMA includes all lands within 100 feet of the shoreline (including the seashore and bluff areas of Fort Funston), all areas that are subject to tidal action, and any other area so designated on San Francisco Sectional Maps CZ4, CZ5, and CZ13 of the Zoning Map, including the Olympic Country Club, Lake Merced, and the Pacific Ocean shore extending 3 miles out to sea from the mean high tide. The entire Project area is located within the coastal zone. The CZMA requires that federal actions be consistent to the maximum extent practicable with federally approved state coastal plans. Federal actions requiring CZMA consistency findings may include permits issued by the Corps, NPS, and other federal agencies where required. The state coastal management plans, laws, and regulations applicable to the Project are the California Coastal Act and the California Coastal Commission's (CCC's) regulations (discussed below).

National Park Service (NPS) and Golden Gate National Recreation Area (GGNRA) Policies & Plans

National Park Service Management Policies

By enacting the NPS Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of the Interior and the NPS to manage park units "to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations" (16 USC §1). The Organic Act prohibits actions that impair park resources unless a law directly and specifically allows for these actions (16 USC §1a). The *NPS Management Policies 2006* provides more specific guidance regarding park management, including the process by which the NPS evaluates and authorizes requests for special park uses (Section 8.6.), such as the types of construction, operations, and maintenance activities that would be required for the Project. This process is further articulated in *Director's Order Number 53* and the accompanying *Reference Manual* 53, which provide policy guidance for the application, processing, and issuance of special use permits. The fundamental purpose of the national park system, as established by the Organic Act, reaffirmed by the General Authorities Act, and carried through NPS management policies and guidelines, begins with a mandate to conserve park resources and values. Consequently, park managers must always seek ways to avoid, or minimize to the greatest degree practicable, adverse impacts on park resources and values. The laws do give the NPS the management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of the park. That discretion is limited by the statutory requirement that the NPS must leave resources and values unimpaired unless a particular law directly and specifically provides otherwise.

Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan

The Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan (GMP) published in 2014 and adopted in 2015 requires that whenever possible, new facilities will be built in previously disturbed areas or in carefully selected sites with as small a construction footprint as possible and with a sustainable design (NPS, 2015).

The GMP identifies three management zones within Fort Funston and establishes management objectives for these zones. In the Diverse Opportunities Zone (the central area and southern beach), management would focus on providing a range of recreational, interpretive, and educational opportunities supported by a variety of visitor services. The expectation for this zone is a high level of use in centralized activity nodes, leading to the likelihood of high rates of encounters among visitors. Within Fort Funston, management for this zone includes supporting current recreational activities, including dog walking and the unique opportunity for hang gliding in the park, while making landscape and trail improvements and protecting and restoring natural habitat. New visitor facilities could be provided near the parking lot, potentially including restrooms, group picnicking facilities, a visitor contact facility combining food service with park information, and other support structures.

In the Natural Zone (consisting of the corridors along the perimeter and northern beach), the management objective is to protect and support recovery of native habitats while providing for a variety of compatible recreational activities. The plan recommends that visitors have the opportunity to be immersed in a natural environment and be able to seek areas where they could experience natural sounds, tranquility, closeness to nature, and a sense of remoteness and self-reliance. Visitor use is to be managed to ensure that activities and their intensities are compatible with protecting resource integrity.

In the Park Operations Zone (the southeast corner, where the existing SFUSD Environmental Science Center is located), operational facilities could be expanded consistent with the visitor experience management objectives for this zone – to provide orientation, organized meetings, and access to park administration. (NPS, 2014, 2015)

3.10.2.2 State

California Coastal Act

The California Coastal Act (Pub. Res. Code §30000 et seq.) was enacted in 1976 to provide long-term protection of the state's 1,100-mile coastline for the benefit of current and future generations. The Coastal Act provides for the long-term management of lands within California's coastal zone boundary (defined in Pub. Res. Code §30103). The width of the coastal zone varies across the state. The entire Project area is located within the coastal zone.

The Coastal Act includes specific policies for management of natural resources and public access within the coastal zone that constitute the statutory standards applied to coastal planning and regulatory decisions made by the CCC and by local governments, pursuant to the Coastal Act.

Policies related to land use are summarized in this section. A consistency analysis with specific policies is presented in Section 3.10.5, Impact Analysis. Coastal Act policies related to other types of coastal resources are addressed in their respective topical sections of this EIR/EIS.

Coastal Dependency

The Coastal Act prescribes priorities for types of land uses within the coastal zone, focusing on whether a proposed project is "coastal-dependent" or "coastal-related." The Act defines a coastal-dependent development or use as "any development or use which requires a site on or adjacent to the sea to be able to function at all" and coastal-related development as "any use that is dependent on a coastal-dependent development or use" (Pub. Res. Code §30101).

Priority Uses

The Coastal Act recognizes that there is a limited amount of coastal land in the state and prioritizes coastal-dependent development of coastal areas. Section 30255 establishes priorities for coastal-dependent uses and would apply to the Project since it can be demonstrated that components of the Project are coastal-dependent industrial facilities or public service utilities.

Public Access

A primary focus of the Coastal Act is to provide public access to the coast. Per Section 30211, development should not interfere with access.

Local Coastal Programs

The Coastal Act created a unique partnership between the state (acting through the CCC) and local government entities (15 coastal counties and 61 cities) to manage the conservation and development of coastal resources through a comprehensive planning and regulatory program. This is accomplished primarily through the preparation of local coastal programs, or policies and regulations adopted by coastal local governments to carry out Coastal Act policies at the local level. Upon CCC certification of a local coastal program, authority for issuance of coastal development permits is transferred from the state to the certified local government. Until such time, responsibility for issuance of coastal development permits remains with the CCC. The agency also retains jurisdiction over certain coastal areas, such as tidelands and public trust lands.

The local coastal program typically includes a land use plan and implementing regulations (also referred to as an "implementation plan"). The land use plan sets forth the types, locations, and intensities of land uses, along with applicable resource protection and development policies for lands within the coastal zone. The implementation plan typically consists of zoning regulations, zoning map, and permit procedures. In general, a local coastal program is not considered certified until the CCC approves both the land use plan and implementation plan. Within the study area, Daly City, San Francisco, and San Mateo County each has a certified local coastal program.

3.10.2.3 Local

Daly City General Plan

The Daly City 2030 General Plan was adopted on March 25, 2013. Composed of seven elements – Land Use, Housing, Circulation, Safety, Resource Management, Noise, and Coastal (discussed below) – the General Plan outlines the City's vision for planning and development decisions through 2030. The General Plan divides Daly City into 13 planning areas. A portion of the Project would occur within the General Plan's Westlake Planning Area. The General Plan Future Land Use Map identifies Daly City lands within the study area as Low Density Residential (R-LD). One General Plan land use policy was found to be applicable to the Project:

- ***Policy LU-18*****:** Development activities shall not be allowed to significantly disrupt the natural or urban environment and all reasonable measures shall be taken to identify and prevent or mitigate potentially significant effects. (Daly City, 2013)

Daly City Coastal Element

In addition to being an element of the General Plan, the Daly City Coastal Element serves as the Land Use Plan component of Daly City's Local Coastal Program. The Coastal Element was certified by the CCC in 1984 and addresses issues of land use and new development, public access to the coast, recreation, housing, environmentally sensitive habitat areas, hazard areas, and energy resources. One Coastal Element land use policy was found to be applicable to the Project:

- ***New Development Policy 1.*** City review and approval of all new development shall insure that the rights and privacy allowed by law of existing residents are protected, and that existing and proposed recreational uses are protected and, where feasible, enhanced.

Daly City Zoning Ordinance

The Daly City Zoning Ordinance (Title 17) is the primary implementation tool for the land use policies identified in the Daly City General Plan and Daly City Coastal Element. The Zoning Ordinance implements the goals and policies of these documents by identifying specific types of land uses, intensity of uses, and development standards to be used in guiding the development and use of land within Daly City. The Zoning Ordinance incorporates by reference the Daly City zoning map. Daly City lands within the study area are identified on the Zoning Map as R-1 for Single-Family Residential (Daly City, 2002). Sections 17.08.010 and 17.09.040 identify public utility facilities, including: "pumping stations, fire stations, reservoirs, public utility buildings and uses, railroad or rapid transit facilities or other public buildings or uses" as conditional uses which may be permitted in the R-1 district, subject to the securing of a use permit (Daly City, 2003).

San Francisco General Plan

The San Francisco General Plan (San Francisco, 1996a) is the embodiment of the community's vision for the future of San Francisco. To achieve that vision, the General Plan establishes goals and policies to guide near and long-term land use and development decisions. The plan includes 10 elements, including: Housing, Commerce and Industry, Recreation and Open Space, Transportation, Urban Design, Environmental Protection, Community Facilities, Community

Safety, Arts, and Air Quality. Each element provides general policy that articulates the values and policies related to that topic area. The General Plan also includes 17 Area Plans, each of which provides more refined objectives and policies for individual communities within San Francisco. The Project is proposed for the Western Shoreline Area. The General Plan also includes a Land Use Index which depicts the land use designations for lands within the planning area. The Land Use Index identifies lands within the study area as San Francisco ownership (Lake Merced Park Area), Olympic Country Club, Residential and Commercial (Lakewood Apartments area), and GGNRA. San Francisco General Plan land use policies applicable to the Project include:

Environmental Protection Element

- ***General Policy 1.3*:** Restore and replenish the supply of natural resources.

  Undoing past mistakes must also be a major part of comprehensive environmental action. In this regard, San Francisco should undertake projects to acquire or create open space, cultivate more vegetation, replenish wildlife, and landscape man-made surroundings. Projects revitalizing the urban environment should be encouraged and receive top priority. With major efforts in this direction, the City will help reverse past trends toward the destruction of the natural qualities of the environment.

- ***Conservation Policy 2*:** Limit improvements in other open spaces having an established sense of nature to those that are necessary, and unlikely to detract from the primary values of open space.

- ***Shoreline Policy 1:*** Assure that new development adjacent to the shoreline capitalizes on its unique waterfront location, considers shoreline land use provisions, improves visual and physical access to the water, and conforms with urban design policies.

San Francisco Western Shoreline Area Plan

The Western Shoreline Area Plan (San Francisco, 1984) also serves as the Land Use Plan component of San Francisco's Local Coastal Program (except for the Olympic Club property). The document was certified by the CCC on April 26, 1984. The Western Shoreline Plan area is bounded by GGNRA lands near the Cliff House and Sutro Baths in the north, the southernmost extent of Lake Merced in the south, the inland extent of Lake Merced in the east (excluding most of the Outer Sunset and Outer Richmond neighborhoods), and the Pacific Ocean coastline in the west. The plan does not apply to lands under state or federal jurisdiction. Western Area Plan land use policies applicable to the Project include:

- ***Lake Merced Policy 5.1:*** Preserve in a safe, attractive and usable condition the recreational facilities, passive activities, playgrounds and vistas of Lake Merced area for the enjoyment of citizens and visitors to the city.

- ***Lake Merced Policy 5.3:*** Allow only those activities in Lake Merced area which will not threaten the quality of the water as a standby reservoir for emergency use.

- ***Fort Funston Policy 9.1:*** Maximize the natural qualities of Fort Funston. Conserve the ecology of entire Fort and develop recreational uses which will have only minimal effect on the natural environment.

San Francisco Planning Code

The San Francisco Planning Code provides for the implementation of the City's General Plan and Local Coastal Program by establishing standards and regulations governing the types, locations, and intensities of land use throughout the city and county. The Planning Code also incorporates San Francisco Zoning Maps. The San Francisco Zoning Map shows lands within the study area as P for Public (Lake Merced Park Area), RM-2 for Moderate Density Residential (Lakewood Apartments Area); and RH-1(D) for Low Density Residential (Olympic Club area). The Planning Code (§§209.6(b) and 234.2(a)) specifies that utility installation for water utilities is permissible within the RM-2, RH-1(D), and P districts as a conditional use, provided that operating requirements necessitate placement at the proposed location (San Francisco, 2014).

San Mateo County General Plan

The San Mateo County General Plan contains goals, objectives, and policies to guide land use decisions within unincorporated San Mateo County. Adopted in November of 1998, the General Plan comprises 15 chapters, each addressing a specific planning topic, ranging from soils and water resources to historic resources and transportation. The General Plan includes separate policies for urban and rural areas, and the Plan's Urban Land Use Map identifies the portion of the study area occurring within unincorporated San Mateo County as being within an urban planning area. The General Plan identifies this portion of the study area, including the Olympic Club property and lands west of Skyline Drive, as being designated Private Recreation (San Mateo County, 2012a). The General Plan further defines the Olympic Country Club property as a Special Urban Community, meaning an area that is devoted primarily to non-residential or special uses. One General Plan land use policy was found to be applicable to the Project (San Mateo County, 2014b):

- ***Urban Land Use Policy 8.4(a):*** *Land Use Objectives for Special Urban Areas.* For Olympic Country Club, California Golf Club, Peninsula Golf and Country Club, Edgewood County Park, San Bruno Mountain County Park, Sweeney Ridge Skyline Preserve and Hassler Lands, maintain current private or public park and recreational uses. …

San Mateo County Local Coastal Program Policies

The San Mateo County Local Coastal Program policies provide direction for planning and development decisions concerning the types, locations, and intensities of development within San Mateo County's coastal zone. The CCC approved a comprehensive update to San Mateo's Local Coastal Program policies in August 2012. The document is divided into 12 topical components and, like the general General Plan, contains separate policies for urban and rural planning areas. One San Mateo County Local Coastal Program land use policy was found to be applicable to the Project:

- ***Growth Management Policy 1.18(a):*** *Location of New Development.* Direct new development to existing urban areas and rural service centers in order to: (1) discourage urban sprawl, (2) maximize the efficiency of public facilities, services, and utilities, (3) minimize energy consumption, (4) encourage the orderly formation and development of local governmental agencies, (5) protect and enhance the natural environment, and (6) revitalize existing developed areas.

San Mateo County Zoning Regulations

The San Mateo County Zoning Regulations provide for General Plan and Local Coastal Program implementation and guide, control, and regulate development in unincorporated San Mateo County through the establishment of development standards, zoning districts, and land use regulations. The Zoning Regulations also incorporate by reference the San Mateo County Zoning Maps. Lands within the portion of the project study area occurring within unincorporated San Mateo County are identified on the Zoning Maps as: RM-CZ/CD for Resource Management – Coastal Zone/Coastal Development District (western portion of Olympic Club and lands west of Skyline Boulevard); R-E/S-9 for Residential Estate/S-9 Combining District (central portion of Olympic Club property); and RM/CZ for Resource Management – Coastal Zone District (eastern edge of Olympic Club property) (San Mateo County, 2014a). The Zoning Regulations (§6500(b)) provide for the issuance of a use permit for the location of water lines, public utilities, and public service uses in any district, when found necessary for public health, safety, convenience, or welfare (San Mateo County, 2012b).

3.10.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.10.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G, Section X, a project would have a significant impact related to land use and planning if it would:

a) Physically divide an established community;

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or

c) Conflict with any applicable habitat conservation plan or natural community conservation plan.

3.10.3.2 NEPA Impact Thresholds

In accordance with NEPA regulations (40 CFR §1508.27) – and consistent with NPS Director's Order-12 Handbook's Appendix 1 – Environmental Screening Form – the impact analysis considers whether implementation of the proposed Project threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment. NEPA is concerned with impact context and intensity. Therefore, the NEPA impact conclusion statements are presented in terms of the degree of the potential impact, as described in the table below.

Impact Intensity	Impact Description
Negligible:	The proposed project would not involve any activities that would be inconsistent with existing or authorized land uses or conflicts with applicable land use plans, policies, or regulations.
Minor:	The proposed project may result in temporary and localized inconsistency with existing or authorized land uses or applicable land use plans, policies, or regulations.
Moderate:	The proposed project would be inconsistent with existing or authorized land uses or applicable land use plans, policies or regulations, but those inconsistencies would be localized.
Major:	The proposed project would be inconsistent with existing or authorized land uses or applicable land use plans, policies, or regulations, and those inconsistencies would interfere with wide-scale implementation of those laws and requirements.

3.10.3.3 Criteria and Thresholds with No Impact or Not Applicable

Due to the nature of the Project, there would be no impact related to the following topics for the reasons described below:

a) ***Physically divide an established community*.** All of the facilities proposed as part of the Project and alternatives would be constructed within the general area of the existing Canal and Tunnel and would be underground, below grade, or at grade, like the existing Canal and Tunnel. Above-grade Project elements include the electrical building along John Muir Drive and the replacement of the Ocean Outlet structure. Because there are no communities located in areas through which the Project's or an alternative's above-grade facilities would be constructed or rehabilitated, none of the facilities would divide an established community. Thus, the criterion related to the division of an established community is not applicable to the Project and is not discussed further.

c) ***Conflict with any applicable habitat conservation plan or natural community conservation plan*.** No adopted habitat conservation plan or natural community conservation plan covers the Project site(s) and therefore the Project could not conflict with these plans. The San Francisco Recreation and Park Department's 1995 *Significant Natural Resources Areas Management Plan* (SNRAMP) consists of a staff report. General policies and management actions in the staff report relevant to biological resources at Lake Merced include general policies to maintain/promote indigenous plant species and control/remove invasive species, protect special-status species, enhance riparian areas, and maintain/improve water quality of streams and ponds (SFRPD, 1995). While the Project would include construction disturbance to riparian and wetland areas and potential disturbance to special-status plant and animal species at Lake Merced, the Project would contribute to Lake Merced water levels and maintain/improve the water quality of the lake, thereby improving the aquatic habitat. Other impacts and mitigation to compensate for adverse effects on biological resources are discussed in Section 3.4, Biological Resources.

3.10.4 Methodology and Assumptions

The Project's and alternatives' potential to result in impacts related to land use and planning were analyzed qualitatively, based upon familiarity with the Project area, site visits, and a review of aerial photographs and land use maps prepared by planning agencies within the affected jurisdiction. The evaluation of Project consistency with applicable land use laws, regulations, policies, and plans adopted for the purpose of avoiding or mitigating an environmental effect or for protection of the environment is based on their relevance to the siting, construction, and/or operation and maintenance of the Project facilities. There are numerous laws, policies, and plans that either are implicated by relevant significance criteria in this EIR/EIS or were adopted for environmental purposes and thus are evaluated under the appropriate topical sections of this EIR/EIS. These sections include 3.2, Aesthetics; 3.3, Air Quality; 3.4, Biological Resources; 3.5, Cultural and Paleontological Resources; 3.6, Geology and Soils; 3.7, Greenhouse Gas Emissions and Climate Change; 3.8, Hazards and Hazardous Materials; 3.9, Hydrology and Water Quality; 3.11, Noise and Vibration; 3.15, Transportation and Traffic; and 3.16, Utilities and Service Systems. As a result, the following impact analysis considers those laws, regulations, policies, and plans specific to land use that were adopted for environmental purposes.

3.10.5 Impact Analysis

3.10.5.1 Proposed Project

CEQA Analysis

b) Impact LU-1: The project could conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. (Significant and Unavoidable)

The Project elements have been analyzed for overall consistency with applicable land use plans, policies, and regulations of agencies with jurisdiction in the Project area. **Table 3.10-1** summarizes whether the proposed Project and each of the alternatives is consistent with each plan, policy, or regulation.

Based upon an initial review of consistency, there are no substantial and apparent inconsistencies between plans and policies applicable to the Project area and the Project. However, as discussed in Hydrology and Water Quality Impact HYD-9, the Project could be inconsistent with some of the sub-policies of the Coastal Act and with portions of the NPS Management Policies regarding coastal processes. Implementation of **Mitigation Measure 3.9-2, Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies**, would require the final Project engineering design to minimize conflicts with the applicable Coastal Act requirements that new development: 1) be designed to eliminate or mitigate adverse effects on local shoreline sand supply and 2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs (California Coastal Act Sections 30235 and 30253) and with NPS Management Policies regarding minimization of safety hazards and harm to property and natural resources. However, even with implementation of **Mitigation Measure 3.9-2**, elements of the Project necessary to ensure structural integrity may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes and/or with NPS Management Policies. Therefore, even with implementation

TABLE 3.10-1
CONSISTENCY WITH PLANS AND POLICIES APPLICABLE TO THE PROJECT AREA

Plan/Policy	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Federal				
Coastal Zone Management Act	*Consistent*: As part of the Project approvals, Daly City would need to obtain a Coastal Development Permit and a Federal Consistency Determination to demonstrate consistency between the project and approved plans. This is evaluated under the local coastal plans.	*Consistent*	*Consistent*	*Consistent*
National Park Service Management Policies and GMP	*Potentially Inconsistent*: The Project would not result in the impairment of any park resources as described in NPS Management Policies or GMP. The alignment of the new Vista Grande Tunnel under the proposed Project would coincide with existing tunnel therefore locating development in areas previously disturbed by human activities. While other applicable policies under the GMP would not be impacted by the project, they are also analyzed under appropriate sections such as sections 3.2, Biological Resources, 3.5, Cultural Resources, 3.9, Hydrology and Water Quality, and 3.13, Recreation. However, certain Project features associated with the Ocean Outlet structures may, with implementation of mitigation measures, still result in inconsistency with the management policies related to minimizing safety hazards and harm to property and natural resources in siting new developments in areas subject to wave erosion or active shoreline processes.	*Potentially Inconsistent:* In addition to potential inconsistency with the management policies related to minimizing safety hazards and harm to property and natural resources in siting new developments in areas subject to wave erosion or active shoreline processes, the development of a new tunnel and potentially a new Ocean Outlet to the south of the existing structures may conflict with NPS management policies for coastal processes by introducing new developments in an area subject to wave erosion or active shoreline processes when a practicable alternative (i.e., replacement of the existing Tunnel and Ocean Outlet structure at its current location) is available.	*Potentially Inconsistent*	*Consistent*

TABLE 3.10-1 (Continued)
CONSISTENCY WITH PLANS AND POLICIES APPLICABLE TO THE PROJECT AREA

Plan/Policy	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
State				
California Coastal Act	*Potentially Inconsistent*: The Project is considered a coastal-dependent industrial facility or public service utility (§30255). Since the 1890s the Vista Grande Canal and Tunnel have been used to divert stormwater away from Lake Merced to an outlet at the Pacific Ocean. In addition, the Project would protect the ocean outlet from ongoing coastal erosion by replacing the existing Ocean Outlet structure at Fort Funston. The existing Daly City Ocean Outlet structure would be removed and replaced with a low-profile outlet structure set nearer to the existing cliff face to improve beach access, which is another primary focus of the Coastal Act. The protection of public access would be met by projects where development would not interfere with access. In this case, the end result of the Project would enhance public access by removing the existing structure which blocks a portion of the beach, particularly at high tide, with one that is sited at the existing cliff face. Project construction may have short-term indirect effects on shoreline access during the construction period. Project components proposed within the coastal zone would ultimately be buried underground and would not preclude public access to or along the coast. However, certain Project features associated with the Ocean Outlet structures may, with implementation of mitigation measures, still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act Sections 30235 and 30253.	*Potentially Inconsistent*	*Potentially Inconsistent*	*Consistent*
Local				
Daly City General Plan Policy LU-18	*Consistent*: Development activities would not significantly disrupt the natural environment and all reasonable measures have been taken to identify and prevent or mitigate potentially significant effects as evident throughout this EIR/EIS.	*Consistent*	*Consistent*	*Consistent*
Daly City Coastal Element	*Consistent*: In compliance with the Daly City Coastal Element, all new development shall undergo City review and approval to insure the protection of rights and privacy of existing residents and recreational uses. Daly City would issue a Coastal Development Permit as evidence of this compliance.	*Consistent*	*Consistent*	*Consistent*

TABLE 3.10-1 (Continued)
CONSISTENCY WITH PLANS AND POLICIES APPLICABLE TO THE PROJECT AREA

Plan/Policy	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Local (cont.)				
Daly City Zoning Ordinance	*Consistent*: The Project is also consistent with the zoning requirements under the R-1 zoning area provided that the Project secures a permit for the conditional use of a public utility building or other public buildings or uses.	*Consistent*	*Consistent*	*Consistent*
San Francisco General Plan Environmental Protection Element General Policy 1.3	*Consistent*: The Project is consistent with the policy to restore and replenish the supply of natural resources because it would provide a sustainable source of water to improve management of Lake Merced surface levels.	*Consistent*	*Consistent*	*Consistent*
San Francisco General Plan, Environmental Protection Element Conservation Policy 2	*Consistent*: The Project is consistent with this policy because it would not detract from the primary values of open space. The components of this Project are located in a developed setting.	*Consistent*	*Consistent*	*Consistent*
San Francisco General Plan, Environmental Protection Element Shoreline Policy 1	*Consistent*: The Project is consistent with this policy because it would improve visual and physical access to the Pacific Ocean.	*Consistent*	*Consistent*	*Consistent*
San Francisco Western Shoreline Area Plan, Lake Merced Policy 5.1	*Consistent*: The Project would preserve the recreational facilities, passive activities, and vistas of Lake Merced. The Project elements would not interfere with the continued recreational use of the Lake Merced area.	*Consistent*	*Consistent*	*Consistent*
San Francisco Western Shoreline Area Plan, Lake Merced Policy 5.3	*Consistent*: The Project is consistent with this policy because it would not threaten the quality of the water as a standby reservoir for emergency use, and would potentially improve the water quality.	*Consistent*	*Consistent*	*Consistent*
San Francisco Western Shoreline Area Plan, Fort Funston Policy 9.1	*Consistent*: The Project is consistent with this policy to maximize the natural qualities of Fort Funston because the replacement of the outfall structure would improve the beach access and protect the cliffs from further erosion.	*Consistent*	*Consistent*	*Consistent*
San Francisco Planning Code	*Consistent*: The Project is consistent with the San Francisco Zoning Map which allows for utility installation for water utilities as a conditional use.	*Consistent*	*Consistent*	*Consistent*
San Mateo County General Plan Urban Land Use Policy 8.4	*Consistent*: Under this Project, the existing current private or public park and recreational uses at Olympic Country Club or other special urban areas would be maintained.	*Consistent*	*Consistent*	*Consistent*
San Mateo County Local Coastal Program, Growth Management Policy 1.18(a)	*Consistent*: The Project is consistent with this policy because it would maximize the efficiency of public facilities, services, and utilities with the upgrade of an existing facility.	*Consistent*	*Consistent*	*Consistent*

TABLE 3.10-1 (Continued)
CONSISTENCY WITH PLANS AND POLICIES APPLICABLE TO THE PROJECT AREA

Plan/Policy	Proposed Project	Tunnel Alignment Alternative	Canal Configuration Alternative	No Project/No Action Alternative
Local (cont.)				
San Mateo County Zoning Regulations	*Consistent*: The Project is consistent with the San Mateo County Zoning Maps land use requirements for the study area, which would allow for a use permit for the location of water lines, public utilities, and public service uses in any district when found necessary for public health, safety, convenience, or welfare.	*Consistent*	*Consistent*	*Consistent*

SOURCES: NPS, 2006; Daly City, 1984, 1998, 2003, 2013; San Francisco, 1996a, 1996b, 2004, 2014; San Mateo County, 2012b, 2013, 2014a, 2014b of **Mitigation Measure 3.9-2**, certain Project features associated with the Ocean Outlet structures may still result in inconsistency with applicable land use plans and policies of agencies with jurisdiction over the coastal elements of the Project. As a result, **Impact HYD-9**, and therefore **Impact LU-1** as well, could remain *significant and unavoidable* even after the incorporation of available and feasible mitigation. This finding is due in part to the inherent inconsistency between the policies requiring structural integrity with the policy concerning avoidance of shoreline protective devices that would substantially alter natural landforms along bluffs and cliffs.

As part of their determination to approve or disapprove the Project, decision makers will consider the compatibility of the Project with General Plan policies that do not relate to physical environmental issues. Any potential conflicts identified as part of that process would not alter the physical environmental effects of the Project, as analyzed in this EIR/EIS. However, as noted, the potential conflict with some portions of the Coastal Act and NPS Management Policies may not be reduced to less-than-significant with implementation of Mitigation Measure 3.9-2; thus, the impact associated with overall conflicts with land use plans, policies, or regulation may remain *significant and unavoidable*.

Mitigation: Implement Mitigation Measure 3.9-2.

NEPA Analysis

As described in Table 3.10-1, there are no apparent inconsistencies between plans and policies applicable to the Project area and the Project, with the exception of potential conflicts with the Coastal Act and NPS Management Policies as indicated above. Daly City would obtain all applicable permits and approvals for the Project, further ensuring compliance with applicable land use plans, policies, and regulations. The Project would have short-term (non-permanent), minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. Visitor access to the rest of Fort Funston would not be substantially disrupted by Project construction as the staging area proposed is not in the parking lot, but in an undeveloped portion of land near the parking lot (see Section 3.13, Recreation). The road that provides access to the Fort Funston parking lot also would not be disrupted, though it would be used by construction vehicles accessing the staging area (see Section 3.15, Transportation and Traffic). Project operation and maintenance would not involve any activities that would be inconsistent with existing or authorized land uses or that would conflict with applicable land use plans, policies, or regulations, with the exception of potential conflicts with the Coastal Act and NPS Management Policies as indicated above. Therefore, during operation and maintenance, the Project could have a moderate to major impact.

3.10.5.2 Tunnel Alignment Alternative

The following describes the land use effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.10.5.1, Proposed Project, or Section 3.10.5.3, Canal Configuration Alternative, depending on the option selected. Thus, land use effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative would be located within an area south of the existing tunnel. The general methods and duration required to construct the Tunnel Alignment Alternative would not change compared to the Project, and public access would not change compared to the Project. As noted in Table 3.10-1, the Tunnel Alignment Alternative would utilize a previously undisturbed area under GGNRA lands. One of the objectives of the GGNRA General Management Plan is "that whenever possible, new facilities will be built in previously disturbed areas or in carefully selected sites with as small a construction footprint as possible and with a sustainable design" (NPS, 2014). Although the Tunnel Alignment Alternative could locate development in an area not previously disturbed by human activity (i.e., a new tunnel alignment), the location of the Tunnel Alternative Alignment would not affect land uses in the vicinity of the new alignment, because the tunnel would be located underground By definition, it would not be possible to locate this alternative within the previously disturbed area associated with the existing tunnel. Further, there are no other previously disturbed areas of sufficient size that could serve as an alternate tunnel alignment Therefore, although the Tunnel Alignment Alternative would not be located in an area previously disturbed by human activity, it also would not be possible to locate a tunnel alignment alternative in a location that is previously disturbed. Further, as noted for the proposed Project, the potential conflict with some portions of the Coastal Act and NPS Management Policies may not be reduced to less-than-significant with implementation of Mitigation Measure 3.9-2; thus, the impact associated with overall conflicts with land use plans, policies, or regulation may remain *significant and unavoidable.*

Mitigation: Implement Mitigation Measure 3.9-2.

NEPA Analysis

Like the Project, the Tunnel Alignment Alternative would have short-term, minor effects on existing land uses at Fort Funston due to the presence of construction activities in an area used primarily for public recreation. Visitor access to the rest of Fort Funston would not be substantially disrupted by construction, as the staging area proposed is not in the parking lot, but in an undeveloped portion of land near the parking lot (see Section 3.13, Recreation). The road that provides access to the Fort Funston parking lot also would not be disrupted, though it would be used by construction vehicles accessing the staging area (see Section 3.15, Transportation and Traffic).

As described in Table 3.10-1, there are no apparent inconsistencies between plans and policies applicable to the Project area and the Tunnel Alignment Alternative. The GGNRA GMP's management objective is to locate development in areas previously disturbed by human activity whenever possible. However, as described in the CEQA analysis, by definition and purpose, it would not be possible to locate this alternative in the area previously disturbed by the existing Tunnel. Therefore, this alternative may be considered to be inconsistent with this management objective. Daly City would obtain all applicable permits and approvals for the Tunnel Alignment Alternative, further ensuring compliance with other applicable land use plans, policies, and regulations, with the exception of potential conflicts with the Coastal Act and NPS Management

Policies as indicated above. Therefore, during operation and maintenance, this alternative could have a moderate to major impact.

3.10.5.3 Canal Configuration Alternative

The following describes the land use effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.10.5.1, Proposed Project, or Section 3.10.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, land use effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative would be located in an area already in use as a stormwater drainage canal and within the same existing land uses as the proposed Project. The general methods and duration required to construct the Canal Configuration Alternative would not change compared to the proposed Project, and public access would not change compared to the Project.

However, as noted for the Proposed Project, the potential conflict with some portions of the Coastal Act and NPS Management Policies may not be reduced to *less-than-significant* with implementation of Mitigation Measure 3.9-2; thus, the impact associated with overall conflicts with land use plans, policies, or regulation may remain *significant and unavoidable* whether the Canal Configuration Alternative is paired with the proposed tunnel components or the Tunnel Alignment Alternative.

Mitigation: Implement Mitigation Measure 3.9-2.

NEPA Analysis

As described in Table 3.10-1, there are no apparent inconsistencies between plans and policies applicable to the Project area and the Canal Configuration Alternative. Daly City would obtain all applicable permits and approvals for this alternative, further ensuring compliance with applicable land use plans, policies, and regulations. The Canal Configuration Alternative would be located in an area already in use as a stormwater drainage canal, and would therefore have a negligible impact with respect to land use and planning.

The effects on access to Fort Funston would be as described in Section 3.10.5.1, Proposed Project, or Section 3.10.5.2, Tunnel Alignment Alternative, depending on the alternative selected for the tunnel portion. As above, potential conflicts with the Coastal Act and NPS Management Policies could occur whether the Canal Configuration Alternative is paired with the proposed tunnel components or the Tunnel Alignment Alternative. Therefore, during operation and maintenance, this alternative could have a negligible moderate to major impact.

3.10.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the Project would be constructed. Therefore, there would be no change in land use and no impact to existing land use uses or conflicts with applicable land use plans, policies or regulations.

3.10.6 Cumulative Effects

3.10.6.1 Geographic Extent/Context

The geographic scope for the analysis of cumulative land use impacts includes land uses in the vicinity of Lake Merced and Fort Funston that are subject to the plans and policies outlined in Table 3.10-1.

3.10.6.2 Past, Present, and Reasonably Foreseeable Projects

Existing conditions reflect the contributions of past projects to cumulative changes in land use. The following present and reasonably foreseeable projects may result in impacts to land use and planning and are included in the analysis of the Project's cumulative impacts. In addition to project-related construction impacts identified, construction activities would contribute incrementally to cumulative land use and planning impacts from a number of other projects in the area that could be under construction at the same time and could impact the same planning areas.

For example, as presented in Table 3.1-1, construction of the following cumulative projects is expected to occur within the same vicinity and timeframe as other planned and proposed projects.

- *San Francisco Westside Recycled Water Project* (SFPUC) is anticipated to be under construction between 2016 and 2019. Proposed facilities would be within the Oceanside Water Pollution Control Plant, with distribution pipelines located in Skyline Boulevard, north of the proposed Project.

- *Significant Natural Areas Management Plan* (SFRPD) provides recommendations for management of the fragments of unique plant and animal habitats within San Francisco and Pacifica known as Significant Natural Resource Areas that have been preserved within parks that are managed by the SFRPD. Among these is Lake Merced. The plan identifies several conservation- and recreation-related issues for Lake Merced and provides recommendations developed for each of these issues to guide restoration, enhancement, and maintenance work. The final EIR and approval of the plan is expected in 2014. Projects resulting from this plan could create short and long-term impacts to recreation.

- *GGNRA/Muir Woods National Monument General Management Plan* (NPS) indicates that Funston would be managed to continue to support current recreational activities (e.g., dog walking and hang gliding); provide new visitor facilities near the parking lot, fence and protect Battery Davis. The ROD for the Plan was signed in January 2015.

- *Groundwater Supply Project* (SFPUC) Construction began in fall 2014 and is expected to be complete in early 2016. Construction at the Lake Merced Pump Station would add an aboveground structure to the Lake Merced shoreline.

- *Pacific Rod and Gun Club Upland Soil Remediation Project* (SFPUC) is anticipated to be under construction starting early 2015. Because this project consists of soil remediation only, no change to land use would occur.
- *Fort Funston Site Improvements* (NPS) include constructing a restroom, constructing a maintenance facility, and other minor visitor enhancements. The environmental assessment is pending and expected in 2016. The project would also upgrade and expand site utilities and infrastructure including expanding the capacity of the on-site sewage treatment system, widening and straightening the entrance road, lengthening the turn lane from Highway 35 into the site, repaving and restriping the parking area, accessibility improvements, and an upgrade of picnic facilities.
- *Dog Management Plan* (NPS) is pending with a final rule expected in early 2016. This plan would provide policy to determine the manner and extent of dog walking in appropriate areas of Fort Funston; promote the preservation and protection of natural and cultural resources and natural processes; provide a variety of visitor experiences, improve visitor and employee safety and reduce user conflicts; and maintain park resources and values for future generations.

3.10.6.3 Construction

The construction activities associated with the Fort Funston Site Improvements project could impact public access to portions of Fort Funston in the event that both the proposed Project or Tunnel Alignment Alternative and the Fort Funston Site Improvements project are under construction at the same time. Construction activities of the Project or alternatives would not substantially affect land use, and there are no apparent inconsistencies with plans and policies applicable to the Project area associated with the construction phase. Therefore, the Project and alternatives would not contribute to any other construction-related cumulative effect on land use and planning.

3.10.6.4 Operation and Maintenance

The Project and alternatives would have a significant and unavoidable impact related to the applicable CEQA criterion for land use and planning during the operation and maintenance phase, and a moderate to major impact related to the NEPA thresholds, related to potential conflicts with some sub-policies of the Coastal Act and NPS Management Policies. The environmental analysis documents for the above-listed cumulative projects did not identify any substantial inconsistency with plans and policies applicable to the Project area; and no other coastal development is proposed in the near vicinity of the proposed Project’s Ocean Outlet. Further, projects such as Pacific Rod and Gun Club Upland Soil Remediation Project and the Significant Natural Areas Management Plan are intended to improve the overall conditions of those project areas. Thus, a cumulative land use impact is not expected associated with long-term changes in land use that could conflict with applicable plans, policies, or regulations adopted for the purpose of avoiding or mitigating an environmental effect or be inconsistent with existing or authorized land uses or applicable land use plans, policies, or regulations beyond that identified for the proposed project alone.

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3.11 Noise and Vibration

This section discusses the affected environment in the vicinity of the Project site, and the potential for construction and operation of the proposed Project and alternatives to increase noise and vibration levels. The analysis included in this section was developed based on noise standards provided in the San Francisco General Plan and the San Francisco Noise Ordinance, and Federal Transit Administration (FTA) vibration prediction equations.

3.11.1 Affected Environment

3.11.1.1 Technical Background and Noise Terminology

Noise can be defined generally as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather, a broad band of frequencies varying in levels of magnitude (sound power). Therefore, the sound pressure level constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in **Figure 3.11-1**.

Noise exposure is a measure of noise over a period of time. Noise level is a measure of noise at a given instant in time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual receptor. These successive additions of sound to the community noise environment vary the community noise level from instant to instant, requiring the

COMMON OUTDOOR ACTIVITIES	NOISE LEVEL (dBA)	COMMON INDOOR ACTIVITIES
	110	Rock band
Jet flyover at 1,000 feet		
	100	
Gas lawnmower at 3 feet		
	90	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80	
Noisy urban area, daytime		
Gas lawnmower at 100 feet	70	Garbage disposal at 3 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60	
		Large business office
Quiet urban daytime	50	Dishwasher in next room
Quiet urban nighttime	40	Theater, large conference room (background)
Quiet suburban nighttime		
	30	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20	
		Broadcast/recording studio
	10	
	0	

SOURCE: ESA, 2013

Vista Grande Drainage Basin Improvement Project . 207036.01

Figure 3.11-1
Typical Noise Levels

measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts.

This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

L_{eq}: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The L_{eq} is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

L_{max}: the instantaneous maximum noise level for a specified period of time.

L_{50}: the noise level that is equaled or exceeded 50 percent of the specified time period. The L_{50} represents the median sound level.

L_{90}: the noise level that is equaled or exceeded 90 percent of the specific time period. This is considered the background noise level during a given time period.

L_{dn}: also abbreviated DNL, it is a 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: similar to DNL, the Community Noise Equivalent Level (CNEL) adds a 5 dBA "penalty" for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10 dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

As a general rule, in areas where the noise environment is dominated by traffic, the L_{eq} during the peak-hour is generally within one to two decibels of the L_{dn} at that location.

Effects of Noise on People

When a new noise is introduced to an environment, human reaction can be predicted by comparing the new noise to the ambient noise level, which is the existing noise level comprised of all sources of noise in a given location. In general, the more a new noise exceeds the ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- outside of the laboratory, a 3 dBA change is considered a just-perceivable difference;
- a change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- a 10 dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence, the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such as traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement.

Noise levels may also be reduced by intervening structures, such as a row of buildings, a solid wall, or a berm located between the receptor and the noise source. According to the U.S. Department of Housing and Urban Development (HUD) Noise Guidebook (HUD, 2009), standard building construction results in an exterior-to-interior noise reduction of 20 dBA with windows closed.

Fundamentals of Vibration

As described in the FTA's Transit Noise and Vibration Impact Assessment (FTA, 2006) ground-borne vibration can be a serious concern for nearby neighbors, causing buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, sheet pile-driving, and operating heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to express RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. For the purposes of this assessment, the methodology described in the FTA's Transit Noise and Vibration Impact Assessment (FTA, 2006) was used to evaluate Project-related vibration effects to nearby sensitive land uses. The FTA's Transit Noise and Vibration Impact Assessment (FTA, 2006) provides vibration source levels at a reference distance of 25 feet for a variety of construction equipment, which can be used to make propagation adjustments to approximate vibration levels farther away. Sensitive receptors for vibration assessment include structures (especially older masonry structures), people who spend a lot of time indoors (especially residents, students, the elderly and sick), and vibration-sensitive equipment such as hospital analytical equipment and equipment used in computer chip manufacturing.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the exception of blasting and sheet pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance can be well below the damage threshold for normal buildings.

3.11.1.2 Sensitive Receptors

Land uses surrounding the Project site mostly consist of Lake Merced, the Olympic Club golf course, Fort Funston, and several residential single- and multi- family homes and commercial buildings. Noise-sensitive land uses are typically defined as residences, schools, institutions, places of worship, hospitals, care centers and hotels. As shown in **Figure 2-1** in Chapter 2, the nearest noise-sensitive land uses to the Project site are the single-family homes located approximately 1,000 feet south-east from diversion structure and multi-family homes located approximately 100 feet west from the Lake Merced Portal. Other nearby noise-sensitive land uses includes multi- and single-family homes located approximately 2,000 feet east of the Project area, on the east shore of Lake Merced.

Active parks, recreation centers, and playgrounds are not as sensitive to noise as residences, schools, hospitals, or convalescent care facilities, because background noise levels at active parks and recreation centers and at school playgrounds tend to be elevated. However, users of natural recreation areas may value an increased degree of quiet for passive recreational uses.

The land uses described above also would be sensitive to vibration. No additional vibration-sensitive land uses, such as those employing vibration-sensitive equipment, were identified near the Project construction sites. One building that may be sensitive to vibration damage is located near the proposed tunnel shaft at Fort Funston. The Missile Assembly Building, while not considered historic, is a 1959 masonry building at the southeast corner of the Fort Funston parking lot.

3.11.1.3 Existing Noise Environment

The existing noise environment in the immediate Project area is dominated by traffic noise generated by John Muir Drive, Highway 35, and Lake Merced Boulevard. Other noise sources in the area include human and wildlife (i.e., birds chirping), activities at the Olympic Club, and distant surf noise. In 2009, San Francisco modeled the existing day-night noise levels (L_{dn}) within the city boundaries, which includes cumulative noise levels generated by industrial activities and vehicular traffic from freeways and arterial roadways (San Francisco, 2009). The existing modeled noise levels in the Project area would be driven primarily by traffic noise from John Muir Drive where noise levels were modeled to be approximately between 60 and 65 dBA L_{dn}.

Additionally, during wet weather, operation of the existing force main results in noise emanating from the air relief valve at the beach.

3.11.2 Regulatory Setting

3.11.2.1 Federal

Under the authority of the Noise Control Act of 1972, the USEPA established noise emission criteria and testing methods published at 40 Code of Federal Regulations Part 204, which apply to interstate rail carriers and some construction and transportation equipment, such as portable air compressors and medium- and heavy-duty trucks. In 1974, the USEPA issued guidance levels for the protection of public health and welfare in residential land use areas. The guidance levels specified an outdoor L_{dn} of 55 dBA and an indoor L_{dn} of 45 dBA. These guidance levels are not considered as standards or regulations and were developed without consideration of technical or economic feasibility.

Under the Occupational Safety and Health Act of 1970 (29 USC §1919 et seq.), the Occupational Safety and Health Administration (OSHA) has adopted regulations designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise level exposure as a function of the amount of time during which the worker is exposed. The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed, ensuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation.

The Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan (GMP) published in 2014 and adopted in 2015 requires that whenever possible, new facilities will be built in previously disturbed areas or in carefully selected sites with as small a construction footprint as possible and with a sustainable design (NPS, 2014, 2015). The GMP applies mitigation measures to the actions proposed in the plan, including those pertaining to soundscapes. Those that may be relevant to management of Fort Funston in relation to the proposed Project include standard noise abatement measures that would be followed during construction, including:

- a schedule that minimizes impacts on adjacent noise-sensitive resources,
- the use of the best available noise control techniques wherever feasible,
- the use of hydraulically or electrically powered tools when feasible, and
- the position of stationary noise sources as far from sensitive resources as possible.

3.11.2.2 State

The State of California does not have statewide standards for environmental noise but requires each county to include a noise element in its general plan (California Government Code §65302(f)). In addition, Title 4 of the California Code of Regulations has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure.

Occupational noise exposure is regulated by California Occupational Safety and Health Administration (Cal-OSHA), which has promulgated Occupational Noise Exposure Regulations

(8 Cal. Code Regs. §§5095-5099). These regulations set employee noise exposure limits and are equivalent to the Federal OSHA standards described in Section 3.11.2.1, Federal (Regulations).

The California Noise Act of 1973 sets forth a resource network to assist local agencies with legal and technical expertise regarding noise issues. The objective of the act is to encourage the establishment and enforcement of local noise ordinances.

3.11.2.3 Local

Daly City Municipal Code

Section 9.22.030 of the Daly City municipal code states that between the hours of 10:00 p.m. and 6:00 a.m. no person shall cause, create, or permit any noise which may be heard beyond the confines of the property of origin. The Police Department enforces Chapter 9.22 of the Municipal Code.

San Francisco Noise Ordinance

The San Francisco Noise Ordinance (Article 29, San Francisco Police Code, Section 2900) provides noise standards for transportation, construction, mechanical equipment, entertainment and human animal behavior. The following sections relevant to the Project are included to address and limit disruptive noise intrusions from these sources:

> ***Section 2907*****:** Sections 2907(a) and (b) of the San Francisco Noise Ordinance (Article 29 of the San Francisco Police Code) state that construction equipment shall not emit noise in excess of 80 dBA when measured at a distance of 100 feet, or at an equivalent sound level at some other convenient distance. For trucks, this noise limit is more stringent than the federal noise standard. This noise level limit does not apply to impact tools and equipment that contain manufacturer-recommended noise-attenuating intake and exhaust mufflers approved by the Director of Public Works or Director of Building Inspection. This noise level limit also does not apply to pavement breakers and jackhammers, provided that such equipment is fitted with manufacturer-recommended acoustically attenuating shields or shrouds approved by the Director of Public Works or Director of Building Inspection.

> ***Section 2908: Construction work at night*****:** Construction activities are generally prohibited between the hours of 8:00 P.M. and 7:00 A.M. if the noise created would be in excess of the ambient noise level by 5 dBA at the nearest property line; although exceptions to these limits can be made in certain cases by the Director of Public Works or the Director of Building Inspection.

> ***Section 2909(c): Public Property Noise Limits*****:** No person shall produce or allow to be produced by any machine or device, or any combination of same, on public property, a noise level more than ten dBA above the local ambient at a distance of twenty-five feet or more, unless the machine or device is being operated to serve or maintain the property or as otherwise provided in this Article. This Subsection would not apply to construction equipment which is addressed by Sections 2007 and 2908 but could apply to operational stationary noise sources.

> ***Section 2909(d): Fixed Residential Interior Noise Limits***: In order to prevent sleep disturbance, protect public health and prevent the acoustical environment from progressive deterioration due to the increasing use and influence of mechanical equipment, no fixed noise source may cause the noise level measured inside any sleeping or living room in any

dwelling unit located on residential property to exceed 45 dBA between the hours of 10:00 p.m. to 7:00 a.m. or 55 dBA between the hours of 7:00 a.m. to 10:00 p.m. with windows open except where building ventilation is achieved through mechanical systems that allow windows to remain closed.

3.11.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.11.3.1 CEQA Significance Criteria

Based on CEQA Guidelines Appendix G Section XII, a project would have a significant impact related to noise and vibration if it would:

a) Result in exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

b) Result in exposure of persons to, or generation of, excessive groundborne vibration or groundborne noise levels;

c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

e) For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within 2 miles of a public airport or public use airport, expose people residing or working in the area to excessive noise levels; or

f) For a project located in the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

3.11.3.2 NEPA Impact Thresholds

The NPS is the lead federal agency for compliance with NEPA and has the responsibility for the scope, content and legal adequacy of this document. The following noise and vibration thresholds were determined by the NPS to describe the intensity of impacts under NEPA.

Construction Noise

Impact Intensity	Impact Description
Negligible:	Construction noise would be below ambient noise levels.
Minor:	Construction noise would exceed ambient noise levels but would not exceed 90 dBA during daytime hours or 80 dBA during nighttime hours at residential uses, or 100 dBA at commercial or industrial land uses at any time.
Moderate:	Construction noise would approach 90 dBA during daytime hours or 80 dBA during nighttime hours at residential uses, or 100 dBA at commercial or industrial land uses at any time.
Major:	Construction noise would exceed 90 dBA during daytime hours or 80 dBA during nighttime hours at residential uses, or 100 dBA at commercial or industrial land uses at any time.

Operational Noise

For this analysis, the intensity of noise impacts is based on the degree of predicted change in sound levels compared to existing conditions.

Impact Intensity	Impact Description
Negligible:	The change in sound levels would not be perceptible (i.e., less than 3 dBA).
Minor:	Sound levels would change by 3 to 5 dBA. The short- or long-term changes would result in noise levels that would shift between the "normally acceptable" and "conditionally acceptable" ranges of the California Land Use Noise Compatibility Guidelines (California Governor's Office of Planning and Research, 2003, Appendix C).
Moderate:	Sound levels would change by 6 to 9 dBA. The short- or long-term changes would result in noise levels that would shift between the "conditionally acceptable" and "normally unacceptable" ranges of the California Land Use Noise Compatibility Guidelines.
Major:	Sound levels would change by more than 9 dBA. The short- or long-term changes would result in noise levels that would shift between the "clearly unacceptable" and "normally unacceptable" ranges of the California Land Use Noise Compatibility Guidelines.

Vibration

For this analysis, the intensity of noise impacts are based on the FTA's vibration annoyance and construction vibration damage criteria's listed in **Tables 3.11-1** and **3.11-2**, respectively.

Impact Intensity	Impact Description
Negligible:	Project contribution does not alter existing vibration levels.
Minor:	Project increases vibration levels, but levels are below those indicated for each land use type and frequency combination in Table 3.11-1 and building category in Table 3.11-2.
Moderate:	Project increases vibration levels, but levels are at those indicated for each land use type and frequency in Table 3.11-1 and those indicated for each building category in Table 3.11-2.
Major:	Project increases vibration levels and levels exceed those indicated for each land use type and frequency in Table 3.11-1 or those indicated for each building category in Table 3.11-2.

TABLE 3.11-1
GROUND-BORNE VIBRATION IMPACT LEVELS

Land Use Category	Ground-borne Vibration Impact Levels in VdB		
	Frequent Events	**Occasional Events**	**Infrequent Events**
Category 1: Buildings where vibration would interfere with interior operations.	65	65	65
Category 2: Residences and buildings where people normally sleep.	72	75	80
Category 3: Institutional land uses with primarily daytime use.	75	78	83

SOURCE: FTA, 2006, Table 8-1

TABLE 3.11-2
CONSTRUCTION VIBRATION DAMAGE CRITERIA

Building Category	PPV (in/sec)	Approximate Lv (VdB)
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete masonry (no plaster)	0.3	98
III. Non-Engineered timber and masonry Buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

SOURCE: FTA, 2006, Table 12-3

3.11.3.3 Criteria and Thresholds with No Impact or Not Applicable

Because of the nature of the Project and its physical setting, the Project and alternatives would not result in impacts related to the following significance criteria; these criteria are not discussed in the impact analysis for the following reasons:

e) ***For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within 2 miles of a public airport or public use airport, expose people residing or working in the area to excessive noise levels; and***

f) ***For a project located in the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.***

The Project site is located outside a 2-mile radius of a public airport or private airstrip (approximately 7.3 miles from the San Francisco International Airport, the nearest airport). Therefore, the criteria related to aircraft noise exposure are not applicable to the Project and alternatives and are not discussed further.

3.11.4 Methodology and Assumptions

The ambient noise levels in the vicinity of the project area were characterized using the 2009 San Francisco background noise levels (San Francisco, 2009)**.** The noise levels during construction at each nearby noise-sensitive receptor were calculated using referenced noise levels and usage factors from the Federal Highway Administration (FHWA) Road Construction Noise Model (RCNM, 2006). Construction-related traffic noise generated by haul and vender truck trips were assessed using the FHWA Traffic Noise Prediction Model (FHWA RD-77-108) and the daily round trips shown in Table 2-4. The FTA Transit Noise and Vibration Assessment Manual (FTA, 2006) was used to identify the potential vibration sources that associated with the Project and to estimate the potential vibration levels at the closest sensitive receptors.

To estimate the operational noise impacts, the primary noise sources were identified to come from the motors at the wetlands pump station and diversion structure gates. The motors, for both the pumps and the gates, were calculated using the assumption that each would be running at 10 horse power (hp) and 1,800 rpm. Propagation equations for stationary mechanical equipment were used to estimate the noise level at the nearest noise-sensitive receiver (Bies, 2009).

The following assumptions are used to determine significant impacts under the criteria described in Section 3.11.3.1, CEQA Significance Criteria.

Construction Noise. Noise impacts from short-term non-impact construction activities could result in a significant construction impact if short-term construction activity exceeds noise standards adopted in local general plans or noise ordinances, and/or if it creates a substantial temporary or periodic increase in ambient noise levels. For purposes of this analysis, a significant noise impact would result if construction noise audible beyond the property of origin is generated within Daly City between the hours of 10:00 p.m. and 6:00 a.m. In San Francisco, a significant impact would result if construction noise exceeds the San Francisco Noise Ordinance thresholds of greater than 80 dBA at 100 feet at any time, greater than 5 dBA above the existing ambient noise level at the nearest property line between the hours of 8:00 p.m. and 7:00 a.m., or exceeds the speech interference criterion (defined below) of 70 dBA every work day for longer than two weeks.

> *Speech Interference*. Speech interference is an indicator of impact on typical daytime and evening activities. A speech interference threshold, in the context of impact duration and time of day, is used to identify substantial increases in noise from temporary construction activities. Noise peaks generated by construction equipment could result in speech interference in adjacent buildings if the noise level in the interior of the building exceeds 45 to 60 dBA. A typical building can reduce noise levels by 25 dBA with the windows closed (USEPA, 1974). This noise reduction could be maintained only on a temporary basis in some cases, since it assumes windows must remain closed at all times. Assuming a 25 dBA reduction with the windows closed, an exterior noise level of 70 dBA L_{eq} at receptors would maintain an acceptable interior noise environment of 45 dBA. (Such noise levels would be sporadic rather than continuous in nature, because different types of construction equipment would be used throughout the construction process.)

Construction Ground-Borne Vibration. For the purposes of this assessment, the methodology described by the FTA is used. This analysis also assumes that the appropriate construction vibration damage building category for the Missile Assembly Building is Category IV, Buildings extremely susceptible to vibration damage. This is considered to be protective of this 1959 masonry building that is not considered historic, but is nonetheless a Fort Funston resource which currently is used for storage. The Project would result in a significant vibration impact if this building would be exposed to the FTA vibration threshold level of 0.12 in/sec PPV or 90 VdB, or if residential receptors would be exposed to a vibration level of 72 VdB for Category 2 (residential) land uses (FTA, 2006, Table 12-3, Table 8-1). The criterion for residential land uses is for “frequent” events; this is used for construction activities that would involve impact pile driving.

Operational Noise. Noise impacts from long-term operation-related activities could result in a significant impact if noise levels exceed applicable thresholds set forth by the San Francisco Noise Ordinance, which prohibits generation of a noise level more than 10 dBA above the local ambient at a distance of 25 feet or more from a stationary noise source emanating from public property land uses.

3.11.5 Impact Analysis

3.11.5.1 Proposed Project

CEQA Analysis

a, d) Impact NOI-1: Project construction could temporarily expose persons to or generate noise levels in excess of local noise ordinances or create a substantial temporary increase in ambient noise levels. (Less than Significant with Mitigation)

Temporary construction-related noise effects are considered significant if (a) construction noise audible beyond the property of origin is generated within Daly City between the hours of 10:00 p.m. and 6:00 a.m., as specified in the Daly City Municipal Code; (b) construction activity within San Francisco generates noise levels in excess of 5 dBA above the existing ambient noise levels at the nearest property line between the hours of 8:00 p.m. and 7:00 a.m.; (c) noise levels from specific non-impact construction equipment operating in San Francisco exceed 80 dBA at 100 feet; (d) noise levels exceed 70 dBA (speech interference criterion) at the nearest sensitive receptor (building exterior) for construction activities in one place for more than two weeks, or (e) construction activities generate substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. No nighttime construction work is proposed in Daly City, and so no construction activity would occur within Daly City between 10:00 p.m. and 6:00 a.m. Therefore, no *significant* impact would occur with respect to the Daly City Municipal Code construction noise restrictions, and this threshold is not discussed further.

Onsite Construction Activities

Construction activity noise levels at and near the Project site would fluctuate depending on the particular type, number, and duration of the uses of various pieces of construction equipment. It is anticipated that Project construction would take approximately 24 to 44 months to complete. The details of the construction activities and methods for the Project are summarized in **Table 2-1** and include demolition and tree removal; Project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. Impact pile driving is expected to occur in three locations within the Project site: the John Muir Drive crossing, a temporary construction shaft located at Fort Funston for construction access to the Tunnel, and the Ocean Outlet (for installation of the temporary coffer dam). **Table 3.11-3** shows typical noise levels produced by construction equipment that is expected to be in operation during Project construction. Project construction would generate a significant amount of noise corresponding to the type and usage of off-road equipment during each construction activity.

As shown in Table 3.11-3, impact pile driving would produce noise levels of up to 101 dBA at a distance of 50 feet. Impact pile driving would occur during daytime hours only; therefore, the applicable significance threshold for impact construction activities is the 70 dBA speech interference criterion. Noise from construction activities generally attenuates at a rate of 6 dB per doubling of distance (Caltrans, 2013). The nearest sensitive receptors to where impact pile driving activities would take place at the John Muir Drive crossing are approximately 1,000 feet away; these residences would experience noise levels of approximately 68 dBA L_{eq} during impact pile

TABLE 3.11-3
TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Level[a] (dBA, L_{eq} at 50 Feet)
Excavator	81
Compactor	83
Impact or Vibratory Pile Driver	101
Crane	81
Loader	79
Drill Rig	79
Air Compressor	78
Ventilation Fan	79
Dump truck	76

dBA = A-weighted decibels, Lmax = maximum noise exposure level for the given time period

[a] Maximum noise levels correspond to a distance of 50 feet from the noisiest piece of equipment associated with a given piece of construction equipment.

SOURCE: FHWA, 2006

driving activities, which would not exceed the 70 dBA speech interference criterion and would therefore be *less than significant*. The nearest receptors to the Ocean Outlet cofferdam location are 1,700 feet away and separated from the Ocean Outlet location by the tall bluffs along the coast. As described in Sections 2.5.1.4, John Muir Drive Crossing and Lake Merced Outlet, and 2.5.1.2, Debris Screening Device and Diversion Structure, impact pile driving activities would affect any given sensitive receptor for no more than nine days for the crossing over John Muir Drive and 13 days for the diversion structure. As described in Section 2.5.1.4, these pile driving activities would not be completed concurrently or consecutively; rather, pile driving for the diversion structure would follow completion of the John Muir Drive crossing, and would be separated from pile driving for the John Muir Drive crossing by approximately 4.5 months (Table 2-2).

The nearest sensitive receptors to where impact pile driving activities would take place at the tunnel shaft at Fort Funston are approximately 600 feet away; these residences would experience noise levels of approximately 72 dBA L_{eq} during impact pile driving activities. Although the noise level at the nearest sensitive receptor would exceed the 70 dBA L_{eq} speech interference criterion, as described in Section 2.5.2, Vista Grande Tunnel and East and West Portals, impact pile driving activities at the tunnel shaft would affect any given sensitive receptor for no more than four days. Because this effect would not last longer than two weeks, it is considered *less than significant.*

Additionally, soldier pile drilling activities would occur at the Lake Merced Portal where the nearest sensitive receptors are approximately 100 feet away. The noise level at the nearest residential receiver to where drilling activities would take place would be approximately 66 dBA L_{eq}. As described in Section 2.5.2.1, Lake Merced (East) Portal, drilling activities at the Lake Merced Portal would not last longer than two days and would not exceed the 70 dBA L_{eq} speech interference criterion. This noise would therefore be *less than significant* under this threshold.

As shown in Table 3.11-3, the highest noise level associated with non-impact construction equipment would be 83 dBA from a distance of 50 feet. Assuming an attenuation rate of 6 dB per doubling of distance, the highest non-impact construction equipment would be as high as 77 dBA from 100 feet. This would not exceed the San Francisco Noise Ordinance threshold of 80 dBA at 100 feet and therefore would not be considered significant under this threshold. However, the nearest sensitive receptors to the Project site are the residences approximately 100 feet from the Lake Merced Portal. Other sensitive receptors are located approximately 200 feet east of the upstream end of the Canal. At these locations, ongoing construction activities could generate noise levels in excess of 70 dBA over a period of several months (see construction schedule in **Table 2-2**). Construction-generated noise levels in excess of the 70 dBA speech interference criterion for a period of two or more weeks would result in a *significant* impact.

Non-impact work at the tunnel shaft may occur during nighttime hours and therefore also would be subject to the threshold applicable between 8:00 p.m. and 7:00 a.m. in San Francisco. The nearest residential receptors are approximately 600 feet from the tunnel shaft. Again assuming attenuation of 6 dB per doubling of distance, the noise level generated at these receptors would not exceed 5 dBA above the existing ambient noise level of 60 dBA (San Francisco, 2009). Similarly, ongoing non-impact construction noise levels would not exceed the 70 dBA speech interference criterion at these receptors. Exposure to construction noise at individual residences would also be lessened due to local topography and natural barriers such as fences and trees and would not exceed regulatory significance thresholds.

In addition to regulatory thresholds, this analysis evaluates the potential for the Project to result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project. Some land uses are noise-sensitive in ways not addressed by regulatory noise thresholds, such as recreational areas used for passive recreational uses. At Lake Merced and its surrounding recreational amenities, ambient noise levels average between 50 and 60 dBA Ldn as a result of the proximity to heavily traveled roadways and other urban uses (San Francisco, 2009). Additionally, this area commonly experiences periodic loud noise from uses such as the San Francisco Police Department firing range on the western bank of South Lake. Nonetheless, Lake Merced provides passive recreational opportunities, including wildlife viewing, that may be particularly noise-sensitive.

Fort Funston, while also adjacent to urban roadways and located near many urban uses, provides a natural setting for passive recreation, and the dominant noises at the park, such as wind and wave noise, contribute to its natural setting. The ambient noise levels at Fort Funston generally are below 55 dBA Ldn (San Francisco, 2009). Only visitors on the beach would hear Ocean Outlet construction activities, and noise from construction above the bluffs within Fort Funston would not be audible at the beach due to the topography of the bluffs. As described in Section 2.6.5, Project Maintenance, at an estimated interval of approximately 25 years (depending on erosion rates), Daly City would demolish and remove the portions of the Ocean Outlet structure and Tunnel that become exposed due to continuing bluff erosion and would reconstruct the Ocean Outlet structure. Construction activities at the beach would be similar to those described for proposed Ocean Outlet construction and would be *less than significant*.

The Project's ongoing non-impact Tunnel construction activities occurring over a period of approximately 17 to 37 months would result in noise levels up to 77 dBA immediately outside the staging area fence line, decreasing to approximately 71 dBA along the Sunset Trail extending south from the parking lot, and to 59 dBA or lower along the portion of the Sunset Trail extending north from the parking lot. Non-impact construction noise would attenuate such that it is indistinguishable from ambient noise from Battery Davis northward, but may be audible above ambient noise in other portions of Fort Funston. For areas closest to the construction staging area, this could result in a substantial temporary increase above noise levels existing without the Project, a potentially significant impact.

Construction activities around the Canal and Tunnel, in combination with the impact pile driving at the John Muir Drive crossing and Fort Funston shaft, may have the potential to exceed the 70 dBA L_{eq} speech interference threshold for greater than two weeks. Additionally, Tunnel construction activities would generate substantial continuous noise at Fort Funston, where visitors may value an increased degree of quiet for passive recreational uses. If 24-hour tunneling is not permitted, construction-related noise at the Fort Funston staging area would occur for an additional year or more. Therefore, onsite construction-related activities could result in a significant impact by resulting in a substantial temporary increase in ambient noise levels at Fort Funston above levels existing without the Project. Implementation of Mitigation Measures 3.11-1 and 3.11-2, which would require the use of noise control methods and technologies, would reduce this potential impact to a *less-than-significant* level.

Mitigation Measure 3.11-1: The applicant shall require construction contractors to implement the following measures:

- Equipment and trucks used for Project construction shall use the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible).
- Impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for Project construction shall be hydraulically or electrically powered where feasible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves shall be used where feasible; this could achieve a reduction of 5 dBA. Quieter procedures, such as use of drills rather than impact tools, shall be used whenever feasible.
- Stationary construction noise sources shall be located as far from adjacent residential receptors as possible. Stationary noise-generating construction equipment shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, and/or controlled using other measures to the extent this does not interfere with construction purposes.

Mitigation Measure 3.11-2: To further address potential nuisance impacts of Project construction, construction contractors shall implement the following:

- Signs shall be posted at all construction site entrances to the property upon commencement of Project construction, for the purposes of informing all contractors/subcontractors, their employees, agents, material haulers, and all other persons at the applicable construction sites, of the basic requirements of Mitigation Measures 3.11-1.
- Signs shall be posted at the construction sites that include permitted construction days and hours, a day and evening contact number for the job site, and a contact number in the event of problems.
- An onsite complaint and enforcement manager shall respond to and track complaints and questions related to noise.

Offsite Construction-Related Traffic Activities

Construction haul and delivery trucks would access the site using designated truck routes. This increase in truck traffic, compared to existing conditions, would contribute incrementally to traffic noise along local streets. These streets may include John Muir Drive, Lake Merced Boulevard, and Highway 35. Truck noise levels depend on vehicle speed, load, terrain, and other factors. The effects of construction-related truck traffic would depend on the existing level of background noise at a particular sensitive receptor. The construction-related traffic noise levels were calculated using FHWA Traffic Noise Prediction Model (FHWA RD-77-108) and the daily round trips shown in **Table 2-4**, results are shown in **Table 3.11-4**. The existing traffic noise levels along various roadways in the Project vicinity were taken from the 2009 San Francisco Background Noise Levels (San Francisco, 2009). As shown in Table 3.11-4, the incremental noise increases along roadways that would be affected by construction-related traffic during various construction phases would be less than the existing traffic noise level and the contribution of trucks would increase noise levels by less than 3 dBA. Therefore, off-site construction-related traffic noise impacts would be *less than significant.*

TABLE 3.11-4
CONSTRUCTION AND EXISTING TRAFFIC NOISE LEVELS FROM 50 FEET FROM HAUL ROADS

Construction Location	Road Way	Existing Traffic Noise levels, dBA Ldn[1] [a]	Construction-Related Traffic Noise Levels, dBA Ldn[2] [b]	Resultant Noise Level Ldn[3] [a + b]	Incremental Increase [(a + b) - a]
Tunnel/Staging Area	John Muir Drive	65	57	66	1
	Lake Merced Blvd.	65	58	66	1
	Highway 35	65	58	66	1
Ocean Outlet and Tunnel Portals	John Muir Drive	65	49	65	0
	Lake Merced Blvd.	65	50	65	0
	Highway 35	65	50	65	0
Canal and Wetlands	John Muir Drive	65	52	65	0
	Lake Merced Blvd.	65	54	65	0
	Highway 35	65	54	65	0

NOTES:
1 Existing traffic noise levels are estimated using the 2009 San Francisco Background Noise Levels Map (San Francisco, 2009).
2 Construction noise levels are based on construction-related heavy truck and auto trips shown in Table 2-4.
3 The existing traffic noise levels (column a) is logarithmically added to the construction-related traffic noise levels (column b).

SOURCE: ESA, 2014

Other Offsite Construction-Related Effects

As described in Section 2.4, the Project includes potential improvements within the Vista Grande Basin storm drain system upstream of the Vista Grande Canal or in areas adjacent to Lake Merced, including within San Francisco (described in the draft Lake Management Plan, Section 5.1, Appendix A). Such improvements are largely speculative as details relating to location, design, and construction methods have not been developed. Additionally, some of the actions to improve stormwater quality within the Basin are educational efforts (such as green infrastructure education programs) with no construction-related action that could generate noise. The impacts of constructing physical improvements, such as detention and filtration systems, catch basin screens, and habitat enhancements around Lake Merced, would likely result in minor construction-related noise impacts similar to those described for Project facilities, above, with the exception of impact equipment which is unlikely to be needed. Such construction activities would be completed within daytime hours specified in local noise ordinances and would not be expected to exceed the significance thresholds for temporary construction-related noise impacts. Therefore, noise generated by the construction of these improvements would be *less than significant.*

In addition to the above described improvements, the Lake Management Plan includes potential installation of an aeration system within the Lake. Construction of an aeration system could require construction of an on-shore pump station to house the air compressors and placement of the bubbler devices on the lake bed. Because the timing of this construction would be unlikely to overlap with nearby construction activities for the Project, it would not be additive with the rest of Project construction. Additionally, because no impact tools are likely to be used in the construction of a pump station, temporary construction impacts would be *less than significant* like those of the Project's non-impact construction activities. Nevertheless, the construction of an aeration mixing system within Lake Merced would require subsequent CEQA and/or NEPA review prior to implementation.

Significance after Mitigation: Implementation of Mitigation Measures 3.11-1 and 3.11-2 would reduce construction-related noise levels by approximately 5 to 15 dBA, which would reduce significant noise levels to below the 70 dBA L_{eq} speech interference criterion and would reduce temporary and periodic construction noise to below levels substantially greater than ambient noise. Therefore, noise impacts associated with onsite construction activities would be reduced to a *less than significant* impact after mitigation. All other construction-related noise impacts are *less than significant* as compared to applicable thresholds.

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b) Impact NOI-2: Project construction could result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. (Less than Significant with Mitigation)

Construction equipment could generate noticeable vibration at the existing nearest residential land uses. The greatest potential for vibration generation would be during the pile driving activities at Canal and Tunnel components. Vibration levels from pile driving at the Ocean Outlet location would not generate any significant perceptible ground-borne vibration levels due to the use of construction equipment that does not generate significant levels of vibration and the Ocean Outlet's distance to the nearest receptor. **Table 3.11-5** shows the vibration levels for different construction equipment at 25 feet. As the equipment moves farther away, the vibration level drops rapidly, due to absorption from the ground through which the vibration propagates.

TABLE 3.11-5
VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Reference VdB Level from 25 feet	Reference PPV Level from 25 feet (in/sec)
Large Bulldozer	87	0.089
Impact Pile Driver	112	1.518
Loaded Trucks	86	0.076
Caisson Drill	87	0.089
Excavator with Hammer	87	0.089
Compactor	87	0.089

SOURCE: FTA, 2006

The rumbling sound caused by vibration of room surfaces within a building is called groundborne noise. The rumble is the noise radiated from the motion of the room surfaces. Unlike airborne noise, groundborne noise levels are primarily dominated by low-frequency sound waves (FTA, 2006). The predominant sources of groundborne noise are blasting and rail transit pass-by events. The highest vibration levels during construction would be the result of pile driving activities, which would not generate significant low-frequency noise levels. Since Project construction would not involve activities that would generated significant low-frequency vibration events, it is unlikely that groundborne noise would be generated during construction at the nearest residential home, and impacts of groundborne noise would be *less than significant*.

Sheet pile driving would take place for construction of the debris screening device and diversion structure directly downstream of the box culvert (location shown on Figure 2-2a). Sheet piles would be driven into the ground using an impact pile driver to support the John Muir Drive crossing. The nearest residential receiver would be homes located approximately 1,000 feet southeast from where pile driving activities would take place, and as shown in **Table 3.11-6**, the vibration level would be approximately 64 VdB and 0.006 in/sec PPV. These vibration levels are below the FTA's construction vibration thresholds for residential land uses and building damage, and therefore would be considered *less than significant.*

Non-impact construction activities would occur near homes along the proposed Vista Grande Canal, which would include the use of a large bulldozer, loaded trucks, excavators and compactors. These residential receivers would be located approximately 200 feet from where the nearest non-impact construction activities would occur. As shown in Table 3.11-6, at this distance, these receptors would be exposed to vibration levels of up to 60 VdB and 0.004 in/sec PPV during non-impact construction activities. These vibration levels are below the FTA's construction vibration thresholds for residential land uses and building damage, and therefore would be considered *less than significant.*

TABLE 3.11-6
CANAL CONSTRUCTION VIBRATION LEVELS

Equipment	Distance to Nearest Sensitive Receiver	Estimated Maximum Vibration at Nearest Sensitive Receiver: Vibration Level, VdB	Estimated Maximum Vibration at Nearest Sensitive Receiver: Vibration Level, PPV (in/sec)
Large Bulldozer	200	60	0.004
Impact Pile Driver	1,000	64	0.0060
Loaded Trucks	200	59	0.003
Excavator with Hammer	200	60	0.004
Compactor	200	60	0.004

SOURCE: FTA, 2006; ESA, 2014

The proposed Vista Grande Tunnel would be accessed from a temporary construction shaft located at Fort Funston and tunneling would begin in both directions, as illustrated in Figure 2-2b and detailed in Section 2.5.2. Sheet piles would be driven in the ground at Fort Funston to support the shaft. The nearest vibration-sensitive receiver to the where pile driving activities would take place is the Missile Assembly Building located in Fort Funston, approximately 100 feet from sheet pile driving activities would take place. As shown in **Table 3.11-7**, the vibration level would be approximately 94 VdB and 0.1898 in/sec PPV. The vibration levels at the Missile Assembly Building in Fort Funston would be above the FTA's building damage threshold for susceptible buildings (0.12 in/sec PPV or 90 VdB); therefore, this source of ground-borne vibration could result in a *significant* impact. Implementation of **Mitigation Measure 3.11-3** would reduce the potential impact to *less than significant.*

TABLE 3.11-7
TUNNEL CONSTRUCTION VIBRATION LEVELS

Sensitive Receiver (Distance)	Equipment Type	Estimated Maximum Vibration at Sensitive Receiver: Vibration Level, VdB	Estimated Maximum Vibration at Sensitive Receiver: Vibration Level, PPV (in/sec)
Missile Assembly Building (100 feet)	Large Bulldozer, Caisson Drill, Excavator with Hammer, or Compactor	69	0.0111
	Impact Pile Driver	94	0.1898
	Loaded Trucks	68	0.0095
Nearest residence (600 feet)	Large Bulldozer, Caisson Drill, Excavator with Hammer, or Compactor	46	0.0008
	Impact Pile Driver	71	0.0129
	Loaded Trucks	45	0.0006
Edge of bluff (1,000 feet)	Large Bulldozer, Caisson Drill, Excavator with Hammer, or Compactor	39	0.0004
	Impact Pile Driver	64	0.0060
	Loaded Trucks	38	0.0003

SOURCE: FTA, 2006; ESA, 2014

Construction, including pile driving, at the tunnel shaft location and construction staging area would generate vibration levels of up to 71 VdB and 0.013 in/sec PPV at the nearest residences to this construction site (about 600 feet away). These vibration levels are below the FTA's construction vibration thresholds for residential land uses and building damage, and therefore would be considered *less than significant.*

Furthermore, construction activities at Fort Funston, including pile driving, would generate vibration in an area of Dune Sand overlying the Merced Formation as well as Landslide Deposits, as described in Section 3.6, Geology and Soils. The coastal bluffs at Fort Funston are mapped within a zone subject to seismically induced instability. No significance threshold for vibration levels has been identified for potential vibration-induced instability of soils. However, estimated vibration levels at the bluffs resulting from construction activities within the Fort Funston staging area are provided for informational purposes in Table 3.11-7. At a distance of approximately 1,000 feet, vibration levels from construction activities at Fort Funston would be negligible and well below the damage threshold for extremely susceptible buildings Table 3.11-2). Furthermore, implementation of Mitigation Measure 3.6-3b would require that additional slope stability studies be completed and that, if necessary, design specifications and construction methods be implemented to avoid such an effect.

There would also be soldier pile drilling activities (caisson drill) at the Lake Merced Portal where vibration levels would be approximately 69 VdB and 0.011 in/sec PPV at the nearest residential receiver located 100 feet away. This vibration level would not exceed the FTA's threshold for residential land uses (72 VdB), and so would not be considered a *significant* impact.

Mitigation Measure 3.11-3: To address the vibration impact at the Missile Assembly Building located in Fort Funston, Daly City shall require construction contractors to implement the following vibration monitoring measures:

1) A pre-construction visual survey of the Missile Assembly Building shall be conducted and existing conditions shall be documented by use of photography or video. A qualified and licensed structural engineer and architectural historian shall be retained to assess whether the potentially affected structure(s) could withstand a vibration level above the "stop work" threshold of 0.12 in/sec PPV (90 VdB). If this assessment results in a higher threshold for potential damage than 0.12 in/sec PPV (90 VdB), that higher threshold shall be used in lieu of 0.12 in/sec PPV (90 VdB) for purposes of part 2.

2) The construction contractor shall monitor vibration levels during tunnel construction, especially during impact pile driving at the temporary construction shaft. If construction vibration levels measured at the Missile Assembly Building exceed 0.12 in/sec PPV (90 VdB) or the higher threshold determined in part 1 if applicable, construction shall be halted and other feasible construction methods shall be employed to reduce the vibration levels below the standard threshold. Alternative construction methods may include sonic or vibratory pile drivers.

Significance after Mitigation: Implementation of Mitigation Measure 3.11-3 would ensure that vibration levels at the Missile Assembly Building would not exceed the FTA's vibration thresholds for building damage for older buildings that may be extremely susceptible to vibration.

The use of sonic or vibratory pile drivers, as recommended in case vibration levels exceed the threshold at the Missile Assembly Building, would reduce vibration levels to approximately 0.09 in/sec PPV and 87 VdB, which are below the 0.12 in/sec PPV and 90 VdB potential building damage thresholds. Therefore, vibration impacts associated with construction-related activities would be reduced to a *less than significant* impact after mitigation.

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a, b, c, d) Impact NOI-3: Project operation would not expose receptors to noise levels in excess of the San Francisco Noise Ordinance; would not expose persons to excessive groundborne vibration or groundborne noise levels; and would not result in a substantial permanent, temporary, or periodic increase in ambient noise levels in the Project vicinity above existing levels. (Less than Significant)

Operational activities at the Canal portion of the Project site, including operation of a wetlands pump station with two pumps and 10 gate motors at the diversion structure, could produce increased noise levels. Each of these activities is discussed in detail below.

Two 10 hp pumps would be in operation to pump low flows from the diversion structure to one of the wetland cells. The wetlands pump station would be located underground, approximately 1,000 feet northwest from the nearest residential receiver. The maximum sound level generated by each pump would be 84 dBA at a distance of 3 feet (Bies, 2009). The two pumps would be enclosed in an underground concrete structure, which would attenuate the noise generated by the pumps. The closest existing residences are located approximately 1,000 feet southeast of the wetlands pump station across Lake Merced Boulevard. Assuming a 10 dB attenuation from the concrete pump enclosure, the maximum combined noise level from the two pumps would reach approximately 38 dBA at the nearest residential property boundary.

Four canal gates and six diversion gates would be in operation as needed to control the flow of drainage through the canal. The gates would be located within the diversion structure located approximately 1,000 feet northwest of the nearest residential receiver. The maximum sound level generated by each of the gate motors would be 81 dBA at a distance of 3 feet (Bies, 2009). Assuming a 10 dB attenuation from the concrete motor enclosure, the maximum combined noise level from the gates would reach approximately 45 dBA at the nearest residential property boundary.

The combined operational maximum noise level, when both the pumps and gate motors are running, would be approximately 41 dBA at the nearest residential receiver. The San Francisco Noise Ordinance states that noise levels cannot exceed 10 dBA above the local ambient noise level when emanating from public property land uses. According to modeled background noise levels (San Francisco, 2009), the ambient noise level at the closest residential land use is approximately 55 dBA. For the Project to violate the San Francisco Noise Ordinance, the Project's operational noise level would have to exceed 65 dBA. The proposed Project operational noise level of 41 dBA would not exceed the San Francisco noise limit thresholds. Therefore, the increases in noise levels during operation of the wetland pumps and canal and diversion gate motors would result in a *less-than-significant* impact.

The Tunnel portion of the Project would not result in operational noise in excess of existing conditions. Because the force main would be abandoned and the protruding portion removed, the noise from the existing air relief valve at the beach associated with operation of the force main under existing conditions would cease, resulting in quieter operation than the existing infrastructure. The potential improvements described in the draft Lake Management Plan (Appendix A) would not create operational noise, with the possible exception of an aeration mixing system, which could generate some minor operational noise within and near Lake Merced that would be similar to the noise from the Project's pumps within the diversion structure. The operation of an aeration mixing system within Lake Merced would require subsequent CEQA and/or NEPA review prior to implementation.

Additionally, operation of the Project would not create a *significant* source of new vibration or groundborne noise.

Mitigation: None required.

NEPA Analysis

As discussed in the CEQA analysis above, during the construction of the diversion structure and tunnel shaft at Fort Funston, noise levels generated by impact pile driving would be approximately 68 and 72 dBA L_{eq} at the closest residential receiver during daytime hours, respectively. There is potential for construction activities occurring during the nighttime hours at the tunnel shaft and construction staging area at Fort Funston. Construction noise would exceed the ambient noise levels at the closest residential receiver, but would not exceed the 90 dBA daytime or the 80 dBA nighttime residential construction noise thresholds. Therefore, noise impacts associated with construction-related activities would result in a short-term, minor adverse impact. Additionally, implementation of Mitigation Measures 3.11-1 and 3.11-2, recommended to reduce impacts relative to CEQA significance thresholds, would further reduce construction noise levels.

As discussed in the CEQA analysis, during construction, vibration levels at the nearest residential receiver would be as high as approximately 64 VdB and 0.006 in/sec PPV during sheet pile driving at the diversion structure and 94 VdB and 0.1898 in/sec PPV from sheet pile driving at Fort Funston for the tunnel shaft. Construction activities at the Canal would occur during the daytime only, but construction may occur 24 hours a day for the tunneling activities. The highest vibration level of 94 VdB and 0.1898 in/sec PPV would exceed the FTA's ground-borne vibration impact thresholds and the construction vibration damage criteria for buildings extremely susceptible to vibration damage, such as the Missile Assembly Building approximately 100 feet from the proposed tunnel shaft location. Therefore, vibration impacts associated with construction-related activities would result in a short-term, major impact. Implementation of **Mitigation Measure 3.11-3** would reduce vibration levels to below the FTA's ground-borne vibration impact thresholds and the construction vibration damage criteria at the Missile Assembly Building, but construction-related vibration levels would still be increased in the area. Therefore, vibration impacts associated with construction-related activities would be reduced to a minor adverse impact intensity after mitigation.

As discussed in the CEQA analysis, the combined maximum noise level from operation of the pumps and gate motors would be approximately 41 dBA at the nearest residential receiver. The ambient noise level at the closest residential receiver would be 55 dBA (San Francisco, 2009). The operational noise level of the Project would below the existing ambient noise level of 55 dBA and the change in sound levels would not be perceptible (i.e., less than 3 dBA). Therefore, noise impacts associated with operation-related activities would result in a negligible impact.

The impact of construction noise and vibration on recreational users is addressed in Section 3.13, Recreation.

3.11.5.2 Tunnel Alignment Alternative

The following describes the noise and vibration effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.11.5.1, Proposed Project, or Section 3.11.5.3, Canal Configuration Alternative, depending on the option selected. Thus, noise and vibration effects for the canal portion would be as described in those sections.

CEQA Analysis

Onsite Construction Activities

The construction methods and duration to construct the Tunnel Alignment Alternative would not change appreciably from a noise and vibration perspective compared to the Tunnel portion of the Project. The details of the surface construction activities and methods for this alternative would be substantially similar to the Project, as summarized in Table 2-1 and include demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. The duration of the construction period at Fort Funston would be similar to that for the proposed Project: 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston. Impact pile driving would occur at the tunnel shaft at Fort Funston. The location of the tunnel shaft would be somewhat farther from the nearest residential receiver compared to Tunnel portion of the Project as a result of shifting the tunnel alignment up to 50 feet to the south, away from the residences. Additionally, soldier pile drilling would occur at the Lake Merced Portal. The location of the Lake Merced Portal would be farther from the nearest residential receiver than under the proposed Project because it would be shifted to the south, away from the apartment complex on John Muir Drive. A digger shield or soft ground micro-tunnel boring machine (MTBM) would be used for tunnel construction rather than an excavator under this alternative. The use of this type of tunnel boring equipment in soft ground would not generate substantial noise that would be detectable at the surface (i.e., at the opening of the tunnel shaft). The noise associated with ventilation fans and other equipment nearer to or at the surface would be as described for the proposed Project.

Noise impacts at the nearest residential receptor to where impact pile driving activities would take place at Fort Funston for the tunnel shaft would be exposed to a maximum noise level of no more than 72 dBA L_{eq} resulting from pile driving. Although the noise level at the nearest sensitive receptor would exceed the 70 dBA L_{eq} speech interference criterion, as described in Section 2.5.2, Vista Grande Tunnel and East and West Portals, impact pile driving activities at the tunnel shaft would affect any given sensitive receptor for no more than four days. Because this effect would not last longer than two weeks, it is considered *less than significant*.

Additionally, soldier pile drilling activities would occur at the Lake Merced Portal where the nearest sensitive receptor would be more than 100 feet away. The noise level at the nearest residential receiver to where drilling activities would take place would be approximately 66 dBA L_{eq}. As described in Section 2.5.2.1, Lake Merced (East) Portal, drilling activities at the Lake Merced Portal would not last longer than two days and would not exceed the 70 dBA L_{eq} speech interference criterion. This noise would therefore be *less than significant*.

As described for the proposed Project, construction activities around the tunnel shaft and Lake Merced Portal, in combination with the impact pile driving at the Fort Funston shaft and soldier pile drilling at the Lake Merced Portal, may have the potential to exceed the 70 dBA L_{eq} speech interference threshold for greater than two weeks. Additionally, Tunnel construction activities would generate substantial continuous noise at Fort Funston, where visitors may value an increased degree of quiet for passive recreational uses. Therefore, onsite construction-related activities could result in a significant impact by resulting in a substantial temporary increase in ambient noise levels at Fort Funston. Implementation of **Mitigation Measures 3.11-1** and **3.11-2** would reduce construction-related noise levels by approximately 5 to 15 dBA, which would reduce noise levels to below the 70 dBA L_{eq} speech interference criterion and would reduce temporary and periodic construction noise to below levels substantially greater than ambient noise. Therefore, noise impacts associated with construction-related activities would be reduced to a *less-than-significant* impact after mitigation.

Offsite Construction-Related Truck Traffic

Noise levels associated with haul and delivery trucks accessing the site during construction would not change compared to the Project. As described for the Project, the incremental noise increases along roadways that would be affected by construction-related traffic during various construction phases would be less than the existing traffic noise level by at most 15 dBA Ldn. Therefore, off-site construction-related traffic noise impacts would be *less than significant.*

Construction Vibration

The greatest potential for vibration generation under the Tunnel Alignment Alternative would occur during the pile driving activities for the tunnel shaft. Like the Project, vibration levels from construction at the Ocean Outlet would not generate significant ground-borne vibration levels due to the distance to the nearest sensitive receiver and the use of construction equipment that does not generate significant levels of vibration. The use of a digger shield or soft ground MTBM would not generate substantial vibration, and vibration would not be detectable at the surface or affect soil stability in the Project vicinity. Table 3.11-7 shows the vibration levels for different construction equipment at their closest point to the nearest residential land use adjacent to the site. As the equipment moves farther away, the vibration level drops rapidly, due to absorption from the ground through which the vibration propagates.

The proposed Tunnel Alignment Alternative would start from a temporary construction shaft located at Fort Funston (within a staging area shown on Figure 2-6) and tunneling would begin in both directions. Sheet piles would be driven in the ground at Fort Funston to support the tunnel shaft. The nearest vibration-sensitive receiver to the where pile driving activities would take place is the Mission Assembly Building located in Fort Funston, approximately 100 feet from where sheet pile driving activities would take place. As shown in Table 11.3-12, the vibration level would be approximately 94 VdB and 0.1898 in/sec PPV. These vibration levels are above both the FTA's construction vibration and building damage thresholds for historic land uses; therefore would be considered significant. Implementation of **Mitigation Measure 3.11-3** would ensure that vibration levels at the Missile Assembly Building would not exceed the FTA's building damage thresholds for buildings that may be extremely susceptible to vibration. Therefore, vibration impacts associated with construction-related activities would be reduced to a *less than significant* impact after mitigation. As described for the Project, vibration generated by pile driving or other activities at Fort Funston would result in negligible vibration levels at the edge of the bluffs, and implementation of Mitigation Measure 3.6-3b would require that additional slope stability studies be completed and that, if necessary, design specifications and construction methods be implemented to avoid adverse effects on soil stability at the bluffs.

There would also be soldier pile drilling activities at the Lake Merced Portal where vibration levels would be approximately 69 VdB and 0.011 in/sec PPV at the nearest residential receiver that would be located at least 100 feet away, as shown in Table 3.11-7. This vibration level would not exceed the FTA's threshold for residential land uses (80 VdB), and so would be considered a *less-than-significant* impact.

Similar to the proposed Project, groundborne noise impacts would be *less than significant*.

Operation

The operational activities associated with the Tunnel Alignment Alternative would not change when compared to the Tunnel portion of the Project. As detailed in the Project analysis in Section 3.11.5.1, the Tunnel portion of the Project would not result in operational noise in excess of existing conditions. Because the force main would be abandoned and the protruding portion removed, the noise from the existing air relief valve at the beach associated with operation of the force main under existing conditions would cease, resulting in quieter operation than the existing infrastructure. Operational noise associated with the Canal portion would be as described in Section 3.11.5.1, Proposed Project, or in Section 3.11.5.3, Canal Configuration Alternative, depending on the option selected. The contribution of the Tunnel Alignment Alternative to long-term noise levels would be negligible, resulting in a *less than significant* impact.

NEPA Analysis

As discussed in the CEQA analysis, the construction methods and duration to construct the Tunnel Alignment Alternative would not change appreciably from a noise and vibration perspective compared to the Tunnel portion of the Project. The duration of the construction period at Fort Funston would be similar to that for the proposed Project: 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston.

As described in Section 3.11.5.1, Proposed Project, residences approximately 600 feet away from impact pile driving at the proposed tunnel shaft location would experience noise levels of approximately 72 dBA L_{eq} during impact pile driving activities. Under the Tunnel Alignment Alternative, the tunnel shaft would be located in approximately the same location; thus construction noise effects would be similar to the proposed Project. Drilling activities at the Lake Merced Portal would occur only during the day and would not exceed 90 dBA. Therefore, the Tunnel Alignment Alternative would have a short-term, minor adverse impact with respect to construction noise. As noted above, if 24-hour tunneling is not permitted, construction-related impacts at and near the Fort Funston staging area would occur for an additional year or more. Additionally, implementation of Mitigation Measures 3.11-1 and 3.11-2, recommended to reduce impacts relative to CEQA significance thresholds, would further reduce construction noise levels.

During the construction of the Tunnel Alignment Alternative vibration levels at the nearest residential receiver would be similar to the proposed Project and vibration impacts associated with construction-related activities would result in a short-term, major impact. Implementation of **Mitigation Measure 3.11-3** would reduce vibration levels to below the FTA's construction vibration damage criteria at the Missile Assembly Building, but construction-related vibration levels would still be increased in the area. Therefore, vibration impacts associated with construction-related activities would be reduced to a minor adverse impact after mitigation.

As detailed in the Project analysis in Section 3.11.5.1, the Tunnel portion of the Project would not result in operational noise in excess of existing conditions. Operational noise associated with the Canal portion would be as described in Section 3.11.5.1, Proposed Project, or in Section 3.11.5.3, Canal Configuration Alternative, depending on the option selected. The contribution of the Tunnel Alignment Alternative to long-term noise levels would be negligible.

3.11.5.3 Canal Configuration Alternative

The following describes the noise and vibration effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.11.5.1, Proposed Project, or Section 3.11.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, noise and vibration effects for the tunnel portion would be as described in those sections.

CEQA Analysis

Onsite Construction Activities

The construction methods for the Canal Configuration Alternative would not change appreciably from a noise and vibration perspective compared to the Project, as described in Chapter 2, except that the collection box and box culvert would not be constructed. This would result in reduced duration of construction activity. The details of the construction activities and methods for this alternative would be substantially similar to the Canal portion of the Project, as summarized in Table 2-1 (excluding the collection box and box culvert) and include demolition and tree removal; project component construction or demolition; excavation; spoils storage, diversion, and disposal and dewatering activities; and installation of work/staging areas. Impact pile driving is expected to occur in one location associated with the Canal Configuration Alternative, the John Muir Drive crossing and diversion structure.

Impact ALT-NOI-1: The Canal Configuration Alternative could temporarily expose persons to or generate noise levels in excess of the San Francisco Noise Ordinance or create a substantial temporary increase in ambient noise levels. (Significant and Unavoidable)

The nearest sensitive receptors to where impact pile driving activities would take place at the John Muir Drive crossing and diversion structure are approximately 200 feet away; these residences would experience noise levels of approximately 82 dBA L_{eq} during impact pile driving activities, which would exceed the 70 dBA speech interference criterion. As described in Sections 2.5.1.4, John Muir Drive Crossing and Lake Merced Outlet, and 2.5.1.2, Debris Screening Device and Diversion Structure, impact pile driving activities would affect any given sensitive receptor for no more than nine days for the crossing over John Muir Drive and 13 days for the diversion structure. As described in Section 2.5.1.4, these pile driving activities would not be completed concurrently or consecutively; rather, pile driving for the diversion structure would follow completion of the John Muir Drive crossing, and would be separated from pile driving for the John Muir Drive crossing by approximately 4.5 months (Table 2-2). Therefore, although these pile driving activities would exceed the 70 dBA speech interference criterion, they would not do so for a period of greater than two weeks, and would not result in a *significant* impact.

Although the above impacts would not individually exceed significance thresholds, other construction activities along the Canal, in combination with the impact pile driving for the John Muir Drive crossing and diversion structure, may have the potential to exceed the 70 dBA L_{eq} speech interference threshold for greater than two weeks. Therefore, onsite construction-related activities could result in a *significant* impact. Implementation of **Mitigation Measures 3.11-1** and **3.11-2**, which would require the use of noise control methods and technologies, would reduce construction-related noise levels by approximately 5 to 15 dBA. A reduction of at least 12 dBA would be needed to reduce noise levels to below the 70 dBA speech interference criterion. Therefore, if a noise reduction of at least 12 dBA is not achieved, noise impacts associated with construction-related activities could remain significant after mitigation (*significant and unavoidable*).

Offsite Construction-Related Truck Traffic

Noise levels associated with haul and delivery trucks accessing the site during construction would not change compared to the Project, though the duration of construction along the Canal likely would be reduced. As described for the Project, the incremental noise increases along roadways that would be affected by construction-related traffic during various construction phases would be less than the existing traffic noise level by at most 15 dBA Ldn. Therefore, off-site construction-related traffic noise impacts on city streets would be *less than significant*.

Construction Vibration

The greatest potential for vibration generation under the Canal Configuration Alternative would occur during the pile driving activities for the John Muir Drive crossing and diversion structure. Table 3.11-5 shows the reference vibration levels for different construction equipment at 25 feet. As the equipment moves farther away from a receptor, the vibration level drops rapidly, due to absorption from the ground through which the vibration propagates.

Impact ALT-NOI-2: The Canal Configuration Alternative could result in the exposure of persons to or generation of excessive groundborne vibration. (Significant and Unavoidable)

Sheet pile driving using an impact pile driver would take place to accommodate construction of the John Muir Drive crossing and diversion structure at the mouth of the Canal. The nearest residential receiver to pile driving activities would be homes located approximately 200 feet south-east from the from where pile driving activities would take place, and as shown in **Table 3.11-8**, the vibration level would be approximately 85 VdB and 0.007 in/sec PPV. These vibration levels are above the FTA's construction vibration impact thresholds for residential land uses, and therefore would be considered *significant*. Implementation of **Mitigation Measure 3.11-4** would reduce the potential impact, but not to a *less-than-significant* level.

TABLE 3.11-8
CANAL CONFIGURATION ALTERNATIVE
CONSTRUCTION VIBRATION LEVELS ALONG THE CANAL

Equipment	Construction Maximum Vibration to the Nearest Residential Receiver Located 200 feet Away	
	Vibration Level, VdB	Vibration Level, PPV
Large Bulldozer	60	0.0039
Impact Pile Driver	85	0.0671
Loaded Trucks	59	0.0034
Excavator with Hammer	60	0.0039
Compactor	60	0.0039

SOURCE: FTA, 2006; ESA, 2014

Mitigation Measure 3.11-4: To address the vibration impact at the homes located approximately 200 feet south-east from where impact pile driving would take place at during the construction of the Canal Configuration Alternative's John Muir Drive crossing and diversion structure, Daly City shall require construction contractors to implement the following vibration monitoring measures:

1) Sequence demolition, earth-moving, and ground-impacting operations so as to not to occur in the same time period; and

2) Avoid nighttime activities.

Significance after Mitigation: Implementation of Mitigation Measure 3.11-4 would reduce Project-related vibration levels at the nearest residential building located approximately 200 feet south-east from the John Muir Drive crossing and diversion structure; however, it is expected that they would continue to exceed the FTA's vibration thresholds residential land uses. Therefore, vibration impacts associated with construction-related activities would remain *significant and unavoidable* after mitigation. Similar to the proposed Project, groundborne noise impacts would be *less than significant.*

Operations

The operational activities associated with the Canal Configuration Alternative would be approximately the same as those of the Canal portion of the Project as detailed in Section 2.7.2.2, Canal Configuration Alternative, but the locations of the operational noise sources such as the pumps and gate motors would be shifted southeast along the Canal alignment, and as a result would be closer to residential receptors than under the proposed Project.

The combined maximum operational noise level, when both the pumps and gate motors are running, would be approximately 52 dBA at the nearest residential receiver. The San Francisco Noise Ordinance states that noise levels cannot exceed 5 dBA above the local ambient for residential land uses. According the San Francisco Background Noise Map (San Francisco, 2009), the ambient noise level at the closest residential land use is approximately 55 dBA. For a project to violate the San Francisco Noise Ordinance its operational noise level would have to exceed 60 dBA. The Canal Configuration Alternative's operational noise level of 52 dBA would not exceed the San Francisco noise limit thresholds. Therefore, the increases in noise levels during operation of the Canal Configuration Alternative would result in a *less than significant* impact.

NEPA Analysis

As discussed above, the construction methods for the John Muir Drive crossing and diversion structure would be the same as for the Project. During the construction of these components, noise levels generated by impact pile driving would be approximately 82 dBA L_{eq} at the closest residential receiver during daytime hours. It is anticipated that there will be no construction activities along the Canal during nighttime hours. Construction noise would exceed the ambient noise levels at the closest residential receiver, but would not exceed the 90 dBA daytime NEPA residential construction noise threshold. Therefore, noise impacts associated with construction-related activities would result in a short-term, minor adverse impact.

During pile driving for the John Muir Drive crossing and diversion structure, vibration levels at the nearest residential receiver would be as high as approximately 85 VdB and 0.007 in/sec PPV, which would exceed the FTA's ground-borne vibration impact thresholds Therefore, vibration impacts associated with construction-related activities would result in a short-term, major impact. Implementation of **Mitigation Measure 3.11-4** would reduce vibration levels, but not to below the FTA's ground-borne vibration impact thresholds. Therefore, vibration impacts associated with construction-related activities would be reduced with mitigation, but would remain a short-term, major adverse impact after mitigation.

As discussed in the CEQA analysis, the combined maximum noise level from the operation of the pumps and gate motors would be approximately 52 dBA at the nearest residential receiver. The operational noise level of the Canal Configuration Alternative would below the existing ambient noise levels and the change in sound levels would not be perceptible (i.e., less than 3 dBA). Therefore, noise impacts associated with operation-related activities would result in a negligible impact.

3.11.5.4 No Project/No Action Alternative

Because no new construction would occur under the No Project/No Action Alternative, no construction noise or ground-borne vibration would be generated by this alternative, which would result in no impact.

There would be no changes to the existing operation of the existing Canal and Tunnel. Noise generated by the operation and maintenance of these components would not change. Therefore, the No Project/No Action Alternative would result in no impact. Because the force main would continue to operate, the noise from the air relief valve at the beach associated with operation of the force main under existing conditions would continue to occur.

3.11.6 Cumulative Effects

3.11.6.1 Geographic Extent/Context

The geographic scope of the cumulative noise analysis is the Project vicinity, including surrounding sensitive receptors (generally within 0.25 mile of the Project site). Noise impacts tend to be localized; therefore, the area near the Project site would be most affected by the Project or alternatives.

3.11.6.2 Past, Present and Reasonably Foreseeable Projects

The existing conditions reflect the contributions of past projects. The following current and reasonably foreseeable projects are located within 0.25 miles of the Project site and are expected to occur with the same vicinity and time frame as the Project and alternatives, which could result in cumulative impacts to noise and vibration conditions. These projects are discussed in more detail in Table 3.1-1.

- Regional Groundwater Storage and Recovery Project (SFPUC)
- Groundwater Supply Project (SFPUC)
- 2800 Sloat Boulevard (Private Developer)
- Pacific Road and Gun Club Upland Soil Remediation Project (SFPUC)
- Fort Funston Site Improvement Project (NPS)

3.11.6.3 Construction

Construction of the Project or alternatives could result in temporary noise and vibration increases. Cumulative vibration impacts would occur if two vibration-generating activities are within a relatively close distance from one another. There are no other projects near the Project or an alternative that would result in an incremental increase in vibration at any of the nearby land uses in the area. Therefore, no *significant* impact would result from the cumulative scenario to which the Project's or an alternative's incremental impact could contribute. Cumulative noise increases in the site vicinity could occur if there are concurrent construction activities in the site vicinity or if there are cumulative truck noise increases along shared haul routes. Cumulative projects listed in Section 3.11.6.3 could overlap, to some extent, with construction of the Project or alternatives. Of the projects listed in Section 3.11.6.2, the Fort Funston Site Improvements project is closest to the Project site at Fort Funston. The improvement activities may occur in close proximity (less than 0.25 miles) of the Project's construction activities at Fort Funston. The construction schedule for the Fort Funston project has not yet been determined. Construction of these two projects could pose cumulative noise impacts on residences near Fort Funston if construction were to occur at the same time. However, there is an intervening hill between the nearest residential receptor and the Fort Funston site. The intervening distance and topography would prevent any cumulative effects from construction-related noise even if construction of these two projects were to coincide. The other cumulative projects are located farther away and would not contribute to a potential cumulative noise impact on nearby residences.

However, there is the potential for these projects to generate construction-related traffic on local access routes. If this were to occur, cumulative truck traffic and associated traffic noise increases could result on local access roads (John Muir Drive, SR 35, Lake Merced Boulevard, Brotherhood Way, and 19th Avenue). Currently, there are high traffic noise levels on these regional roadways (over 66 dBA L_{dn}). In such noise environments, truck traffic increases of 40 trucks per hour or more would be required to cause a perceptible increase in the noise environment (3 dBA increase) along these routes and, with the Project and alternatives contributing an average of less than 10 trucks per hour, such cumulative increases in truck traffic are not expected to occur. Therefore, cumulative noise increases in the Project vicinity or cumulative truck noise increases along proposed haul routes from concurrent construction activities would be *less than significant*.

3.11.6.4 Operation and Maintenance

The Project and alternatives would not generate operation- and maintenance-related vibration, and so could not contribute to long-term cumulative vibration impacts. As described in Section 3.11.5.1, Proposed Project, and Section 3.11.5.3, Canal Configuration Alternative, the operation noise levels generated by the two pump stations and gates would be as high as 52 dBA, and would not exceed the San Francisco noise limit thresholds. As described in Section 3.11.5.1 and Section 3.11.5.2, Tunnel Alignment Alternative, the Tunnel portion of the Project and alternative tunnel would not generate operation- and maintenance-related noise above existing conditions.

As described in Section 3.11.6.2, projects located within 0.25 mile of the Project area include: Lake Merced Boathouse Renovation, Regional Groundwater Storage and Recovery Project, Groundwater Supply Project, GGNRA/Muir Woods National Monument General Management Plan, Significant National Areas Management Plan, Lake Merced Pump Station Essential Upgrade, For Funston Site Improvements, and Pacific Rod and Gun Club Update Soil Remediation Project. None of these projects is expected to generate long-term increases in ambient noise levels.

Because the Project and alternatives alone would not generate *significant* noise levels, and other present and reasonably foreseeable projects are not expected to generate any long-term noise increases audible to the same receptors as noise from Canal operation, no *significant* cumulative impact is expected to occur, and the Project's and alternatives' contribution to cumulative noise effects would not be cumulatively considerable.

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3.12 Geologic and Paleontological Resources

This section provides an assessment of potential impacts on geologic and paleontological resources that might be present in the vicinity of the proposed Project. Mitigation measures to avoid, minimize, or mitigate impacts are identified, where feasible.

3.12.1 Affected Environment

Geologic resources include geological strata and structures that provide evidence of past geological processes. The NPS defines geologic resources as “features produced from the physical history of the earth, or processes such as exfoliation, erosion and sedimentation, glaciation, karst or shoreline processes, seismic, and volcanic activities” (NPS, 2006). This definition includes both geologic features and geologic processes; this section focuses on geologic features as park resources.

Paleontological resources are the fossilized evidence of past life found in the geologic record. Fossils are preserved in sedimentary rocks, which are the most abundant rock type exposed at the surface of the earth. Despite the abundance of these rocks, and the vast numbers of organisms that have lived through time, preservation of plant or animal remains as fossils can be a rare occurrence. In many cases, fossils of animals and plants occur only in limited areas and in small numbers relative to the distribution of the living organisms they represent. In particular, fossils of vertebrates – animals with backbones – are sufficiently rare to be considered nonrenewable resources.

For both types of resources, the CEQA analysis focuses on impacts on unique resources. A unique geologic feature or unique paleontological resource may be a resource that is the best example of its kind locally or regionally, provides a key piece of information about its context, is exclusive locally or regionally, or is an example of a resource not known to occur elsewhere in the region. For paleontological resources, any vertebrate fossil may be considered a unique paleontological resource.

3.12.1.1 Geologic Context

The proposed Project is on the San Francisco Peninsula, which is within the Coast Range Geomorphic Province. The topography of the Coast Ranges is characterized by northwest-southeast-trending mountain ridges and intervening valleys that have formed over millions of years due to movements of the earth’s crust. Much of the bedrock underlying the northern Coast Ranges is referred to as the Franciscan Complex—a mixture of ancient seafloor sediments and volcanic rocks that have been altered by heat and pressure deep within the earth. The prominent northwesterly structural and topographic trend of the northern Coast Ranges is not readily evident in the city of San Francisco, except for minor hills and valleys and the orientation of structural blocks of the Franciscan Complex underlying the city. The present local topography is the result of the erosion of Franciscan Complex rocks of varying hardness overlain by scattered areas deposits of relatively recent shallow marine, estuarine, and coastal terrestrial deposits including windblown sand that locally overlie cover bedrock exposures. In addition, artificial fill has also contributed to the local topography in portions of the proposed Project area (CDMG, 2000). The outlet is sited on the beach below nearly vertical coastal bluffs. The geologic context, relevant to the geologic and paleontological resources context described below, is discussed in detail in Section 3.6.1.2, Geology and Soils.

Geologic Resources in the Project Area

As identified in the NPS Management Policies, examples of geologic features in parks include rocks, soils, and minerals; geysers and hot springs in geothermal systems; cave and karst systems; canyons and arches in erosional landscapes; sand dunes, moraines, and terraces in depositional landscapes; dramatic or unusual rock outcrops and formations; and paleontological and paleoecological resources such as fossilized plants or animals or their traces (NPS, 2006).

The geologic units in the Project area are described in Section 3.6, Geology and Soils (see also Figure 3.6-2). As noted above, the geologic units include fill, landslide deposits, dune sands, the Colma Formation, and the Merced Formation. The Merced Formation is located along the shoreline and exhibits the shifting effects of glacially driven sea level changes. In addition, the San Andreas Fault System passes through the Merced Formation, exhibiting seismites (beds disturbed by earthquakes) that reflect the local seismic history.

3.12.1.2 Paleontological Context

The western portion of the Project would be within the Golden Gate National Recreation Area (GGNRA), managed by the NPS. According to NPS management policies (NPS, 2006), areas with potential paleontological resources must be monitored during construction projects. As discussed further in Section 3.12.2, Regulatory Setting, National Park Service Management Policies (2006; Section 4.8.2.1) require that paleontological resources, including both organic and mineralized remains in body or trace form, be protected, preserved, and managed for public education, interpretation, and scientific research. The Paleontological Resource Preservation Act (PRPA) defines paleontological resources as “any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth.”

The NPS provides guidance on identifying paleontological resources within the GGNRA in *Guide to the Golden Gate National Recreation Area Paleontological Sensitivity Map* (Henkel and Elder, 2014). This guidance document provides the NPS definition of paleontological resources, describes the NPS requirements of the three NPS fossil likelihood categories (Likely, Possible, and Unlikely), and catalogues and describes the geological units within the GGNRA within each of the three likelihood categories, along with a description of fossils known to occur within those geological units, if any. The three fossil likelihood categories are defined as follows:

- **Likely -** Any significant ground disturbance in units of the Likely category requires contacting either a park service paleontologist or NPS-approved private consulting paleontologist before work begins in order to assess if monitoring of the site by a professional paleontologist is required during the project.

- **Possible -** Disturbances in areas of the Possible category should be assessed by a park service paleontologist prior to project work and generally need only be monitored for fossils during the project by project personnel.

- **Unlikely -** Units in the Unlikely category have little to no potential for fossils and require little attention with regards to paleontological resource protection.

The eastern portion of the project would be on non-federal lands. The Society of Vertebrate Paleontology (SVP) has established guidelines for the identification, assessment, and mitigation of adverse impacts on nonrenewable paleontological resources (SVP, 1995). Most practicing paleontologists in the United States adhere closely to the SVP's assessment, mitigation, and monitoring requirements as outlined in these guidelines, which were approved through a consensus of professional paleontologists. Many federal, state, county, and city agencies have either formally or informally adopted the SVP's standard guidelines for the mitigation of adverse construction-related impacts on paleontological resources. The SVP has helped define the value of paleontological resources and, in particular, indicates that geologic units of high paleontological potential are those from which vertebrate or significant invertebrate or significant suites of plant fossils have been recovered in the past (i.e., are represented in institutional collections). The SVP has helped define the value of paleontological resources and, in particular, states the following:

- Vertebrate fossils and fossiliferous (fossil-containing) deposits are considered significant nonrenewable paleontological resources, and are afforded protection by federal, state, and local environmental laws and guidelines.

- A paleontological resource is considered to be older than recorded history, or 5,000 years before present, and is not to be confused with archaeological resource sites.

- Invertebrate fossils are not significant paleontological resources unless they are present with an assemblage of vertebrate fossils or they provide previously unknown information on the origin and character of the plant species, past climatic conditions, or the age of the rock unit itself.

- A project paleontologist, special interest group, lead agency, or local government can designate certain plant or invertebrate fossils as significant.

Based on these principles, the SVP has outlined criteria for screening the paleontological potential of rock units and has established assessment and mitigation procedures tailored to accommodating such potential. High and low potential rocks are determined by applying the following criteria (SVP, 1995):

- **High Potential.** Rock units (or formations) in which vertebrate or significant invertebrate fossils have been found. These rock units include sedimentary and some volcanic formations that contain significant fossil resources anywhere within their geographic extent and sedimentary deposits formed in a time period or composed of materials suitable for the preservation of fossils. Only invertebrate fossils that provide new information on existing flora or fauna or on the age of a rock unit would be considered significant.

- **Low Potential.** Rock units that have few, if any, records of vertebrate fossils in institutional collections, or that have been shown in surveys or paleontological literature to be largely absent of fossil resources. Low potential rocks also include metamorphic and igneous rocks other than some volcanic rocks.

Although not discussed in SVP standards, artificial fills, slope deposits (such as colluvium,[1] landslides, and earth flows), and soils are materials with little or no potential to contain paleontological resources. While such materials were originally derived from rocks, they have been weathered or reworked such that fossils would not likely be preserved.

Paleontological Resources in the Project Area

Most fossils in the Peninsula and San Francisco areas are generally found along the Pacific Coast in marine units, such as the Purisima Formation, Monterey Formation, Butano Formation, Colma Formation, and Merced Formation, and in locations within the outcropping marine units in the Santa Cruz Mountains. Fossils found along the coast include vertebrates (e.g., extinct camels, horses, and sea mammals) and invertebrates (e.g., clams, snails, echinoderms, and crustaceans). Fossil localities diminish along the eastern flank of the Santa Cruz Mountains, likely due to the presence of chaotically mixed and severely fractured Franciscan Complex bedrock and geologically younger alluvial deposits in the upland foothills.

The Project site is located on the southwest shore area of Lake Merced from immediately adjacent to the lake edge, extending west along the Tunnel to the Ocean Outlet. The geologic units at the site mapped by Bonilla (1998) and Gilpin (2007) are discussed in Section 3.6, Geology and Soils. **Table 3.12-1** below, which lists each of the geologic units and each unit's ranking for the potential presence of paleontological resources, indicates that only the Merced and Colma Formations have a high potential for significant paleontological resources. In addition, the NPS also considers Landslide Deposits and Dune Sand to have a "Possible" ranking for fossil likelihood.

TABLE 3.12-1
SURFACE GEOLOGY AND PALEONTOLOGICAL RESOURCE POTENTIAL

Geologic Unit & Map Abbreviation	Known Fossils	Age	GGNRA Ranking	SVP Ranking
Artificial Fill (Qaf)	None	Quaternary (Holocene)	Unlikely	Low Potential
Landslide Deposits (Qls)	None	Quaternary (Holocene)	Possible	Low Potential
Beach Deposits (Qb)	None	Quaternary (Holocene)	Unlikely	Low Potential
Dune Sand (Qd)	None	Quaternary (Holocene)	Possible	Low Potential
Colma Formation (Qc)	Vertebrates	Pleistocene	Possible	High Potential
Merced Formation (QTm)	Vertebrates, invertebrates, plants	Pliocene-Pleistocene	Likely	High Potential

SOURCE: Bonilla, 1998; Gilpin, 2007; Henkel and Elder, 2014; SVP, 1995

[1] A loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.

The following sections discuss the units with Likely and Possible rankings.

Landslide Deposits and Dune Sand

The NPS GGNRA guidance document notes that Quaternary units all have the potential for producing fossil material, especially microfossils such as pollen, foraminifera, or diatoms (Henkel and Elder, 2014). Macroinvertebrates and vertebrates also may rarely be present. However, no specific fossil finds have been noted within the GGNRA. The highly disturbed and generally recent timeframe results in a low potential using the SVP ranking system.

Colma Formation

The NPS GGNRA guidance document noted that fossils are not common within this unit, placed within the Possible Category (Henkel and Elder, 2014). Identified fossils include mammoth, bison, and ground sloth remains from various locations in San Francisco. Diatoms, trees, and pollen have also been reported from the Colma Formation. A Columbian mammoth was reported at the Cliff House Beach north of the Project site. Vertebrate fossils including parts of mammoths and bison have been found in the Colma Formation within San Francisco near the base of Telegraph Hill (Rodda and Baghai, 1993). In addition, a mammoth tooth was discovered in the Colma Formation during excavation for the Transbay Transit Center in downtown San Francisco in 2012 (Transbay, 2014). The search of the UCMP fossil collections database did not identify any vertebrate fossil localities in the Colma Formation within San Francisco.

Merced Formation

A search of the fossil collections database at the University of California Museum of Paleontology (UCMP) identified the fossil remains of nine vertebrate mammals collected at Fort Funston Beach from the Merced Formation (UCMP, 2014). The fossils included two sloths, one horse, one llama, one mastodon, one antelope ancestor, two unspecified hoofed animals, and one unidentified vertebrate. One plant fossil was collected at Fort Funston and three unspecific invertebrate fossils have been collected from the Merced Formation at Thornton Beach to the south (two) and Ocean Beach to the north (one). In addition to the above-listed UCMP recorded fossils, the NPS GGNRA guidance document also identified trace fossils (marks left behind by organisms, such as trackways, burrows, footprints, or feces), a wing of a beetle, clams, terrestrial mammal remains (camels, mammoths, whales, and bison), bird remains (common murre), and diatoms (major group of algae that leaves silica remains) (Henkel and Elder, 2014).

3.12.2 Regulatory Setting

3.12.2.1 Federal Regulations

Paleontological Resources Preservation Act

The PRPA (16 USC §470aaa et seq.), part of the Omnibus Public Land Management Act, directs the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land using "scientific principles and expertise." PRPA incorporates most of the recommendations of the report of the Secretary of the Interior entitled Assessment of Fossil

Management on Federal and Indian Lands (Department of the Interior, 2000) in order to formulate a consistent paleontological resources management framework. In passing the PRPA, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. This act defines paleontological resources as “any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth.” The law stipulates that the Secretary of the Interior should manage and protect paleontological resources using scientific principles. The PRPA codifies existing policies of the NPS, BLM, U.S. Forest Service, Bureau of Reclamation, and USFWS, and provides the following:

1. Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from federal lands;
2. Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants);
3. Uniform definitions for “paleontological resources” and “casual collecting;” and
4. Uniform requirements for curation of federal fossils in approved repositories.

National Park Service Organic Act

Paleontological resources are considered park resources and values that are subject to the “no impairment” standard in the National Park Service Organic Act of 1916.

NPS Management Policies

The NPS Management Policies (2006, Section 4.8.1) require the preservation and protection of geologic resources as integral components of park natural systems. As described in the Management Policies, the NPS “will, except as identified below, allow natural geologic processes to proceed unimpeded. Intervention in natural geologic processes will be permitted only when:

- directed by Congress;
- necessary in emergencies that threaten human life and property;
- there is no other feasible way to protect natural resources, park facilities, or historic properties;
- intervention is necessary to restore impacted conditions and processes, such as restoring habitat for threatened or endangered species.”

The Policies include further guidance specific to shoreline areas; these are provided in Section 3.9.2.1 in Section 3.9, Hydrology and Water Quality, in which coastal processes affecting geologic resources along the shoreline are discussed in detail.

Section 4.8.2.1 of the Management Policies require that paleontological resources, including both organic and mineralized remains in body or trace form, be protected, preserved, and managed for public education, interpretation, and scientific research. Further, the Management Policies state that all construction projects in areas with potential paleontological resources must be preceded by a preconstruction surface assessment prior to disturbance. For any occurrences noted, or when the site may yield paleontological resources, the site will be avoided or the resources will, if necessary, be collected and properly cared for before construction begins. Areas with potential paleontological resources must also be monitored during construction projects (NPS, 2006).

3.12.2.2 State Regulations

California Public Resources Code

Several sections of the Public Resources Code protect paleontological resources. Section 5097.5 prohibits "knowing and willful" excavation, removal, destruction, injury, and defacement of any paleontological feature on public lands (lands under state, county, city, district, or public authority jurisdiction, or the jurisdiction of a public corporation), except where the agency with jurisdiction has granted permission.

3.12.2.3 Local Regulations

There are no local regulations relevant to the discussion of paleontological resources impacts.

3.12.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.12.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section V, a project would cause adverse impacts on paleontological resources if it would:

a) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature.

3.12.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook Environmental Screening Form (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have measurable impacts on geologic and paleontological resources, with impact intensity based on the impact descriptions in the following table.

Impact Intensity	Impact Description
Negligible:	Geologic or paleontological resources would not be affected, or the effects would be at low levels of detection and would not have a discernible effect on resources or public use of those resources.
Minor:	Effects on geologic or paleontological resources would be detectable but would not be appreciable.
Moderate:	Effects on geologic or paleontological resources would be readily apparent and long-term, and would result in substantial, noticeable effects on geologic or paleontological resources on a local scale.
Major:	Effects on geologic or paleontological resources would be readily apparent and long-term, and would result in substantial, noticeable effects to geologic or paleontological resources on a regional scale.

3.12.4 Methodology and Assumptions

This analysis of potential effects of the proposed Project and alternatives on geologic and paleontological resources is based on a review of relevant literature and site-specific information. The study area used for the analysis of potential effects of the proposed Project and alternatives on paleontological resources includes the zone of expected surface disturbance from the Project, and the stratigraphic context in which fossils are potentially located. To assess the potential paleontological productivity of each geologic unit present, published geological and paleontological literature was reviewed, and paleontological inventories were evaluated. Geologic maps and reports covering the bedrock and surficial geology of the project vicinity were reviewed to determine the exposed and subsurface rock units, to assess the potential paleontological productivity of each rock unit, and to delineate their respective areal distribution in the project site and surrounding area. The museum records at the University of California Museum of Paleontology (UCMP) at Berkeley were searched in order to determine whether any of the geologic units present within the Project site and vicinity previously have yielded significant paleontological resources. The NPS GGNRA guidance document provides records of fossil finds organized by geologic unit (Henkel and Elder, 2014). No subsurface exploration was conducted for this assessment. The results of this research were used to assign NPS and SVP rankings to the geologic units within the Project site and surrounding area in accordance with NPS and SVP protocols (Henkel and Elder, 2014; SVP, 1995). The results of the literature and records search and the paleontological resources survey are discussed in Section 3.12.1.4, Paleontological Resources in the Project Area.

3.12.5 Impact Analysis

3.12.5.1 Proposed Project

CEQA Analysis

a) Impact PAL-1: The Project would directly or indirectly destroy a unique paleontological resource or site or unique geological feature. (Less than Significant with Mitigation)

The Project would have impacts on paleontological resources if it directly or indirectly resulted in breakage and crushing as the result of disturbance to fossils that have eroded onto the surface and subsurface rocks and sediments in which fossils are entombed. The Project would have impacts on unique geological features if it directly or indirectly resulted in damage to unique features, such as those showing the geologic processes of fluctuating sea level rise or seismic events.

The Canal and Lake Merced portion of the Project, as well as the eastern portion of the Tunnel, are within the Colma Formation. As shown in Table 3.12-1, this geologic unit has an NPS ranking of “Possible” and SVP ranking of “High Potential” for paleontological resources. The western portion of the Tunnel, the Tunnel shaft and Fort Funston staging area, the Ocean Outfall, and the work area for improvements at the Avalon Canyon access road, are within the Merced Formation, known to have significant paleontological resources (NPS ranking of “Likely” and SVP ranking of “High Potential”). As discussed in the Section 3.12.1.4, Paleontological Resources in the Project Area, vertebrate fossils have been found in the Fort Funston area. The Merced Formation would have features showing the effects of sea level fluctuations or seismic events. However, because a large portion of both the Canal and Tunnel alignments already were disturbed during their original construction, and any paleontological resources or geological features within the existing alignments would have been previously removed or disturbed, the likelihood of adverse effects on significant paleontological resources or unique geologic features are generally low. However, excavation at the Canal for the box culverts, diversion structure, Lake Merced Outlet, and constructed treatment wetlands would result in some disturbance of previously undisturbed soils and rocks. Similarly, the replacement Tunnel would have a larger diameter and therefore would disturb previously undisturbed soils and rocks surrounding the existing Tunnel. Additionally, excavation for the temporary tunnel drilling shaft at Fort Funston and roadway improvements at Avalon Canyon would result in new disturbance. Because the new disturbance would occur within geologic units with moderate to high potential for paleontological resources, potentially significant fossils could be adversely affected during construction, particularly within the Merced Formation.

The location and depth of subsurface fossiliferous units or unique geologic features is not known and it is not possible to definitively analyze the potential for adverse effects on subsurface paleontological resources or geologic features within the areas of Project disturbance. It is assumed that adverse effects could occur during surface and subsurface excavation. If unknown unique geologic features are present in the area of disturbance, these likely would be destroyed. However, the overall Merced Formation, which extends at least 4 miles along the coast of San Francisco and San Mateo Counties, and then extends further inland south as far south as Burlingame, is much greater in size than the extent of the Project’s disturbance area. Similarly, the Colma Formation extends far beyond the Project vicinity. Therefore, it is unlikely that unique geologic features would be subject to disturbance as a result of Project construction because examples of the same types of features are present throughout the Colma and Merced Formations. With respect to geologic features visible within the bluffs at Fort Funston, although these may be considered unique geologic resources, the structures and processes proposed under the Project would not result in substantial changes in the amount of disturbance to the bluffs at this location. The Ocean Outlet structure would occupy a slightly larger portion of the bluff face to accommodate the enlarged tunnel, but would not directly or indirectly destroy or obscure features that are visible from the beach that show evidence of geologic processes such as sea level rise or seismic events. Therefore, Project impacts would be *less than significant.*

The construction process of replacing the tunnel along the existing alignment would use subsurface tunneling equipment that would widen the tunnel and remove the existing tunnel materials. The excavated materials would consist of demolished existing tunnel materials, along with excavated geologic materials from the widened tunnel that would no longer exhibit geological features and processes after excavation. Because the tunnel is well below the ground surface and the tunnel walls would be shored to prevent collapse, the tunnel walls would not be accessible for the observation of geological features and processes. Similar to the tunnel, the excavated materials from the vertical tunneling shaft would also consist of excavated geologic materials that would no longer exhibit geological features and processes once excavated, and the shaft walls would not be accessible for observation due to the requirement for sidewall support.

For paleontologically sensitive areas, the objective of implementing mitigation measures is to reduce adverse effects on paleontological resources by recovering fossils and associated contextual data prior to and during ground-disturbing activities. Ground-disturbing activities could expose and cause impacts on unknown paleontological resources, which would be a potentially *significant* impact. This impact would be reduced to a *less-than-significant* level with implementation of **Mitigation Measure 3.12-1** (Inadvertent Discovery of Paleontological Resources). This mitigation would reduce adverse effects on paleontological resources by recovering fossils and associated contextual data prior to and during ground-disturbing activities.

Mitigation Measure 3.12-1 Inadvertent Discovery of Paleontological Resources.

Prior to construction, a training session on the recognition of the types of paleontological resources that could be encountered and the procedures to be followed if they are found shall be presented to Project construction personnel by a qualified professional paleontologist. A qualified paleontologist shall be on call when excavations disturb the Merced and Colma Formations. In the event that potential vertebrate fossils are discovered, work shall cease at the location and a qualified paleontologist shall evaluate the discovery, as described below. For areas of excavation on federally managed lands that would disturb the Merced formation, NPS shall determine the NPS paleontologist or NPS-approved private paleontologist that will perform this monitoring. Consistent with NPS guidance, disturbance within other formations present in Fort Funston shall be monitored for fossils by trained Project construction personnel unless the NPS paleontologist determines that monitoring by a qualified paleontologist is necessary.

If potential vertebrate fossils are discovered by construction crews or a paleontological monitor, all earthwork or other types of ground disturbance within 50 feet of the find shall stop immediately and the monitor shall notify Daly City, as well as the NPS if the potential fossil is found on federal lands. Work shall not resume until a qualified professional paleontologist can assess the nature and importance of the find. Based on the scientific value or uniqueness of the find, the qualified paleontologist may record the find and allow work to continue, or recommend salvage and recovery of the fossil. The qualified paleontologist may also propose modifications to the stop-work radius based on the nature of the find, site geology, and the activities occurring on the site. If treatment and salvage is required, recommendations shall be consistent with NPS guidelines (on federal land), SVP 1995 guidelines (on non-federal land), and currently accepted scientific practice, and shall be subject to review and approval by Daly City, and by NPS if the potential fossil is found on federal land. If required, treatment for fossil remains may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection [e.g., the University of California Museum of Paleontology (UCMP)], and may also include preparation of a report for publication describing the finds. Daly City shall ensure that information on the nature, location, and depth of all finds is readily available to the scientific community through university curation or other appropriate means.

Significance after Mitigation: Less than Significant.

NEPA Analysis

The process of excavation would remove some geologic resources. The construction process of replacing the tunnel along the existing alignment would use subsurface tunneling equipment that would widen the tunnel and remove the existing tunnel materials. The excavated materials would consist of demolished existing tunnel materials, along with excavated geologic materials from the widened tunnel that would no longer exhibit geological features and processes after excavation. Because the tunnel is well below the ground surface and the tunnel walls would be shored to prevent collapse, the tunnel walls would not be accessible for the observation of geological features and processes. Similar to the tunnel, the excavated materials from the vertical tunneling shaft would also consist of excavated geologic materials that would no longer exhibit geological features and processes once excavated, and the shaft walls would not be accessible for observation due to the requirement for sidewall support.

Project construction associated with the tunnel shaft and tunnel could disturb up to approximately 3,600 cubic yards of currently undisturbed soils within the Colma Formation and 13,000 cubic yards within the Merced Formation (pre-disturbance volume). However, the extent of the areas to be disturbed relative to the extent of the Colma and Merced Formations is relatively small with subsurface tunnel areas entirely inaccessible. In addition, the reuse of the same tunnel alignment would be consistent with NPS Management Policies because it minimizes intervention with existing natural processes by reusing the existing tunnel alignment instead of relocating the tunnel to an alternative undisturbed location. The volume of currently undisturbed Colma and Merced Formations that would be disturbed by Project construction represents a small portion of the overall extent of these resources. Therefore, the relative loss of geologic resources associated with the Colma and Merced Formations would be detectable, as measured by the removal of geologic materials from the excavation area, but would not be appreciable because there are extensive other areas that include the same type of geologic materials, and because the material to be removed currently is inaccessible and is in the location of the existing tunnel which already has been excavated and the materials removed. Therefore, this would be a minor impact.

Although there are no known paleontological resources in the areas proposed for ground disturbance, the inadvertent discovery or destruction of a paleontological resource could result in a negligible to moderate impact depending on the type of resource and the nature of the Project's effect on the resource. It is unlikely that the Project could result in a major impact on paleontological resources because the relatively limited extent of new ground disturbance would not result in impacts that could be noticeable on a regional scale. Impacts to paleontological resources could be reduced with implementation of Mitigation Measure 3.12-1 (Inadvertent Discovery of Paleontological Resources), which outlines procedures that would be followed in the event that resources are inadvertently uncovered during construction. Because this mitigation would require the curation of accidentally discovered paleontological resources and would make information about the discovery available for research purposes, its implementation would ensure that the Project would not have a discernable effect on the public use of such resources, resulting in a negligible impact.

3.12.5.2 Tunnel Alignment Alternative

The following describes the geologic and paleontological resources effects associated with construction and operation of an alternative tunnel alignment. The Canal components would be the same as described in Section 3.12.5.1, Proposed Project, or Section 3.12.5.3, Canal Configuration Alternative, depending on the option selected. Thus, geologic and paleontological resources effects for the Canal portion would be as described in those sections.

CEQA Analysis

Similar to the proposed Project, ground disturbing activities for the Tunnel Alignment Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. As described for the proposed Project, it is unlikely that unique geologic features would be subject to disturbance as a result of Project construction because examples of the same types of features are present throughout the Colma and Merced Formations. However, if a new Ocean Outlet location is needed and/or as the bluff erodes over time, exposing both the existing and new tunnels under this alternative, a larger area of the bluff face would be occupied by project-related structures than under existing conditions, potentially obscuring more of the visible features from the beach that show evidence of geologic processes such as sea level rise or seismic events. Nonetheless, for the same reasons described for the proposed Project, the Tunnel Alignment Alternative would have a *less-than-significant* impact with respect to unique geologic features. For potential impacts to paleontological resources, because this alternative would construct a new tunnel, it would result in greater disturbance of previously undisturbed soils. Implementation of Mitigation Measure 3.12-1 would ensure that procedures are in place to reduce potential impacts on paleontological resources to a *less-than-significant* level.

NEPA Analysis

As for the Project, the process of excavation would remove some geologic resources. The construction process of creating a new tunnel would use subsurface tunneling equipment (i.e., a digger shield or MTBM) that would remove all materials within the new tunnel alignment. The excavated materials would consist of crushed spoils that would no longer exhibit geological features and processes after excavation. Because the tunnel is well below the ground surface and the tunnel walls would be shored to prevent collapse, the tunnel walls would not be accessible for the observation of geological features and processes. Similar to the tunnel, the excavated materials from the vertical tunneling shaft would also consist of excavated geologic materials that would no longer exhibit geological features and processes once excavated, and the shaft walls would not be accessible for observation due to the requirement for sidewall support.

Construction of the Tunnel Alignment Alternative associated with the tunnel shaft and tunnel could disturb up to approximately 4,600 cubic yards of currently undisturbed soils within the Colma Formation and 15,000 cubic yards within the Merced Formation (pre-disturbance volume) within the Merced Formation. The volume of currently undisturbed Colma and Merced Formations that would be disturbed by construction of this alternative represents a small portion of these resources, Therefore, the relative loss of geologic resources associated with the Colma and Merced Formations would be detectable, as measured by the removal of geologic materials from the excavation area, but would not be appreciable because there are extensive other areas that include the same type of geologic materials, and because the material to be removed currently is inaccessible. Therefore, this would be a minor impact. However, the use of a new tunnel alignment would not be consistent with NPS Management Policies because it would not minimize the intervention with existing natural processes by reusing the existing tunnel alignment, but would instead relocate the Tunnel to an alternative, previously undisturbed location.

Although there are no known paleontological resources in the areas proposed for ground disturbance, the inadvertent discovery or destruction of a paleontological resource could result in a negligible to moderate impact depending on the type of resource and the nature of the Tunnel Alignment Alternative's effect on the resource. It is unlikely that the Tunnel Alignment Alternative could result in a major impact on paleontological resources because the relatively limited extent of new ground disturbance would not result in impacts that could be noticeable on a regional scale. Impacts to paleontological resources could be reduced with implementation of Mitigation Measure 3.12-1, which outlines procedures that would be followed in the event that resources are inadvertently uncovered during construction. Because this mitigation would require the curation of accidentally discovered paleontological resources and would make information about the discovery available for research purposes, its implementation would ensure that the Tunnel Alignment Alternative would not have a discernible effect on the public use of such resources, resulting in a negligible impact.

3.12.5.3 Canal Configuration Alternative

The following describes the geologic and paleontological resources effects associated with construction and operation of an alternative canal configuration. The Tunnel components would be the same as described in Section 3.12.5.1, Proposed Project, or Section 3.12.5.2, Tunnel Alignment Alternative, depending on the option selected. Thus, geologic and paleontological resources effects for the tunnel portion would be as described in those sections.

CEQA Analysis

Similar to the proposed Project, ground disturbing activities for the Canal Configuration Alternative would have the potential to uncover previously unknown paleontological resources or damage unique geologic features. As described for the proposed Project, it is unlikely that unique geologic features would be subject to disturbance as a result of Project construction because examples of the same types of features are present throughout region. For the same reasons described for the proposed Project, the Canal Configuration Alternative would have a *less-than-significant* impact with respect to unique geologic features. For potential impacts to paleontological resources, this alternative would result in a similar amount of disturbance of previously undisturbed soils compared to the Canal components of the proposed Project. Implementation of Mitigation Measure 3.12-1 would ensure that procedures are in place to reduce potential impacts on paleontological resources to a *less-than-significant* level.

NEPA Analysis

The process of excavation would remove some geologic resources. However, the extent of the areas to be disturbed relative to the extent of the Colma Formation is negligible because most of the disturbance associated with the Canal Configuration Alternative components is within the previously disturbed Canal. Therefore, the relative loss of geologic resources would be negligible to minor for these components.

Although there are no known paleontological resources in the areas proposed for ground disturbance, the inadvertent discovery of a paleontological resource could result in a negligible to moderate impact depending on the type of resource discovered and the nature of the Canal Configuration Alternative's effect on the resource. It is unlikely that the Canal Configuration Alternative could result in a major impact on paleontological resources because the relatively limited extent of new ground disturbance would not result in impacts that could be noticeable on a regional scale. Impacts to paleontological resources could be reduced with implementation of Mitigation Measure 3.12-1, which outlines procedures that would be followed in the event that resources are inadvertently uncovered during construction. Because this mitigation would require the curation of accidentally discovered paleontological resources and would make information about the discovery available for research purposes, its implementation would ensure that the Canal Configuration Alternative would not have a discernable effect on the public use of such resources, resulting in a negligible impact.

3.12.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed and the Vista Grande Canal and Tunnel would be retained. Because no new construction or ground-disturbing activities would occur under the No Project/No Action Alternative, no geologic features would be removed and no undiscovered unique geologic and paleontological resources would be encountered, therefore there would be no impact.

No impact to geologic and paleontological resources would occur as a result of ongoing operation and maintenance of the existing infrastructure.

3.12.6 Cumulative Effects

3.12.6.1 Geographic Extent/Context

The geographic scope for the analysis of potential cumulative geologic and paleontological resources impacts is limited to the immediate Project vicinity because impacts related to geologic and paleontological resources are generally site-specific and depend on the specific localized resources and resource potential. As a result, they are not typically additive or cumulative in nature.

Past, Present, and Reasonably Foreseeable Projects

Existing conditions reflect the contributions of past projects to cumulative impacts on geologic and paleontological resources.

There are several proposed projects including groundwater and recycled water projects and commercial and residential developments in the Project vicinity. These current and reasonably foreseeable projects' geologic and paleontological impacts are not anticipated to combine with the impacts of the proposed Project or alternatives in a manner that is cumulatively considerable, because impacts related to geologic and paleontological resources are generally site-specific and depend on and are limited to the localized resources and resource potential.

3.12.6.2 Construction

All of the identified current and reasonably foreseeable future projects that involve ground disturbance have the potential to combine with the impacts of the proposed Project or an alternative to result in a cumulative impact to unknown buried geologic and paleontological resources. All of these above-listed projects as well as the proposed Project and alternatives have been, or would be, required to adhere to the body of laws and regulations pertaining to the protection of geologic and paleontological resources, including the PRPA, CEQA, and Public Resources Code Section 5097.98. In addition, the cumulative projects identified on NPS-managed lands, in particular, would be required to adhere to strict federal resource protection measures developed specifically for these management areas, such as those described in the NPS Management Policies (NPS, 2006). Therefore, no *significant* cumulative impact to geologic and paleontological resources is anticipated.

3.12.6.3 Operation and Maintenance

The proposed Project and alternatives would have no operation or maintenance-related impacts related to CEQA criteria or NEPA thresholds for geologic and paleontological resources because no new ground disturbance would occur as a result of operation and maintenance, and therefore, operation and maintenance would not contribute to a cumulative impact.

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3.13 Recreation

This section evaluates potential impacts on recreational resources that could result from implementation of the Project and identifies mitigation measures to reduce or avoid impacts, as appropriate. For the purposes of this assessment, recreational resources are generally defined as the natural and built features that people use for recreation (e.g., parks, fields, trails, beaches, and playgrounds), including facilities associated with the recreational resource that enable recreation, such as parking facilities and restrooms. This section also describes regulations pertinent to the proposed Project.

Recreational resources analyzed under CEQA examine the impact of the Project and alternatives on existing neighborhood and regional parks and recreational facilities on non-federal lands. Under NEPA, the analysis would focus on how lands and waters under federal jurisdiction, such as the National Park Service, would be impacted by the proposed Project.

3.13.1 Affected Environment

The analysis addresses publicly accessible recreational resources near the project area (i.e., within an approximate 1/3 mile area), including local roadways used for bicycling and designated recreational trails. The San Francisco Recreation and Parks Department (SFRPD), Daly City Public Works Department, and National Park Service (NPS) manage the majority of the open space and recreational resources in the Project area. The SFRPD manages more than 230 parks, playgrounds, and open spaces throughout San Francisco that are available to the public for recreation. The San Francisco Department of Public Works (SFDPW) maintains and manages several of the paved paths used for recreational purposes in the Project vicinity. Privately owned recreational resources in the Project vicinity include the Olympic Club and San Francisco Golf Club. The Golden Gate National Recreation Area (GGNRA), which follows the California coastline for nearly 60 miles, consists of land designated by the U.S. Department of the Interior and administered by the NPS. Fort Funston is a unit of the GGNRA. Recreational facilities are discussed below and shown in **Figure 3.13-1**.

3.13.1.1 Recreational Facilities

Lake Merced

Lake Merced is a 368-acre freshwater lake within a larger 614-acre San Francisco property in southwest San Francisco. The SFPUC maintains Lake Merced as a non-potable emergency water supply for San Francisco to be used for firefighting or sanitation purposes if no other water sources are available. While the SFPUC manages the water within Lake Merced, the SFRPD manages the lake’s recreational areas pursuant to a 1950 resolution giving the SFRPD management of the surface of the Lake Merced property for recreational purposes.

A 4.5-mile paved pedestrian path surrounds the perimeter of the lake. There are parcourse exercise stations located adjacent to the pedestrian path at several locations. The lake provides a variety of recreational opportunities including a trail for runners, walkers and cyclists; picnic facilities; and water access for fishing, rowing, and boating. Facilities include restrooms, picnic areas, a fishing pier, a boathouse, and a boat launch. The lake is surrounded by three golf clubs (the private Olympic Club and San Francisco Golf Club and the public Tournament Players Cup (TPC) Harding Park (formerly Harding Park Golf Course)), the San Francisco Police Department shooting range, the Pacific Rod and Gun Club site, residential areas, Lowell High School, San Francisco State University, Fort Funston, and the Pacific Ocean.

North and South Lakes are used year-round by six permitted rowing and Dragon Boat clubs, which consist primarily of student athlete groups. It is estimated that there are approximately 250 on-water users per day (Kinsey, 2012). Lake Merced hosts several special events annually, including races and walks around the perimeter of the lake and boating races. The SFRPD also offers canoeing and kayaking classes on Lake Merced as part of its public recreation program.

Harding Road, located near the junction of the Great Highway and John Muir Drive, provides access to TPC Harding Park, and houses restrooms, a boathouse, public parking, shoreline access points, four floating docks, three stationary docks, a parcourse, a boat launch ramp, and picnic tables with post barbecue grills. The recently renovated boathouse provides a meeting room and caterer's kitchen available as a rental facility for up to 85 people. Shoreline access points are located adjacent to the picnicking area on the North Lake in areas that have a moderate slope and are relatively free of vegetation. Two floating docks are located in front of the boathouse on South Lake and one is located along the boat launch ramp on the North Lake. These docks are used primarily for boaters to access the lake. Two stationary docks are located on the North Lake, to the west of the boat launch ramp. These docks are used mainly for fishing access as a majority of the lake's shoreline is inaccessible due to dense vegetation. The lake's parcourse begins on the west side of the entrance area and continues along the multi-use path to the Sunset Circle entrance area. The Lake Merced dog play area, managed by the SFRPD is located at Lake Merced Boulevard and Middlefield Drive.

An area adjacent to John Muir Drive at the southwest end of South Lake includes parking, picnic benches, shoreline access, a portable toilet, and a stationary dock for fishing. It also provides pedestrian and bicycle access across the berm between South Lake and Impound Lake to Lake Merced Boulevard.

An area adjacent to Lake Merced Boulevard at the southeast end of South Lake includes parking, picnic benches, access across the berm between South Lake and Impound Lake to John Muir Drive, and access to an informal trail network that was once a nature walk.

Sunset Circle, adjacent to Lake Merced and Sunset Boulevards, includes parking, restrooms, access to a network of informal trails along the multi-use path to the east and west, a parcourse connecting to the main entrance along the multi-use path to the west, a stationary dock for fishing to the west, and access to the TPC Harding Park Clubhouse via a pedestrian bridge to the south. The pedestrian bridge is also used for fishing.

SOURCE: ESA, 2014

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.13-1
Recreational Opportunities

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Tournament Players Cup Harding Park

TPC Harding Park is a municipal golf club owned by San Francisco. The 18-hole course covers 163 acres and is part of the PGA Tour's TPC network of courses, following an agreement between the tour and San Francisco in November 2010. The TPC Harding Park complex also contains a nine-hole course known as the Fleming Golf Course, putting green, club house, banquet facilities, and a restaurant (SFRPD, 2014).

San Francisco Golf Club

The San Francisco Golf Club is a privately owned 18-hole golf course located south of Brotherhood Way and between Lake Merced Boulevard and Junipero Serra Boulevard. Access to the course is available via Highway 1/Junipero Serra Boulevard and Thomas More Way. The golf course facilities include approximately 130 acres of fairways and greens, a clubhouse, and a restaurant.

Olympic Club Lakeside

The Olympic Club is a privately owned sports club with locations in downtown San Francisco and south of Lake Merced. Access to the Olympic Club's Lakeside facilities is via Skyline Boulevard. The facility includes two 18-hole golf courses, a 9-hole golf course, a clubhouse, and a tennis center.

San Francisco Zoo

The San Francisco Zoo occupies 125 acres along the Great Highway between Skyline and Sloat Boulevards. San Francisco and the San Francisco Zoological Society operate the zoo in partnership. The Recreation and Park Commission governs the zoo, and a 60-member Board of Directors governs the Zoological Society (SF Zoo, 2014a). The San Francisco Zoo is an accredited member of the Association of Zoos and Aquariums, a nonprofit organization for the advancement of zoos and aquariums in the areas of conservation, education, science, and recreation. The zoo houses more than 250 animal species and receives more than 980,000 visitors annually. The zoo is open year-round from 10 a.m. to 5 p.m. (SF Zoo, 2014b).

Golden Gate National Recreation Area

GGNRA, established by Congress in 1972, is the largest national park unit in an urban area in the United States. The GGNRA lands are located in Marin, San Francisco, and San Mateo Counties. Upwards of 20 million people per year visit this recreation area, which includes Alcatraz Island, Muir Woods, Crissy Field, the Presidio, Marin Headlands, Stinson Beach, Fort Mason, Ocean Beach, and Fort Funston (NPS, 2014a). The GGNRA operates under NPS policies and guidelines, in accordance with the *Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan* (NPS, 2014).

Fort Funston

Fort Funston, part of the GGNRA, is a former harbor defense installation featuring 200-foot-high sandy bluffs, with a network of trails for hiking or horseback riding. The approximately 160-acre park experiences high visitor use as a result of its diverse recreational attractions, including horseback riding, surfing, wildlife viewing, visiting historical sites, hang gliding, and dog walking (NPS, 2013). A 2009 study estimated that Fort Funston received approximately 556,000 visits that year, with a slight seasonal variation in visitation, May through September having the highest visitation levels (Industrial Economics, Inc., 2011). Due to the high cliffs and reliable winds, it is one of the premier places for hang gliding in the country and is considered a Hang-III (intermediate) site, providing a launch area and wheelchair-accessible viewing deck. Because dogs are permitted on leash or under voice control throughout the approximately 195-acre Fort Funston—excluding the 12-acre closure in northwest Fort Funston and the northern end of the Coastal trail—many park users are private and commercial dog walkers (NPS, 2013, 2014c). The 2009 estimates indicated that there were approximately 115 dogs for every 100 visitors at Fort Funston (Industrial Economics, Inc., 2011). The Fort contains historic coastal batteries and a former Nike missile launch site, providing visitors the opportunity to view historic coastal defense sites.

Numerous trails including Horse Trail, Battery Davis Trail, Sunset Loop Trail, Coastal Trail, and Chip Trail can be accessed from the Fort Funston parking lot, a large paved lot located at the top of the bluffs off of Skyline Boulevard. The loop trails are wheelchair accessible, but trails down to the beach are not. Beach goers can access the beach from a sand ladder that is accessed from the Coastal Trail at the southwestern corner of the parking lot. In addition to a parking lot, portable toilets are currently available, and planning efforts are underway for the construction of a new restroom facility at the parking lot. The Fort Funston Native Plant Nursery, located south of the parking lot, grows native plants for restoration projects throughout the GGNRA and hosts volunteer work days.

Thornton State Beach

Thornton State Beach is a 58-acre protected beach in the state park system located on the coast of Daly City directly south of Fort Funston. It is currently closed to the public due to damage sustained from landslides. A segment of the Bay Area Ridge Trail (see Recreation Trails below) connects Fort Funston to Thornton State Beach.

Daly City Parks

Daly City has 13 municipal parks and 12 tot lots for a total of approximately 83 acres of developed public recreational open space (Daly City, 2013a). The following recreational facilities and parks are found within the Project vicinity: Westlake Park, Palisades Park, Northridge City Park, Broderick-Terry Dueling Site Park, and Mussel Rock Park.

3.13.1.2 Recreational Trails

Juan Bautista de Anza National Historic Trail

The Juan Bautista de Anza National Historic Trail is a 1,210-mile historic route from Nogales, Arizona to San Francisco, California commemorating the route of the 1775–1776 Spanish Expedition. The NPS operates and maintains signage for the trail and promotes public access to areas related to the Anza expedition to provide educational opportunities and preserve this significant part of Southwestern history. In San Francisco, the expedition members founded and established the Mission and Presidio of San Francisco. The Historic Trail travels up Highway 1 (19th Avenue) to Golden Gate Park, then continues north to Mountain Lake Park, the Presidio of San Francisco, and Fort Point. The Historic Trail Corridor also extends north from Lake Merced and parallels 19th Avenue between 23rd Avenue and 31st Avenue (NPS, 2014b).

Lake Merced Multi-Use Path

Lake Merced multi-use path is a paved path that extends approximately 4 miles along the perimeter of Lake Merced. Main access to the path is from four parking areas: 1) at the end of Sunset Boulevard; 2) along Lake Merced Boulevard near the southern tip of the lake; 3) along John Muir Drive near the southern tip of the lake; and 4) along Skyline Boulevard at the main entrance to Lake Merced. Further, numerous informal trails branch off of the multi-use path and access the lake's shoreline. These informal trails are located near the Lake Merced Boulevard parking area and near Middlefield Drive and Lake Merced Boulevard.

Sunset Boulevard

Sunset Boulevard runs north to south from Lincoln Way to Lake Merced Boulevard, connecting Golden Gate Park to Lake Merced. The boulevard is 20 city blocks long and is lined by 2.5 miles of paved and unpaved walking paths and hundreds of trees and shrubs. The SFDPW Bureau of Forestry provides maintenance for Sunset Boulevard. SFDPW crews remove dead trees and prune trees of dead or damaged limbs. In addition, the SFDPW implemented a water efficiency project that uses low-water use plants and efficient irrigation techniques (SFDPW, 2011).

Bay Area Ridge Trail

The Bay Area Ridge Trail is a multi-use trail created as a ring around the Bay Area's ridgelines overlooking the San Francisco Bay. The Bay Area Ridge Trail Council is an independent nonprofit organization that works with agencies and local governments, parks and others to plan, design, and build the Ridge Trail. Over 340 miles out of the planned 550-mile route have been created (Bay Area Ridge Trail, 2014).

A hiking/biking segment of the Ridge Trail hugs the west side of Lake Merced from Sunset Boulevard to Lake Merced Boulevard and continues on to John Daly Boulevard where it connects to State Route 35 and continues south. A hiking/equestrian segment connects at an entrance to Fort Funston off of State Route 35 near Battery Davis and winds south through Fort Funston bluffs and then onto the beach all the way to Thornton State Beach before it reconnects with the hiking/biking segment off of John Daly Boulevard.

California Coastal Trail

The California Coastal Trail is a continuous interconnected public trail system along the California coastline. It is actively being created through a collaborative effort between the Coastal Commission, California State Parks, and the nonprofit organization Coastwalk. A segment of the Coastal Trail runs through the Fort Funston bluffs before connecting to the beach (Coastwalk, 2014).

3.13.1.3 Bicycle Routes

Local and regional roadways in San Francisco and Daly City are popular routes for both bicycle commuters and recreationists, as well as for more general bicycle travel. These routes exist within a larger regional network of popular bicycling routes in the surrounding areas, including, but not limited to, abundant popular routes south of San Francisco in the Peninsula foothills and north of San Francisco in Marin County. The San Francisco Municipal Transportation Agency (SFMTA) and Daly City classify bicycle routes in the Project area as Class I, II, or III facilities.[1] Class I bicycle facilities are designated bicycle paths separated from roads with exclusive right-of-way for use by bicyclists or pedestrians. Class II bicycle facilities are bicycle lanes striped within the paved areas of roadways and for the preferential use by bicycles. Class III bicycle facilities are signed bicycle routes that allow cyclists to share streets with vehicles; Class III facilities may consist of a variety of features, including streets with wide curb lanes (travel lane width closest to the curb is at least 14 feet wide), sharrows,[2] traffic-calming measures, or simply streets signed as bicycle routes. Further, it should be noted that bicycles are permitted to use all city streets, regardless of whether or not a bicycle route is present, and are subject to all the duties applicable to a driver of a motor vehicle (SFMTA, 2009; Daly City, 2013b). The following bicycle routes are in the project area and are described in more detail in 3.15, Transportation and Traffic: Legion of Honor to San Mateo County (Route 85); Winston Drive/Lake Merced Boulevard (Route 86); Skyline Boulevard and John Muir Drive (Route 91); Lake Merced (Route 885); and Skyline Boulevard (Route 95)/Pacific Coast Bicycle Route.

3.13.2 Regulatory Setting

3.13.2.1 Federal Regulations

Title 36 of the Code of Federal Regulations (Parks, Forests, and Public Property)

Section 1.1 Purpose. (a) The regulations in this chapter provide for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the National Park Service. (b) These regulations would be utilized to fulfill the statutory purposes of units of the National Park System: to conserve scenery, natural and historic objects, and wildlife, and to provide for the enjoyment of those resources in a manner that would leave them unimpaired for the enjoyment of future generations.

GGNRA/Muir Woods National Monument General Management Plan

The Golden Gate National Recreation Area/Muir Woods National Monument General Management Plan published in 2014 and adopted in 2015 identifies three management zones within Fort Funston and establishes management objectives for these zones. In the Diverse Opportunities Zone (the central area and southern beach), management would focus on providing a range of recreational,

1 The State of California defines bicycle facilities in the California Streets and Highway Code, Section 890.4.
2 Shared roadway bicycle pavement markings within traffic lane.

interpretive, and educational opportunities supported by a variety of visitor services. The expectation for this zone is a high level of use in centralized activity nodes, leading to the likelihood of high rates of encounters among visitors. Within Fort Funston, management for this zone includes supporting current recreational activities, including dog walking and the unique opportunity for hang gliding in the park, while making landscape and trail improvements and protecting and restoring natural habitat. New visitor facilities could be provided near the parking lot, potentially including restrooms, group picnicking facilities, a visitor contact facility combining food service with park information, and other support structures.

In the Natural Zone (consisting of the corridors along the perimeter and northern beach), the management objective is to protect and support recovery of native habitats while providing for a variety of compatible recreational activities. The plan recommends that visitors have the opportunity to be immersed in a natural environment and be able to seek areas where they could experience natural sounds, tranquility, closeness to nature, and a sense of remoteness and self-reliance. Visitor use is to be managed to ensure that activities and their intensities are compatible with protecting resource integrity.

In the Park Operations Zone (the southeast corner, where the existing SFUSD Environmental Science Center is located), operational facilities could be expanded consistent with the visitor experience management objectives for this zone – to provide orientation, organized meetings, and access to park administration. (NPS, 2014d, 2015)

National Park Service 2006 Management Policies

The 2006 Management Policies state that the purpose of NPS interpretive and educational programs is to provide memorable educational and recreational experiences that will (1) help the public understand the meaning and relevance of park resources, and (2) foster development of a sense of stewardship. The programs do so by forging a connection between park resources, visitors, the community, and the National Park System (NPS, 2006). Specific policies that are most likely to be applicable to the proposed project are summarized below.

> ***Section 8.2: Visitor Use.*** Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks, and the Service will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of American society. Any park closures or restrictions must be consistent with applicable laws, regulations, and policies, and require a written determination by the superintendent that such measures are needed to protect public health and safety; prevent unacceptable impacts to park resources or values; carry out scientific research; minimize visitor use conflicts; or otherwise implement management responsibilities. In addition, Any restrictions imposed will be fully explained to visitors and the public. Visitors will be given appropriate information on how to keep adverse impacts to a minimum, and how to enjoy the safe and lawful use of the parks. (NPS, 2006)
>
> ***Section 8.2.2: Recreational Activities.*** The NPS Management Policies outline the management guidelines for activities within national parks. For recreational activities, the NPS will manage them according to the criteria established for visitor use of the parks.

> Examples of the broad range of recreational activities that take place in parks include, but are not limited to, boating, camping, bicycling, fishing, hiking, horseback riding and packing, outdoor sports, picnicking, mountain and rock climbing, etc. Many of these activities support the federal policy of promoting the health and personal fitness of the general public, as set forth in Executive Order 13266. (NPS, 2006)

3.13.2.2 State Regulations

California Coastal Act

The California Coastal Act (Pub. Res. Code §30000 et seq.) was enacted in 1976 to provide long-term protection of the state's 1,100-mile coastline for the benefit of current and future generations. The Coastal Act provides for the long-term management of lands within California's coastal zone boundary (defined in Pub. Res. Code §30103). The width of the coastal zone varies across the state. The entire Project area is located within the coastal zone. Coastal Act sections that are applicable to the proposed project are summarized below.

> **Article 3 – Recreation**
>
> ***Section 30220 - Protection of certain water-oriented activities.*** Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.
>
> ***Section 30221 - Oceanfront land; protection for recreational use and development.*** Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreational activities that could be accommodated on the property is already adequately provided for in the area.

3.13.2.3 Local Regulations

No local regulations specifically govern recreational resources that are applicable to the recreation impact analysis under CEQA and NEPA. However, information on plans and policies relevant to the recreation resources within and near the Project area are summarized briefly below. Those portions of the Project located within the coastal zone would require issuance of a coastal development permit pursuant to San Francisco Planning Code sections 330 et seq.

Western Shoreline Area Plan

The Western Shoreline Area Plan (San Francisco, 1996), which is part of the San Francisco General Plan, is San Francisco's plan for the Local Coastal Zone established by the California Coastal Commission. Policies related to recreation at the Lake Merced area include preserving recreational facilities, passive activities, playgrounds, and vistas of the Lake Merced area; and maintaining a recreational pathway around the lake for multiple use.

Daly City 2030 General Plan

The Open Space Element of the General Plan indicates that open space for recreational purposes comprises both public and private recreational open space. Public recreational open space consists of Daly City parks and related facilities, and state and county parks. Private recreational open space consists of private golf and country clubs accessible only to members (Daly City, 2013a). The Daly City General Plan provides the following policies that are relevant to the analysis of recreation:

> ***Policy RME-10*:** Minimize development in all areas designated as open space preservation.

> ***Policy RME-11*:** Areas designated as open space recreation-public shall continue to be maintained and upgraded by the Public Works Department.

San Mateo County General Plan

The San Mateo County General Plan provides the following policies that are relevant to the analysis of recreation:

> ***Policy 6.5(a): Access to Park and Recreation Facilities.*** Attempt to provide appropriate access and conveniences for all people in park and recreation facilities.

> ***Policy 6.14(a): Site Planning for Public and Private Facilities.*** Encourage all providers to design sites to accommodate recreation uses that minimize adverse effects on the natural environment and adjoining private ownership.

San Mateo County Local Coastal Program Policies

The Recreation/Visitor-Serving Facilities Component provides the following policies that are relevant to the analysis of recreation:

> ***Policy 11.4: Recreation and Visitor-Serving Facilities Permitted in the Coastal Zone.*** Permit the following facilities in the Coastal Zone: (1) necessary visitor-serving facilities as defined in Policy 11.1, and (2) commercial recreation and public recreation facilities which (a) are designed to enhance public opportunities for coastal recreation, (b) do not substantially alter the natural environment, and (c) do not subvert the unique small town, rural character of the individual communities on the Coastside.

> ***Policy 11.21: Shoreline Access.*** Require that any development along the shoreline provide access in accordance with the policies of the Shoreline Access Component.

3.13.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.13.3.1 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section XV, a project would cause adverse impacts on recreation if it would:

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or

b) Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

3.13.3.2 NEPA Impact Thresholds

In accordance with NEPA regulations (40 CFR 1508.27) – and consistent with NPS Director's Order-12 Handbook's Appendix 1 – Environmental Screening Form – the impact analysis considers whether implementation of the proposed Project affects recreation resources, including supply and demand and visitation activities, as well as visitor experiences. NEPA is concerned with impact context and intensity. Therefore, the NEPA impact conclusion statements are presented in terms of the degree of the potential impact, as described in the table below.

Impact Intensity	Impact Description
Negligible:	Visitors would not notice impacts associated with proposed project activities (e.g., staging, aesthetics, traffic, or noise). There would be no noticeable change in visitor use and experience or in visitor satisfaction or behavior, including visitor safety and recreation opportunities.
Minor:	Visitors would only notice slightly notice/detect/distinguish impacts associated with proposed project activities. Their slight perception of the activities would not appreciably limit or detract from any critical characteristics of the visitor experience. Critical characteristics of the visitor experience include overall visitor satisfaction, visitor safety, and recreation opportunities. Other park areas would remain available for similar visitor uses and experiences. Visitor satisfaction would remain stable.
Moderate:	A few critical characteristics of the existing visitor experience would decrease. The number of visitors engaging in a specific use would be altered, resulting in a noticeable change in visitor satisfaction. Other park areas would remain available for similar visitor uses and experiences; however, some visitors participating in that use or experience might be required to pursue their choice in other available local or regional areas.
Major:	Changes would be highly noticeable to the visitor, and intrusive to the visitor experience. Multiple critical characteristics of the existing visitor experience would deteriorate, or become unavailable and/or the number of visitors engaging in a use would be greatly altered, resulting in a noticeable change in visitor satisfaction. The project construction activities taking place would also likely change the character of the landscape or soundscape, and/or change important vistas or keystone features of the site. Original, pre-project perceptions of the area and traditional visitor uses at the site would be highly altered. Some visitors wishing to continue their use and enjoyment of dog walking, hiking, hang gliding, beach use, etc., would be required to pursue their choice in other available local or regional areas to obtain the desired experience.

3.13.3.3 Criteria and Thresholds with No Impact or Not Applicable

Due to the nature of the proposed Project, there would be no impact related to criterion b, above, for the reasons described below:

b) ***Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.*** The Project does not propose to construct or expand, nor would it require the construction or expansion of, recreational facilities. The Project would not result in a permanent increase in the local population or increased demand for the construction or expansion of recreational facilities due to growth. Similarly, the Tunnel Alignment Alternative and Canal Configuration Alternative do not propose and would not require the construction or expansion of recreational facilities. Therefore, the Project and alternatives would have no impact related to the construction or expansion of recreational facilities.

3.13.4 Methodology and Assumptions

The Project's and alternatives' potential to result in impacts related to recreation analyzed qualitatively, based upon familiarity with the Project area, site visits, and a review of aerial photographs and recreation maps prepared by planning agencies within the affected jurisdiction. The evaluation of Project impact on recreational facilities and visitor experience in the Project area for the purpose of avoiding or mitigating an environmental effect or for protection of the environment is based on the proximity of recreational experiences and facilities to the siting, construction, and operation of the Project facilities.

3.13.5 Impact Analysis

3.13.5.1 Proposed Project

CEQA Analysis

a) **Impact REC-1: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. (Less than Significant)**

Construction

During construction, it is not expected that many recreationists would be displaced from recreational areas in the Project vicinity and thereby substantially increase the use of other nearby parks or recreational facilities. During construction of the crossing under John Muir Drive for the conveyance of flows into Lake Merced, traffic and pedestrian access would be re-routed temporarily around the excavation. The pedestrian bridge between Impound Lake and South Lake would not be altered, expanded, or otherwise changed physically during construction activities.

A chain-link fence would be installed around the perimeter of the Fort Funston staging area. However, public hiking trails that traverse the parking area on top of the bluffs at Fort Funston, the California Coastal Trail and the Bay Area Ridge Trail would be maintained. At the beach outlet, a "U" shaped sheet pile cofferdam would be placed around the beach outlet structure to form a barrier to exclude the public and dogs from the construction area. The cofferdam would be positioned so that beach access would be maintained during construction. During times when vehicles and equipment are being transported along the beach between Avalon Canyon access road and the outlet location, and during construction of the portion of the submarine outfall pipeline that would be replaced, recreationists would avoid use of or be restricted from this portion of the beach. However, this effect would be short-term and would not substantially increase the use of other recreational areas such that deterioration of recreation resources/facilities could occur.

The portion of Fort Funston within the fenced staging area would be inaccessible to the public for the duration of construction. It is also possible that some recreationists that currently use the recreation areas near Project construction areas would not want to use these areas during construction activities due to temporary increases in noise and reduced air quality associated with use of construction equipment. Other recreationists may avoid work areas due to the appearance of construction areas. These potentially displaced recreationists may instead use other portions of Fort Funston, Lake Merced areas, or similar local or regional recreation facilities located in the Project vicinity resulting in occasional increases in use of other recreation facilities. The staging area would occupy approximately 4 acres of the over 100 acres available for dog walking in Fort Funston, restricting dog walking within approximately 4 percent of the available area. There are a number of additional trails, bicycle routes, and other general recreation resources that would be available within the Project vicinity, and in the overall western San Francisco / Daly City area, and the temporary increased use of other local or regional recreation resources that may be attributable to construction of the proposed Project would not likely be enough to result in substantial physical deterioration of recreational resources, or otherwise result in physical degradation of existing recreational resources, and the potential impact on these other recreational resources would therefore be *less than significant.*

For these reasons, Project construction would have a *less-than-significant* impact relative to a potential increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated.

Operation and Maintenance

Roadway surfaces and staging areas would be returned to their general pre-Project conditions after construction. Therefore, roads used as designated bicycle routes and general bicycle use would not be affected during Project operation. The Fort Funston staging area would be recontoured and planted following construction, and would return to similar topography and use as currently are present.

As discussed in Section 2.6.3, Lake Level Management, in determining the actual proposed operation WSE range, SFPUC would consider their operations and maintenance requirements, and would consult with the City and County of San Francisco departments responsible for operating facilities immediately adjacent to Lake Merced to address any facility requirements, such as potential modifications to boat docks to accommodate higher lake water levels.

A potential increase in water surface elevation and potentially improved water quality could result in a minor increase in available lake surface areas used for boating. However, it is not anticipated that any increased lake surface could generate additional use that would cause or accelerate the physical deterioration of the lake or recreational areas associated with it. Additionally, the Project would result in long-term improved recreational access and connectivity on the beach below Fort Funston due to the removal of the existing Ocean Outlet structure, but this improvement is not expected to increase visitor use such that the beach or other areas of Fort Funston would experience physical deterioration. Project operation would have no effect on other recreational facilities elsewhere in the Project area.

For these reasons, Project operation would have a *less-than-significant* impact relative to a potential increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated.

Mitigation: None required.

NEPA Analysis

Construction

Construction areas adjacent to John Muir Drive would be separated from public use areas by a chain-link fence erected along John Muir Drive to exclude the public. An internally braced sheetpile excavation would cross John Muir Drive and traffic and pedestrian access would be temporarily rerouted around the excavation. The pedestrian bridge between Impound Lake and South Lake would not be altered, expanded, or otherwise changed physically during construction activities.

Construction staging at Fort Funston is proposed northeast of an existing NPS service building and parking lot. The staging area would be approximately 4 acres in size and would likely have chain-link fencing around the perimeter. The staging area would be in place for 17 to 37 months depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. If tunneling activities are restricted to approximately 12 hours per day rather than the proposed 24-hour schedule, this would result in a longer overall construction period at Fort Funston (see Table 2-2 in Section 2.5.3.1). Additionally, if staging activities for other Project components occur in this location, the staging area could be in place for several more months.

The public would not be able to access this area, but views of the fence, construction equipment, personnel, and activity would occur. The portion of the Horse Trail that is located in this area (about 600 feet including the southern end of the trail) would not be accessible during construction. The unaffected portion of the Horse Trail would be accessible from areas outside the fenced stating area, including from the Chip Trail. Construction noise would be perceptible from adjacent recreational features such as the Chip Trail, which passes within approximately 100 feet of the boundary of the proposed staging area. As shown in Table 3.11-8 in Section 3.11, Noise, the loudest construction activity within the staging area would be pile driving for the construction shaft, which could cause noise levels of approximately 95 dBA at the Chip Trail, but would be limited to a period of four days. General (non-pile-driving) construction activities could result in noise levels of approximately 75 to 77 dBA at the closest portion of the Chip Trail throughout the construction period. This noise level is approximately equivalent to the ambient noise level in a noisy urban area, as shown in Figure 3.11-1, and would be perceptible above ambient noise levels at Fort Funston. However, it is noted that trail maintenance and repair activities require use of heavy equipment periodically. Construction noise would attenuate to below perceptible levels within several hundred feet of the staging area, and most of the areas accessible to visitors at Fort Funston would be minimally affected by noise. Because the staging area is positioned between the parking lot and SR 35, it is not within a serene or sensitive setting. In addition, the implementation of Mitigation Measure 3.2-1 in Section 3.2, Aesthetics, would require that construction sites be maintained and kept clean, thereby reducing the visual intrusion of construction activities and equipment that could impact visitor experience. Additionally, this mitigation measure would require the use of green screening fence that would minimize views of the staging area through the fencing. Park visitors wishing to use the areas immediately adjacent to the staging area, including the first approximately 400 feet of the Chip Trail after leaving the parking lot, would experience noise and visual intrusion from the staging area that may diminish their experience of the park. Visitors to the network of trails in the northern portion of Fort Funston, the historic military fortifications, the beach, the wheelchair-accessible overlook, and portions of the park closer to the park operations building and Environmental Science Center would be less affected by activities within the construction staging area. Hang gliders may experience angled views of the staging area behind the parking lot, but would be more than 1,000 feet from the staging area while gliding above the cliffs.

As described in the CEQA section above, a “U” shaped sheet pile cofferdam would be placed around the beach outlet structure to form a barrier to exclude the public and dogs from the construction area (see Figure 2-3b). The cofferdam would be positioned so that beach access would be maintained similar to existing conditions during construction. Thus, during higher tides, the waves would reach the cofferdam, making it difficult or unsafe to pass this point, but this would not occur more frequently than under existing conditions. Since the existing outlet and adjacent SFPUC structure are already an exposed area of non-natural features, the construction would be taking place in an area that is not one of the more sensitive parts of the park. Construction at the Ocean Outlet structure would occur over an approximately 5.5-month period, and would generate some noise that may be perceptible above ambient wave noise at the beach. Construction activities within the area isolated by the cofferdam would be visible to hang gliders passing overhead.

Construction-related traffic would temporarily and intermittently affect recreational users at the beach between the Avalon Canyon access road and Ocean Outlet construction site when the beach is used for transport of construction equipment and materials. As shown in Table 2-4, no more than three round-trip haul truck trips per day are anticipated for construction of the Ocean Outlet. At the beginning and end of the Ocean Outlet construction period, additional construction equipment trips would be needed to bring equipment to the site and haul it away. The presence of trucks and equipment would be noticeable to beach goers over a short period of the day, but would not be expected to affect normal visitor use or reduce visitor enjoyment of the area for an extended period of time. The Avalon Canyon access road is not accessible to the public, and use of this road would have no impact on recreation.

Construction at the Ocean Outlet structure would occur along the beach at the base of a steep cliff. A concrete pump would be placed on the bluff above the Ocean Outlet for approximately one week to supply shotcrete for the portal wall. The pump would be located between the top of the bluff and the Sunset Trail, and would not require a trail closure. However, this activity would temporarily affect use and enjoyment of a portion of the Sunset Trail due to the temporary presence of equipment and associated noise and visual disturbance. The presence of these activities and equipment would reduce the quality of the recreation experience temporarily.

During the construction period, visitors to Lake Merced and Fort Funston could experience an increase in traffic volume on local roads due to the slower movements of trucks compared to passenger vehicles. Drivers could experience delays if they were traveling behind a construction truck. Mitigation Measure 3.15-1 in Section 3.15, Transportation and Traffic, would implement a Construction Traffic Management Plan to require methods for maintaining traffic flows on roadways directly affected by Project construction.

The Project would result in short-term, moderate adverse impacts to recreation at Fort Funston associated with construction. As noted above, if 24-hour tunneling is not permitted, construction-related impacts on recreational uses at Fort Funston would occur for an additional year or more. Changes would be noticeable to visitors wishing to use parts of Fort Funston near construction sites, and access to and through these sites would be altered. However, the portion of Fort Funston that would be affected would be small (less than 5 percent). For the rest of Fort Funston, construction would not affect normal visitor use or reduce visitor enjoyment of the area. Therefore, other park areas would remain available for similar visitor uses and experiences. Visitors would be aware of the effects associated with the presence of staging areas and construction equipment and noise; however, alterations in visitor use and experience in areas further from the staging areas would be slight, and impacts in these locations would therefore be minor. Other aspects of the visitor experience would remain available for visitor use and enjoyment without degradation of site resources and values.

Operation and Maintenance

The existing outlet structure currently extends from the cliff across the beach for approximately 80 feet as depicted in Figure 3.2-8. During low tides, there can be as much as 330 feet of beach between the end of the outlet structure and the water; however, during high tides, waves reach to the end of the existing outlet structure, making it difficult or unsafe for pedestrians to cross this portion of the beach. The design for the proposed Ocean Outlet structure has a low profile and is set approximately 55 feet nearer to the existing cliff face, as also shown in Figure 3.2-8. This would allow for a freer passage along the beach during higher tides and enhanced enjoyment of this stretch of beach at all times. The submarine outfall pipeline that extends from the existing outlet structure is completely or partially buried during summer months but becomes exposed during winter months, impeding beach access and detracting from the natural landscape. This condition would continue under the Project. However, the Project would provide an overall improvement in visitor use and experience at Fort Funston due to the replacement of the existing outlet structure which blocks a section of the beach. All construction areas would be returned to similar conditions as existing, restoring the visitor use and experience.

As described in Section 2.6.5, Project Maintenance, as the bluff continues to recede after completion of construction, portions of the Ocean Outlet and Tunnel would again become exposed on the beach, though for a shorter distance than under existing conditions. At an estimated interval of approximately 25 years, Daly City would demolish and remove the exposed portions and reconstruct the Ocean Outlet structure. During times when a portion of the tunnel and outlet are exposed on the beach, these structures could impede some recreational access across the beach, though not to the extent that existing conditions impede access.

Operation of the Project would result in long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure. Changes would be detectable to the area’s visitors and improve the visitor experience and enjoyment of the area, but would not affect normal visitor use of the area. All aspects of the visitor experience would remain available for visitor use and enjoyment without degradation of site resources and values.

3.13.5.2 Tunnel Alignment Alternative

The following describes the recreation resources effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.13.5.1, Proposed Project, or Section 3.13.5.3, Canal Configuration Alternative, depending on the option selected. Thus, recreation resources effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative would be located within an area south of the existing tunnel. The general methods and duration required to construct the Tunnel Alignment Alternative would not change compared to the Project.

A chain-link fence would be installed around the perimeter of the Fort Funston staging area. However, public hiking trails that traverse the parking area on top of the bluffs at Fort Funston, the California Coastal Trail and the Bay Area Ridge Trail would be maintained. At the beach outlet, a “U” shaped sheet pile cofferdam would be placed around the beach outlet construction area to form a barrier to exclude the public and dogs from the construction area. The cofferdam would be positioned so that beach access would be maintained during construction. During times when vehicles and equipment are being transported along the beach between Avalon Canyon access road and the outlet location, and during construction of the portion of the submarine outfall pipeline that would be replaced if the outlet is constructed in the same location as the existing structure, recreationists would avoid use of or be restricted from this portion of the beach. However, this effect would be short-term and would not substantially increase the use of other recreational areas such that deterioration of recreation resources or facilities could occur.

It is possible that some recreationists that currently use the recreation areas near the construction areas would not want to use these areas during construction activities due to temporary increases in noise and reduced air quality associated with use of construction equipment. Other recreationists may avoid work areas due to the appearance of construction areas. Some recreationists may instead use other portions of Fort Funston or similar local or regional recreation facilities located in the Project vicinity resulting in occasional increases in use of other recreation facilities. However, there are a number of additional trails, bicycle routes, and recreation resources that would be available within the Project vicinity, and in the overall western San Francisco / Daly City area, and the temporary increased use of other local or regional recreation resources that may be attributable to construction of the proposed project would not likely be enough to result in substantial physical deterioration of recreational resources, or otherwise result in physical degradation of existing recreational resources, and the potential impact on these other recreational resources would therefore be *less than significant.*

As with the Project, roadway surfaces and staging areas would be returned to their general pre-Project conditions after construction of the Tunnel Alignment Alternative. Therefore, roads used as designated bicycle routes and general bicycle use would not be affected during operation. The Fort Funston staging area would be recontoured and planted following construction, and would return to similar conditions as currently is present. As with the Project, the Tunnel Alignment Alternative would result in improved recreational access and connectivity on the beach below Fort Funston due to the removal of the existing Ocean Outlet structure, but this improvement is not expected to increase visitor use such that the beach or other areas of Fort Funston would experience physical deterioration. Operation of the Tunnel Alignment Alternative would have no effect on other recreational facilities elsewhere in the Project area. For these reasons, there would be a *less-than-significant* impact relative to a potential increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated, and therefore no mitigation is required.

NEPA Analysis

Construction staging at Fort Funston would occur within the proposed staging area. The staging area would be up to 4 acres in size and would likely have chain-link fencing around the perimeter. The public would not be able to access the staging area, but views of the fence, construction equipment, personnel, and activity would occur. Construction noise would be perceptible from nearby recreational features such as the wheelchair-accessible trail leading from the park operations and Environmental Science Center parking lot to the main parking lot. Similar to the proposed Project, regular construction activities could result in noise levels of approximately 77 A-weighted decibels (dBA) at the closest portion of this trail, which would be perceptible above ambient noise levels at Fort Funston, but would attenuate such that most of the areas accessible to visitors at Fort Funston would be minimally affected by noise. It is estimated that the construction staging area would be in place for approximately 17 to 37 months, depending on the timing of tunnel drive construction and on the permitted construction schedule for tunneling. The implementation of Mitigation Measure 3.2-1 in Section 3.2, Aesthetics, would require that construction sites be maintained and kept clean, thereby reducing the visual intrusion of construction activities and equipment that could impact visitor experience. Additionally, this mitigation measure would require the use of green screening fence that would minimize views of the staging area through the fencing. Hang gliders may experience angled views of the staging area, but would be more than 1,000 feet from the staging area while gliding above the cliffs.

The new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. If the option to connect to the existing Ocean Outlet location is selected, construction and long-term maintenance of the Ocean Outlet structure, including the “U” shaped sheet pile cofferdam, the use of a concrete pump on the top of the bluff, the use of the beach to access the construction site from Avalon Canyon access road, and periodic replacement of exposed portions of the tunnel and outlet would be as described for the proposed Project in Section 3.13.5.1.

If a new Ocean Outlet location is selected, the new structure would be similar to that described for the proposed Project, but may not include wing walls depending on the location selected. Under this option, the existing Ocean Outlet structure would be removed and the western end of the tunnel capped, or it would be abandoned in place. Thus, a third structure (in addition to the existing Ocean Outlet structure and SFPUC’s outlet structure) could be present along the beach and toe of the cliff below Fort Funston within an area of approximately 150 feet or less. Recreation conditions would remain similar to existing conditions in the vicinity of the existing outlet structure; with an additional outlet to the south. It is assumed that the existing and new structure would be removed periodically as bluff erosion continues.

During the construction period, visitors to Lake Merced and Fort Funston could experience an increase in traffic volume on local roads due to the slower movements of trucks compared to passenger vehicles. Drivers could experience delays if they were traveling behind a construction truck. Mitigation Measure 3.15-1 in Section 3.15, Traffic and Transportation, would implement a Construction Traffic Management Plan to require methods for maintaining traffic flows on roadways directly affected by construction.

The Tunnel Alignment Alternative would result in short-term, moderate adverse impacts to recreation associated with construction and long-term, minor beneficial impacts to recreation associated with improved beach access provided by the rehabilitated Ocean Outlet structure. Short-term changes associated with construction would be readily apparent to visitors wishing to use parts of the park near construction sites, and access to and through these sites would be altered. However, the portion of Fort Funston that would be affected would be small (less than 5 percent). For the rest of Fort Funston, construction would not affect normal visitor use or reduce visitor enjoyment of the area. Visitors would be aware of the effects associated with the presence of staging areas and construction equipment and noise; however, alterations in visitor use and experience in areas further from the staging areas would be slight. Other aspects of the visitor experience would remain available for visitor use and enjoyment without degradation of site resources and values.

3.13.5.3 Canal Configuration Alternative

The following describes the recreation resources effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.13.5.1, Proposed Project, or Section 3.13.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, recreation resources effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative would be located within the same existing land uses as the proposed Project. The general methods and duration required to construct the Canal Configuration Alternative would not change compared to the Project.

During construction of the John Muir Drive crossing, traffic and pedestrian access would be re-routed temporarily around the excavation. However, this effect would be short-term and would not substantially increase the use of other recreational areas such that deterioration of recreation resources/facilities could occur.

It is possible that some recreationists that currently use the recreation areas near Project construction areas would not want to use these areas during construction activities due to temporary increases in noise and reduced air quality associated with use of construction equipment. Other recreationists may avoid work areas due to the appearance of construction areas. Some recreationists may instead use other Lake Merced areas or similar local or regional recreation facilities located in the Project vicinity resulting in occasional increases in use of other recreation facilities. However, there are a number of additional trails, bicycle routes, and recreation resources that would be available within the Project vicinity, and in the overall western San Francisco / Daly City area, and the temporary increased use of other local or regional recreation resources that may be attributable to construction of the Canal Configuration Alternative would not likely be enough to result in substantial physical deterioration of recreational resources, or otherwise result in physical degradation of existing recreational resources, and the potential impact on these other recreational resources would therefore be *less than significant.*

As with the Project, roadway surfaces and staging areas would be returned to their general pre-Project conditions after construction of the Canal Configuration Alternative. Therefore, roads used as designated bicycle routes and general bicycle use would not be affected during operation. During operation, the water surface elevation (WSE) of Lake Merced could fluctuate due to the diversion of water from the Canal to the lake. A potential increase in water surface elevation and potentially improved water quality could result in a minor increase in available lake surface areas used for boating. However, it is not anticipated that any increased lake surface could generate additional use that would cause or accelerate the physical deterioration of the lake or recreational areas associated with it. The Canal Configuration Alternative operation would have no effect on other recreational facilities elsewhere in the Project area. For these reasons, there would be a *less-than-significant* impact relative to a potential increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated, and therefore no mitigation is required.

NEPA Analysis

Under the Canal Configuration Alternative, construction areas adjacent to John Muir Drive would be separated from public use areas by a chain-link fence erected along John Muir Drive to exclude the public. An internally braced sheet pile excavation would cross John Muir Drive and traffic and pedestrian access would be temporarily rerouted around the excavation.

During the construction period, visitors to Lake Merced could experience an increase in traffic volume on local roads due to the slower movements of trucks compared to passenger vehicles. Drivers could experience delays if they were traveling behind a construction truck. Mitigation Measure 3.15-1 in Section 3.15, Traffic and Transportation, would implement a Construction Traffic Management Plan to require methods for maintaining traffic flows on roadways directly affected by construction.

The Canal Configuration Alternative would result in short-term, minor adverse impacts to recreation. Changes would be detectable to the area’s visitors, but would not affect normal visitor use or reduce visitor enjoyment of the area. Visitors would be aware of the effects associated with the presence of staging areas and construction equipment and noise; however, alterations in visitor use and experience would be slight. Other aspects of the visitor experience would remain available for visitor use and enjoyment without degradation of site resources and values.

3.13.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no impact to recreation. The continued presence of the existing outlet structure would detract from visitor experience due to the blockage it creates across the beach, particularly during higher tides. It currently extends from the cliff across the beach for approximately 80 feet as depicted in Figure 3.2-8. The submarine outfall pipeline that extends from the existing outlet structure is completely or partially buried during summer months but becomes exposed during winter months, impeding beach access and detracting from the natural landscape. These conditions would continue under the No Project/No Action alternative. Therefore, there would continue to be minor impacts to existing recreation and visitor experience.

3.13.6 Cumulative Effects

3.13.6.1 Geographic Extent/Context

The geographic scope for the analysis of cumulative recreation impacts includes the parks, natural areas, and recreational facilities depicted in Figure 3.13-1. These are primarily the publicly accessible recreational resources within approximately 1/3 mile of the Project area, including local roadways used for bicycling and designated recreational trails.

3.13.6.2 Past, Present, and Reasonably Foreseeable Projects

Existing conditions reflect the contributions of past projects to cumulative changes in recreation. The following present and reasonably foreseeable projects may result in impacts to recreation and are included in the analysis of the Project’s cumulative impacts. In addition to project-related construction impacts identified, construction activities would contribute incrementally to cumulative recreation impacts from a number of other projects in the area that could be under construction at the same time and could impact the same recreation areas.

For example, as presented in Table 3.1-1, construction of the following cumulative projects is expected to occur within the same vicinity and timeframe as other planned and proposed projects.

- *San Francisco Westside Recycled Water Project* (SFPUC) is anticipated to be under construction between 2016 and 2019. Proposed facilities would be within the Oceanside Water Pollution Control Plant with distribution pipelines located in Skyline Boulevard, north of the proposed Project.

- *Significant Natural Areas Management Plan* (SFRPD) provides recommendations for management of the fragments of unique plant and animal habitats within San Francisco and Pacifica known as Significant Natural Resource Areas that have been preserved within parks that are managed by the SFRPD. Among these is Lake Merced. The plan identifies several conservation- and recreation-related issues for Lake Merced and provides recommendations developed for each of these issues to guide restoration, enhancement, and maintenance work. The final EIR and approval of the plan is expected in 2014. Projects resulting from this plan could create short and long-term impacts to recreation.

- *Groundwater Supply Project* (SFPUC) Construction began in fall 2014 and is expected to be complete in early 2016. Construction at the Lake Merced Pump Station would add an aboveground structure to the Lake Merced shoreline.

- *Parkmerced Project* (Private Developer) could extend through 2030. Construction of this project could impact recreation activities around Lake Merced or along designated bicycle routes. The first phase of the Parkmerced project is expected to result in the highest level of construction activities, with Lake Merced Boulevard, Brotherhood Way, 19th Avenue, and Junipero Serra serving as the primary construction access routes.

- *Pacific Rod and Gun Club Upland Soil Remediation Project* (SFPUC) is anticipated to be under construction starting early 2015. Because this project consists of soil remediation only, no impact to recreation would occur.

- *GGNRA/Muir Woods National Monument General Management Plan (NPS) examines a range of a*lternatives for management of the GGNRA parks for 20 years. Under the Age*ncy Preferred Alternative, Fo*rt Funston would be managed to continue to support current recreational activities (e.g., dog walking and hang gliding); provide new visitor facilities near the parking lot, fence and protect Battery Davis. The Final EIS/ROD for the Plan is currently pending.

- *Fort Funston Site Improvements* (NPS) include constructing a restroom, constructing a maintenance facility, and other minor visito*r* enhancements. The environmental assessment is pending and expected in 2014. The project would also upgrade and expand site utilities and infrastructure including expanding the capacity of the on-site sewage treatment system, widening and straightening the entrance road, lengthening the turn lane from Highway 35 into the site, repaving and restriping the parking area, accessibility improvements, and an upgrade of picnic facilities. This project could create short and long-term impacts to recreation.

- *Dog Management Plan* (NPS) is pending with a final rule expected in winter 2015. This plan would provide policy to determine the manner and extent of dog walking in appropriate areas of Fort Funston; promote the preservation and protection of natural and cultural resources and natural processes; provide a variety of visitor experiences, improve visitor and employee safety and reduce user conflicts; and maintain park resources and values for future generations. It would have long-term impacts on recreation.

3.13.6.3 Construction

The construction activities of some of the cumulative projects listed in 3.13.6.2, Past, Present, and Reasonably Foreseeable Projects, could impact recreationists in the Project construction areas (in the event that both the proposed Project and cumulative projects are constructed at the same time). The projects that could have a cumulative recreation impact in combination with the Project, given their proximity are the: Significant Natural Resources Areas Management Plan, Dog Management Plan, GGNRA/Muir Woods National Monument General Management Plan, and Fort Funston Site Improvements. Construction activities of the Project or alternatives would not substantially affect recreation or visitor experience. Implementation of the cumulative projects could result in short-term disturbance of existing recreation and visitor experience; however the overall intent of these projects to improve the overall land use of the Project area. Thus, a cumulative recreation impact is not expected associated with construction activities.

3.13.6.4 Operation and Maintenance

The Project and alternatives would have a *less-than-significant* operation and maintenance-related impact associated with the CEQA criteria because they would not increase the use of recreational facilities such that substantial deterioration of the facility would occur or be accelerated. Similarly, the environmental analysis documents for the above-listed cumulative projects did not identify any substantial impact to existing recreational facilities in the Project area. Therefore, the Project and alternatives would not have a cumulatively considerable contribution to a cumulative impact, and *significant* cumulative impacts are not anticipated to occur as a result of the cumulative projects.

The Project's and alternative's long-term, minor effects on recreation and visitor experience generally would be beneficial due to the improvement of beach access and contributions to the augmentation of Lake Merced WSEs. Further, projects such as Pacific Rod and Gun Club Upland Soil Remediation Project and the Significant Natural Areas Management Plan are intended to improve the overall conditions of those project areas. Thus, overall, a minor long-term beneficial cumulative recreation impact is expected associated with operation and maintenance activities.

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3.14 Socioeconomics and Environmental Justice

This section describes the social and demographic setting of the communities surrounding the Project site and discusses the potential for the Project to result in adverse socioeconomic impacts – including effects related to induced population growth and the displacement of housing or jobs – or to disproportionately impact minority or low-income communities.

3.14.1 Affected Environment

The Project site is located near the jurisdictional boundary between San Francisco and Daly City. The study area for the analysis of potential socioeconomic and environmental justice impacts consists of areas of Daly City and San Francisco in the vicinity of the Vista Grande Canal and Tunnel that could be impacted by adverse construction-related effects. These areas include the residential neighborhood located south of the intersection of John Muir Drive and Lake Merced Boulevard in Daly City, near the headworks of the Vista Grande Canal; the residential neighborhood in the vicinity of Avalon Drive and Westmoor Avenue between State Route (SR) 35 and the Avalon Canyon access road; and the residential area located on John Muir Drive in San Francisco immediately northwest of the existing Lake Merced Portal to the Vista Grande Tunnel. These areas are located in Census Tract (CT) 6009 and CT 6010, in Daly City, and CT 604, in San Francisco, respectively. CT 6009 includes the area of Daly City between the San Francisco-Daly City border and John Daly Boulevard west of Highway 1. CT 6010 includes the area south of the San Francisco-Daly City border west of SR 35. CT 604 includes the area west of Highway 1 between the San Francisco-Daly City border and Brotherhood Way on the east side of Lake Merced and between the city boundaries and Sloat Boulevard on the west side of the lake. Businesses and non-profit organizations in the study area include two private golf clubs, a church, and a synagogue. Non-commercial recreational land uses in the area include Lake Merced Park and the Harding Park public golf course. The analysis considers potential construction-related impacts as well as the potential impact of project operations.

3.14.1.1 Population, Housing, and Employment

Table 3.14-1 shows recent and projected population and housing growth trends in San Francisco and Daly City. As shown, between 2000 and 2010, the number of housing units and households (occupied housing units) in San Francisco grew at a somewhat faster rate than in Daly City, and Daly City had a slight drop in population over this period, while San Francisco had a small gain. According to projections prepared by the Association of Bay Area Governments (ABAG), between 2010 and 2040 San Francisco is projected to grow slightly faster than Daly City, based on the forecasts for housing units and households. The current forecast does not provide population forecasts at the city level; the population of San Mateo County, in which Daly City is located, is forecasted to grow by 26 percent between 2010 and 2040, and San Francisco's population is projected to grow by 35 percent over this period (MTC and ABAG, 2013).

Table 3.14-2 shows housing data for the study area as well as Daly City and San Francisco. As shown, residents in the Daly City portion of the study area, as in Daly City overall, are predominantly homeowners while residents in the San Francisco portion of the study area, as in

TABLE 3.14-1
GROWTH TRENDS IN STUDY AREA CITIES

	2000	2010	Annual Average Growth 2000-2010 (%)	2040 (projection)	Projected Annual Average Growth 2010-2040 (%)
Daly City					
Population	103,621	101,123	-0.2%	See note a	See note a
Housing Units	31,311	32,588	0.4%	36,900	0.4%
Households	30,775	31,090	0.1%	35,770	0.5%
San Francisco					
Population	776,733	805,235	0.4%	1,085,730	1.0%
Housing Units	346,527	376,946	0.8%	469,430	0.7%
Households	329,700	345,811	0.5%	447,350	0.9%

NOTE:

[a] The current demographic forecasts for 2040 (MTC and ABAG, 2013) do not include population forecasts at the city level; population forecasts are provided for counties.

SOURCE: MTC and ABAG, 2013; 2014a; 2014b

TABLE 3.14-2
STUDY AREA HOUSING PROFILE (2010)

	Study Area				
	CT 6009 (Daly City)	CT 6010 (Daly City)	CT 604 (San Francisco)	Daly City	San Francisco
Population	3,933	6,913	1,689	101,123	805,235
Total Housing Units	1,505	2,075	1,052	32,588	376,942
Occupied Housing Units	1,449	1,993	1,001	31,090	345,811
Percent Owner Occupied	78.0%	79.1%	15.5%	56.5%	35.8%
Percent Renter Occupied	22.0%	20.9%	84.5%	43.5%	64.2%
Vacant Housing Units	56	82	51	1,498	31,131
Percent Vacant	3.7%	4.0%	4.8%	4.6%	8.3%

SOURCE: U.S. Census Bureau, 2014a

San Francisco overall, are predominantly renters. Housing occupancy rates are higher in the study area CTs than in the respective cities.

The U.S. Census Bureau's American Community Survey for the period 2008 to 2012 indicates that CT 6009 had a civilian labor force of 2,077 and an unemployment rate of 10.8 percent; that CT 6010 had a civilian labor force of 4,165 and an unemployment rate of 4.9 percent, and that CT 604 had a civilian labor force of 1,229 and an unemployment rate of 5.2 percent. By comparison, Daly City had a civilian labor force of 58,182 and an unemployment rate of 9.7 percent and San Francisco had a civilian labor force of 489,373 and an unemployment rate of 8.0 percent

(U.S. Census Bureau, 2014b). According to the California Employment Development Department (EDD), the annual average unemployment rates for the two cities in 2012, the most recent year for which annual average employment information is available, was slightly lower than indicated in the American Community Survey 5-year estimates; this suggests a gradual decline in unemployment as the area emerges from the recession that began in late 2007/early 2008. The EDD data indicate that in 2012, the unemployment rate was 8.4 percent in Daly City and 7.3 percent in San Francisco (California EDD, 2013); EDD does not provide comparable data by census tract.

3.14.1.2 Environmental Justice

The environmental justice analysis considers potential disproportionate impacts on minority and/or low-income populations. Data from the U.S. Census Bureau's 2010 decennial census and the Census Bureau's American Community Survey were used to determine whether a minority and/or low income population exists within the study area, as well as the racial composition of the general population in which the study area is located, represented by San Francisco and Daly City. For this analysis and consistent with guidance on addressing environmental justice concerns prepared by the Council on Environmental Quality (CEQ), a minority population is identified when the minority population of the potentially affected area is greater than 50 percent, or the percentage of the minority population is meaningfully greater than the minority percentage in the general population (CEQ, 1997).

Table 3.14-3 shows the minority composition of the study area (CTs 6009, 6010, and 604) as well as Daly City and San Francisco, based on the 2010 decennial census. Total minority population, defined as the total percentage of population from racial or ethnic groups other than non-Hispanic White, is 61.7 percent in CT 6009, 81.9 percent in CT 6010, 44.4 percent in CT 604, and 70.5 percent for the study area as a whole (i.e., in the CTs combined). The total minority population in Daly City represents 86.1 percent of the city's population and in San Francisco the total minority population represents 58.1 percent of the city's population; the total minority population of both cities represents 61.2 percent of the combined population. Asian populations make up the majorities in CTs 6009 and 6010 and Daly City as a whole, and also constitute the largest single minority population in CT 604 and San Francisco. Because the total minority population of the study area as a whole exceeds 50 percent of the study area population, the study area is considered a minority community according to the CEQ guidance and is thus considered a community of concern for the environmental justice analysis.

CEQ does not provide quantitative guidance regarding what proportion of low-income individuals in an area defines a low-income population. In the absence of such guidance, and consistent with CEQ guidance on consideration of minority populations noted above, the potentially affected area is considered to be low-income if the percentage of low-income residents is "meaningfully greater" than the percentage of low-income residents in the general population. For this analysis, if the percentage of individuals with incomes below the U.S. Census poverty threshold in the study area is 50 percent (or more) higher than the percentage of individuals with incomes below the poverty threshold in the general population, the study area is considered a low-income population. The combined populations of Daly City and San Francisco were assumed to represent the general population. Information on the percentage of people living below the poverty

TABLE 3.14-3
RACIAL CHARACTERISTICS AND POPULATION RELATIVE TO POVERTY LEVEL: STUDY AREA RESIDENTS

	Study Area						
	CT 6009 (Daly City)	**CT 6010 (Daly City)**	**CT 604 (San Francisco)**	***CTs 604, 6009, and 6010 Combined***	**Daly City**	**San Francisco**	***Daly City and San Francisco Combined***
Total Population	3,933	6,913	1,689	***12,535***	101,123	805,235	*906,358*
Hispanic or Latino (All Races)	8.7%	16.9%	10.5%	***13.5%***	23.7%	15.1%	*16.1%*
Non-Hispanic White	38.3%	18.1%	55.6%	***29.5%***	13.9%	41.9%	*38.8%*
Non-Hispanic Black or African American	1.0%	4.9%	4.2%	***3.6%***	3.2%	5.8%	*5.5%*
Race – alone or in combination with one or more other races:							
White	46.5%	29.5%	64.4%	***39.5%***	27.0%	52.3%	*49.4%*
Black or African American	1.9%	6.6%	6.0%	***5.1%***	4.6%	7.2%	*6.9%*
American Indian and Alaska Native	0.7%	0.9%	0.9%	***0.9%***	1.0%	1.4%	*1.3%*
Asian	51.1%	59.5%	27.7%	***52.6%***	58.4%	35.8%	*38.4%*
Native Hawaiian and Other Pacific Islander	0.9%	1.7%	0.9%	***1.3%***	1.4%	0.8%	*0.8%*
Some Other Race	4.2%	8.2%	6.2%	***6.7%***	13.1%	7.8%	*8.4%*
Percent Total Minority (Other Than Non-Hispanic White)	61.7%	81.9%	44.4%	***70.5%***	86.1%	58.1%	*61.2%*
Percent of People Below Poverty Level	4.2%	4.7%	17.5%	**6.3%**	7.8%	13.2%	*12.6%*

NOTES: All population, race, and ethnicity data are from the 2010 Census; data on poverty level are from the American Community Survey.

SOURCE: U.S. Census Bureau, 2014a; 2014b

threshold in the study area CTs, Daly City, and San Francisco is based on the American Community Survey, and is also shown in Table 3.14-3. The data in Table 3.14-3 indicate that the affected area would be considered low-income if the percentage of low-income population was 6.3 percent (or more) higher than the percentage of the low-income population in the cities combined.

The U.S. Census Bureau defines poverty using standards set by the Office of Management and Budget's (OMB) Statistical Policy Directive 14. Income thresholds used to determine who is in poverty vary by family size and composition (U.S. Census Bureau, 2014c). For example, in 2012, the poverty threshold for a single person under 65 was $11,945; for a family of four with two adults and two children under 18, the threshold was $18,498 (U.S. Census Bureau, 2012). If a family's total income is less than the applicable threshold, then every person in that family is considered to be in poverty. The thresholds are the same for all geographic areas and are adjusted for inflation annually, based on the Consumer Price Index (U.S. Census Bureau, 2014c).

As shown in Table 3.14-3, 17.5 percent of the people living in San Francisco CT 604 had incomes or belonged to families with incomes below the poverty threshold. While this is the highest proportion of individuals in poverty of the three census tracts and two cities considered in this analysis, it is less than 150 percent of the percentage of individuals in poverty in San Francisco as a whole or in San Francisco and Daly City combined, and therefore this CT is not considered a low-income community for the purpose of this analysis. In addition, the percentage of the residents in poverty in the study area as a whole (CTs 604, 6009, and 6010) is less than the percentage of low-income residents in the general population, based on the percentage of individuals in poverty in the cities of Daly City and San Francisco combined.

3.14.2 Regulatory Setting

3.14.2.1 Federal

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations, directs all federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and/or low-income populations. The CEQ, in consultation with the USEPA and other affected agencies, subsequently developed guidance to assist federal agencies with their NEPA procedures so that environmental justice concerns were effectively identified and addressed, and individual agencies supplemented the CEQ guidance with their own specific procedures. The Department of the Interior (Interior) produced its NEPA regulations as Part 516 of its departmental manual, and the NPS produced several NEPA handbooks. The current NPS NEPA handbook is DO-12, which has been updated periodically since it was issued in 1982. Most sections of DO-12 derive in whole or in part from the CEQ regulation or Interior NEPA guidelines, giving them the force of law.

3.14.2.2 State

There are no specific state statutes or regulations that require the analysis of social, economic, or environmental justice impacts. CEQA Guidelines Section 15131(a) through (c) does provide guidance for the analysis of economic and social effects, however. Section 15131 states that economic and social effects may be included in an EIR but "shall not be treated as significant effects on the environment." An EIR may trace a cause and effect chain from a decision on a project through expected economic and social changes resulting from the project to physical changes caused in turn by the economic and social changes. In addition, economic and social effects may be used to determine the significance of physical changes caused by the project. Further, public agencies are required to consider economic, social, and particularly housing factors, together with technological and environmental factors, in deciding whether changes in a project are feasible to reduce or avoid significant effects on the environment. If information on these factors is not included in the EIR, the information must be added to the record in some other manner to allow the agency to consider the factors in reaching a decision on the project.

3.14.2.3 Local

There are no specific local statutes or regulations that require the analysis of social, economic, or environmental justice impacts.

3.14.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.14.3.1 CEQA Significance Criteria

Consistent with Appendix G, Section XIII of the CEQA Guidelines, implementation of the project would have a potentially significant CEQA impact related to population and housing if it were to:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure);

b) Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere; or

c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

CEQA does not identify social and economic effects as significant environmental effects.

3.14.3.2 NEPA Impact Thresholds

The following table provides descriptions of impact intensity with respect to socioeconomics and environmental justice.

Impact Intensity	Impact Description
Negligible:	Impacts on low income or minority communities or socioeconomic conditions would not be detectable.
Minor:	Either beneficial or adverse impacts would be slightly detectable but would not be expected to have an overall effect on low income or minority communities or the long-term character of the social and economic environment.
Moderate:	Either beneficial or adverse impacts would be detectable and would likely be long-term. Effects would result in changes to low income or minority communities or the social and economic environment on a local scale.
Major:	Either beneficial or adverse impacts would be considered to have a substantial, highly noticeable influence on low income or minority communities or the social and economic conditions in the region, and could be expected to alter those environments permanently.

3.14.3.3 Criteria and Thresholds with No Impact or Not Applicable

Because of the nature of the Project and its physical setting, neither the Project nor the alternatives carried forward for analysis would result in impacts related to the following significance criteria; these criteria are not discussed in the impact analysis for the following reasons:

a) ***Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure).*** The Project would not directly induce population growth because it does not propose new residential development or substantial new employment opportunities that would attract new residents or employees to the area. Project construction would provide short-term construction employment. Based on information presented in Section 2.5.4, up to 50 workers could be engaged on the Project at one time if the two tunnel drives were constructed sequentially – or up to 85, if the two tunnel drives (and other Project components) were constructed concurrently. These numbers represent a small percentage of the construction workforce in San Francisco and Daly City, and a smaller fraction of the construction workforce in the Bay Area, and workers are expected to be drawn from the local labor pool. The Project would not require new operational employees. The Project is located in a developed urban area and does not involve new roads or infrastructure that would remove a constraint to growth. The enlarged stormwater drainage capacity would address an existing problem of storm-related flooding in the Project area, and would not increase infrastructure capacity such that it would remove a constraint to growth. Therefore, the Project would not have a growth-inducing effect. Similarly, the Tunnel Alignment Alternative and Canal Configuration Alternative also would not induce growth. Both would require construction workforces similar to that required for the proposed Project, and would not result in long-term operational employment. Both would provide similarly increased stormwater drainage capacity, the purpose of which would be to address existing flooding. Therefore, neither alternative would have a growth-inducing effect.

b) ***Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere.*** Because the Project and Canal Configuration Alternative would be located in or adjacent to the same locations as the existing Vista Grande Canal and Tunnel and associated facilities, no housing would be displaced. Although the Tunnel Alignment Alternative would be located outside of the existing Tunnel alignment, its surface construction would occur within the existing Canal alignment (for the alternative Lake Merced Portal), at Fort Funston (staging and tunnel drilling shaft), and on the beach below Fort Funston (ocean outlet). No houses would be displaced as a result of this construction, and as a result this alternative would not necessitate the construction of replacement housing elsewhere. Additionally, the proposed Project and alternatives would have no operational impact related to the displacement of housing.

c) ***Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.*** As noted above, the Project and Canal Configuration Alternative would be located in or adjacent to the same locations as the existing Vista Grande Canal and Tunnel and associated facilities, and no housing or businesses, and therefore no people, would be displaced. Although the Tunnel Alignment Alternative would be located outside of the existing Tunnel alignment, as noted above, this alternative would not displace housing or businesses, and therefore no people would be displaced. Additionally, the proposed Project and alternatives would have no operational impact related to the displacement of people.

3.14.4 Methodology and Assumptions

The analysis assumes that Project operation would improve storm flooding-related conditions along John Muir Drive, near Lake Merced, and in nearby low-lying neighborhoods within the Vista Grande Drainage Basin by reducing flooding potential, and that following construction, Project facilities would be underground, below or at grade, or otherwise unobtrusive. Although Project operation is not expected to result in substantial adverse social or economic impacts, including on neighboring residences, businesses, or recreational uses, because the Project involves creation of a constructed treatment wetland, the analysis considers the potential for the proposed wetland to attract mosquitoes and thereby result in a nuisance impact affecting low-income or minority populations.

3.14.5 Impact Analysis

3.14.5.1 Proposed Project

CEQA Analysis

The Project would have no impact with respect to the CEQA significance criteria for the reasons discussed in Section 3.14.3.3, Criteria and Thresholds with No Impact or Not Applicable.

NEPA Analysis

Environmental Justice

Because the study area does not include a low-income community, as discussed in Section 3.14.1, the Project would not have a disproportionate effect on a low-income community. As described in Section 3.14.1, the majority of residents in the study area are members of racial or ethnic minorities, and therefore the study area is considered a community of concern for the analysis of environmental justice impacts. Project construction has the potential to cause adverse impacts due to noise, dust, construction truck traffic in the area, and other potential health impacts and nuisances. Such construction-related impacts are discussed in more detail in Sections 3.2 through 3.13 and Sections 3.15 and 3.16. Construction-related impacts would be temporary, and as described in the aforementioned sections, would be reduced to the extent feasible with implementation of the identified mitigation measures. As discussed in Section 3.3, Air Quality, construction-related air emissions would be below *de minimis* emissions levels that are part of the General Conformity Rule governing federal actions in nonattainment and maintenance areas. Therefore the Project would be exempt from General Conformity determination requirements and Project construction would have a minor adverse impact on air quality. As discussed in Section 3.11, Noise and Vibration, minimal nighttime construction could occur, construction noise and ground-borne vibration levels would not exceed the respective NEPA and Federal Transit Administration thresholds for these effects, with the exception of in the vicinity of a structure at Fort Funston, and the impact of construction noise and vibration would be minor. As discussed in Section 3.15, Transportation and Traffic, Project construction would have short-term, minor effects on regional roads, and short-term moderate effects on local roads. Implementation of a Construction Management Plan would reduce traffic flow impacts and reduce potential traffic safety hazards. Project construction would not require any lane or road closures and would not entail activities that could affect access to adjacent land uses. Therefore, given the limited nature of construction-related impacts in terms of both duration and intensity, any disproportionate adverse effect on a minority population would be negligible.

The Project would create a constructed treatment wetland. Comments received during scoping indicated a concern that if not maintained properly, the treatment wetland could create noxious odors due to the decay of organic matter and/or may have the potential to attract mosquitoes. Both issues would be addressed with appropriate Project design and management. The primary mechanism by which a wetland might result in odor effects, or attract or increase the local mosquito population would be if the wetland created new sources of stagnant water, and resulted in substantial decayed vegetation. As discussed in Chapter 2, Project Description, Section 2.4.1.3, the wetland cells would be designed and managed so that water would flow by gravity through the wetland, and during periods of very low or no flow, a recirculating pump would draw water from Impound Lake to sustain the wetland and ensure the continuous circulation of water through it, which would prevent the development of stagnant pools that can be conducive to mosquito production. During periods of very low or no flow, a recirculating pump would draw water from Impound Lake to sustain the wetland and ensure the continuous circulation of water through it. Further, as described in Section 2.6.5, Project Maintenance, operation of the treatment wetland would require the use of bacterial methods for mosquito control and vegetation management in accordance with a treatment wetlands management plan. Vegetation management would include the harvesting of biomass about every five years and the removal of silt and other organic material every 10 to 20 years. would be implemented. These wetland design features and management measures would reduce the risk of mosquito breeding at the proposed wetland, and therefore would reduce the potential for a nuisance impact from mosquitoes and mosquito bites, and a public health impact from vector-borne diseases, and potential odor impacts caused by decaying vegetation. In addition, a well-functioning wetland would attract mosquito predators, such as birds and dragonflies. These wetland design features would also ensure that stagnant water does not result in odor effects. Therefore, it is anticipated that any disproportionate adverse effects on minority populations associated with odors or mosquitoes would be negligible.

Socioeconomic Effects

As discussed in Section 3.14.3.3, Criteria and Thresholds with No Impact or Not Applicable, the Project would not induce substantial population growth, either by proposing residential development or providing substantial new employment opportunities, and, because it would be located in or adjacent to the same easements and rights of way as the existing Vista Grande Canal and Tunnel and associated facilities, the Project would not displace housing, businesses, or people. Consequently, the Project is not expected to have a detectable effect on socioeconomic factors including occupations, incomes, the local tax base, or the cultural, racial, or ethnic composition of the area. The Project constitutes an infrastructure improvement designed to reduce flooding in the Vista Grande Basin. As such, it is conceivable that the reduced incidence of flooding could in the future contribute to improved property values and/or lower property insurance rates for residents or businesses whose properties are currently subject to flooding due to the capacity constraints of the existing canal and associated drainage infrastructure. However, property values are linked to a range of market forces, including housing availability (supply versus demand), characteristics of the neighborhood (such as the quality of local schools and the mix of businesses and amenities), and pressures related to growing income disparities within the local and regional workforce. It would be speculative to predict or expect that Project improvements alone would account for more than a minor effect on the value of properties in the Vista Grande Drainage Basin. Such an effect, were it to occur, could be beneficial to the affected property owners but could have adverse effects on renters and prospective buyers by contributing to increased rents and housing prices. It is far more likely that measurable changes to local property values and housing costs would result from larger forces of supply and demand in San Francisco, Daly City, and surrounding cities. Therefore, it is anticipated that any adverse or beneficial socioeconomic effects resulting from reduced flooding due to Project improvements would be minor.

3.14.5.2 Tunnel Alignment Alternative

The following describes the socioeconomic and environmental justice effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.14.5.1, Proposed Project, or Section 3.14.5.3, Canal Configuration Alternative, depending on the option selected. Thus, socioeconomic and environmental justice effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative would have no impact with respect to the CEQA significance criteria for the reasons discussed in Section 3.14.3.3, Criteria and Thresholds with No Impact or Not Applicable.

NEPA Analysis

Environmental Justice

Because the study area is not a low-income community, as discussed in Section 3.14.1, Affected Environment, the Tunnel Alignment Alternative would not have a disproportionate effect on a low-income community. Construction of the Tunnel Alignment Alternative has the potential to cause adverse impacts on a minority community due to noise, dust, and construction truck traffic in the area, and other potential health impacts and nuisances. Such construction-related impacts are discussed in more detail in Sections 3.2 through 3.13 and Sections 3.15 and 3.16. Construction-related impacts would be temporary, and as described in the aforementioned sections would be reduced to the extent feasible with implementation of the identified mitigation measures. Construction impacts related to dust and other air emissions, noise, and traffic would be similar to those summarized above for the Project. The impacts of the construction of the Tunnel Alternative would be limited in terms of both duration and intensity, and any disproportionate adverse effect on a minority population would be negligible.

Because the Tunnel Alignment alternative would be combined with either the proposed Canal improvements described for the Project or the Canal Configuration Alternative, by itself it would have no effect related to odors or mosquitoes potentially associated with created wetlands. As stated at the beginning of this section, if connected with the Project Canal improvements, the environmental justice effects associated with new wetlands would be identical to those described above in Section 3.14.5.1, and if connected to the Canal Configuration Alternative, the effects would be identical to those described below in Section 3.14.5.3. In either case, it is anticipated that any effects on minority populations associated with odors or mosquitoes due to the Canal improvements would be negligible and would not be disproportionately adverse.

Socioeconomic Effects

Because it would be constructed in the same general location (Fort Funston) and its construction and operation workforce needs would be the same as the Tunnel portion of the Project, the Tunnel Alignment Alternative would have the same potential socioeconomic effects as the Project. As discussed for the Project in Sections 3.14.3.3 and 3.14.5.1, the Tunnel Alignment Alternative would not induce substantial population growth and would not displace housing, businesses, or people. Consequently, this alternative is not expected to have a detectable effect on socioeconomic factors including occupations, incomes, the local tax base, or the cultural, racial, or ethnic composition of the area. Similarly, because the Tunnel Alignment Alternative is designed to be as effective as the Project in reducing flooding in the Vista Grande Basin, this alternative could contribute to improved property values and/or lower property insurance rates for residents or businesses whose properties are currently subject to flooding. The effect, if any, of this alternative on property values, is expected to be minor relative to the larger market forces and neighborhood and regional characteristics that typically influence property values. Therefore, it is anticipated that any adverse or beneficial socioeconomic effects resulting from reduced flooding due to implementation of the Tunnel Alignment Alternative would be minor.

3.14.5.3 Canal Configuration Alternative

The following describes the socioeconomic and environmental justice effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.14.5.1, Proposed Project, or Section 3.14.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, socioeconomic and environmental justice effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative would have no impact with respect to the CEQA significance criteria for the reasons discussed in Section 3.14.3.3, Criteria and Thresholds with No Impact or Not Applicable.

NEPA Analysis

Environmental Justice

Because the study area is not a low-income community, as discussed in Section 3.14.1, the Canal Configuration Alternative would not have a disproportionate effect on a low-income community. As described in Section 3.14.1, the majority of residents in the study area are members of racial or ethnic minorities and therefore the study area is considered a community of concern for the analysis of environmental justice impacts. As described for the Project, construction of the Canal Configuration Alternative has the potential to cause adverse impacts due to noise, dust, construction truck traffic in the area, and other potential health impacts and nuisances. Such construction-related impacts are discussed in more detail in Sections 3.2 through 3.13 and Sections 3.15 and 3.16. Construction-related impacts would be temporary, and as described in the aforementioned sections would be reduced to the extent feasible with implementation of the identified mitigation measures. Construction impacts related to dust and other air emissions, noise, and traffic would be similar to those summarized above for the Project. As under the Project, the impacts of construction of the Canal Configuration Alternative would be limited in terms of both duration and intensity, and any effects on a minority population would be negligible and would not be disproportionately adverse.

The Canal Configuration Alternative would create a constructed treatment wetland, and so could have the potential to create noxious odors due to the decay of organic matter and/or to attract mosquitoes. However, as discussed above in Section 3.14.5.1, both odor and mosquito issues can be addressed with appropriate design and management. Therefore, it is expected that any disproportionate adverse effects on minority populations associated with odors or mosquitoes from the alternative treatment wetland would be negligible.

Socioeconomic Effects

Because it would be constructed in approximately the same location (Vista Grande Canal and Lake Merced) and its construction and operation workforce needs would be the same as the Canal portion of the Project, the Canal Configuration Alternative would have the same potential socioeconomic effects as the Project. As discussed for the Project in Sections 3.14.3.3 and 3.14.5.1, the Canal Configuration Alternative would not induce substantial population growth and would not displace housing, businesses, or people. Consequently, this alternative is not expected to have a detectable effect on socioeconomic factors including occupations, incomes, the local tax base, or the cultural, racial, or ethnic composition of the area. Similarly, because the Canal Configuration Alternative is designed to be as effective as the Project in reducing flooding in the Vista Grande Basin, this alternative could contribute to improved property values and/or lower property insurance rates for residents or businesses whose properties are currently subject to flooding. The effect, if any, of this alternative on property values, is expected to be minor relative to the larger market forces and neighborhood and regional characteristics that typically influence property values. Therefore, it is anticipated that any adverse or beneficial socioeconomic effects resulting from reduced flooding due to implementation of the Canal Configuration Alternative would be minor.

3.14.5.4 No Project/No Action Alternative

As described in Section 2.7.2.3, No Project/No Action Alternative, no physical component of the proposed Project would be constructed and none of the proposed operational changes to stormwater routing would be made, and the Lake Management Plan would not be implemented. Because Canal and Tunnel capacity would not be improved, occasional flooding of the Canal and associated flooding of John Muir Drive into Lake Merced and in local neighborhoods would continue. Therefore, there would be no beneficial effect on minority populations from improved conditions due to reduced flooding, no disproportionate adverse effects on minority populations associated with temporary construction impacts or with odors or mosquitoes due to wetland creation, and no adverse or beneficial socioeconomic effects as a result of reduced flooding.

3.14.6 Cumulative Effects

Because the Project and alternatives would not have an impact related to growth inducement or displacement of housing or people, they would not contribute to a cumulative impact related to these CEQA criteria. Because the Project and alternatives would not have an impact related to disproportionate adverse effects on low-income communities, they would not contribute to a cumulative impact related to this issue. Additionally, because impacts related to disproportionate adverse effects on minority communities from noise dust and traffic during construction or from odors and mosquitoes during operations would be negligible, as would effects on occupations, incomes, the local tax base, or the cultural, racial, and ethnic composition of the area, neither the Project nor the alternatives would contribute to cumulative impacts related to these issues.

As described above, the Project, Tunnel Alignment Alternative, and Canal Configuration Alternative could have a long-term, minor, beneficial impact on property values in areas that would experience reduced flooding risk.

3.14.6.1 Geographic Extent/Context

The geographic extent of cumulative impacts related to property values includes the vicinity of residential areas that currently are at risk to experience flooding due to inadequate capacity in the Vista Grande Canal and Tunnel; primarily, the low-lying areas east of Lake Merced Boulevard and south-southeast of the headworks of the Vista Grande Canal.

3.14.6.2 Past, Present, and Reasonably Foreseeable Projects

Existing conditions reflect the contributions of past projects in the Project vicinity. There are no existing significant adverse socioeconomic or environmental justice conditions in the Project vicinity resulting from cumulative projects. The following present and reasonably foreseeable projects presented in Table 3.1-1 include improvements to recreational amenities and housing and commercial developments in the Project vicinity that could incrementally affect the value of properties that would experience reduced flooding risk as a result of the Project.

- *Lake Merced Boathouse Renovations* (SFPUC and SFRPD). Construction was completed in 2014. Improvements during the second phase of the project, including creating space in the second floor of the boathouse for a community room, exercise room, restrooms, SFRPD office space, and a concession area, incrementally enhance the recreational amenities available at Lake Merced.

- *2800 Sloat Boulevard* (Private Developer). The 2008 project approval was extended to 2015, and the construction schedule is to be determined. While the proposed mixed-use development includes 56 residential units, this project would replace three smaller existing commercial buildings (a café, a surf shop, and a two-story motel) with roughly 140,000 gross square feet of commercial space, which would attract new employees to the area and potentially new demand for housing, potentially influencing nearby housing costs and property values. The character and cost of the new residential units also could have an incremental effect on property values and rents in the area.

- *Parkmerced Project* (Private Developer). Over a 20- to 30-year period, approximately 5,780 new residential units would be constructed and about 1,540 of the existing 3,200 residential units would be replaced, for a total of 8,900 residential units. The project would also include new school, day care, and fitness facilities and new open space land uses, including a 2-acre organic farm and community gardens. While this project would almost triple the number of residential units provided by the existing Parkmerced complex, thereby helping to address and alleviate some of the demand for housing in San Francisco and Daly City, this large-scale project also could exert upward pressure on housing and rental prices in the vicinity, depending on the character and cost of the new and replaced units.

3.14.6.3 Construction

As discussed in Section 3.14.5, the Project's socioeconomic effect would result from the reduced risk of flooding that would occur during Project operations; the Project would not contribute to a construction-related cumulative socioeconomic effect.

3.14.6.4 Operation and Maintenance

As discussed above in Section 4.14.5, the Project and alternatives would reduce flooding at properties in the Vista Grande Drainage Basin upstream of the Canal, which could result in a minor increase in property values for residents or businesses whose properties are currently subject to storm-related flooding. While this could contribute to a cumulative impact related to increased property values in the Project vicinity, fewer than 100 residences are located in the area subject to flooding. Given that a total of almost 6,000 new residential units are planned at developments within 0.5 mile of Project the site – and that almost 97,000 new residential units are projected to be added in San Francisco and Daly City by 2040 (as shown in Table 3.14-1), these new developments would have a far greater influence on housing prices and property values in the Project vicinity, and the two cities overall, than would reduced flooding in the Vista Grande Basin. Therefore the Project's contribution to a cumulative impact related to property values is expected to be negligible.

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3.15 Transportation and Traffic

This section evaluates the transportation and traffic impacts that could occur during Project construction and maintenance activities, including potentially significant impacts on traffic flow (including mass transit and non-motorized travel), traffic safety, or access within the surrounding roadway system.

Transportation resources analyzed in a CEQA context examine impacts of the Project on existing transportation facilities. For NEPA purposes, the analysis focuses on whether the Project would have measurable impacts on traffic within, and on routes and/or trails providing access to, NPS-managed land (i.e., Fort Funston in the Project area).

3.15.1 Affected Environment

The study area for transportation and traffic consists of a network of regional and local roadways primarily next to or near Lake Merced and Fort Funston, and roadways affected by Project construction-related vehicles and related activities. This roadway network would be used by construction workers and operators of other construction vehicles, including trucks transporting construction equipment and materials, excavated spoils, and fill materials to and from the work areas.

3.15.1.1 Regional Access

Various state and interstate highways provide regional access to the Project area and connect to the local roadway network. These roadways are described below (see Figure 3.13-1).

State Route (SR) 1 is a six- to eight-lane, north-south highway that connects San Francisco and Daly City with Peninsula communities (and points farther south) and North Bay communities (and points farther north). In the Project area, SR 1 has an interchange with Brotherhood Way. According to California Department of Transportation (Caltrans) data, the annual average daily traffic (AADT) on SR 1 in the Project area is about 101,000 vehicles (Caltrans, 2014). Current traffic flow conditions are acceptable (City of Daly City, 2012).

SR 35 is a four- to six-lane roadway that runs from SR 1 (19th Avenue) in San Francisco to SR 17 on the Peninsula. In the Project area, the roadway (Skyline Boulevard) is a four-lane, north-south divided road providing direct access to Fort Funston. According to Caltrans data, the AADT on SR 35 in the Project area is about 24,000 vehicles (Caltrans, 2014). Current traffic flow conditions are acceptable (City of Daly City, 2012).

Interstate 280 (I-280) is an eight-lane freeway that connects San Francisco with San Jose. In the Project area, I-280 has an interchange at John Daly Boulevard. According to Caltrans data, the AADT on I-280 in the Project area is about 135,000 vehicles (Caltrans, 2014). Current traffic flow conditions are acceptable, except for the northbound segment between the Daly City/South San Francisco city limits and Hickey Road (City of Daly City, 2012).

3.15.1.2 Local Access

The Project area is served by a network of roads with various purposes: “arterials,” designed to carry traffic through an area; “collectors,” designed to connect arterials to local roads and land uses; and “local roads,” which provide direct access to land uses. The roadways that could be affected by Project construction are described below.

John Muir Drive is a two-lane arterial roadway that runs between Lake Merced Boulevard and SR 35 (Skyline Boulevard). On-street parking is permitted. At the intersection of John Muir Drive / Lake Merced Boulevard, there are exclusive left-turn and right-turn lanes onto Lake Merced Boulevard. Based on recent traffic counts, the weekday average daily traffic (ADT) volume along John Muir Drive is about 8,000 vehicles (CHS Consulting Group, 2013).

Lake Merced Boulevard is a four-lane divided arterial roadway that runs generally between John Daly Boulevard and Sunset Boulevard. On-street parking is not permitted. Based on recent traffic counts, the weekday ADT volume along Lake Merced Boulevard is about 17,500 vehicles (CHS Consulting Group, 2013).

Avalon Drive is a two-lane local residential road that could provide access from SR 35 and Avalon Canyon for Project construction access to the new Ocean Outlet structure on the beach below Fort Funston. On-street parking is permitted.

Fort Funston Road is a two-lane 20-foot-wide road that provides access from SR 35 to the Fort Funston parking lots and to buildings (various GGNRA site office and maintenance faculties, as well as the SFUSD Environmental Science Center). Based on recent traffic counts, the ADT volume along Fort Funston Road varies from about 600 to 1,300 vehicles, with a slight seasonal variation in visitation, May through September generally having the highest visitation levels (NPS, 2015).

3.15.1.3 Public Transportation

The San Francisco Municipal Railway system (Muni), which is part of the San Francisco Municipal Transportation Agency (SFMTA), provides bus service near the Project area. Route 18 (46th Avenue) operates along John Muir Drive and Lake Merced Boulevard. It provides weekday and weekend bus transit service between the Palace of the Legion of Honor (in Lincoln Park) and Stonestown Shopping Mall (at 19th Avenue and Winston Drive) (SFMTA, 2010).

The San Mateo County Transit District (SamTrans) also provides bus transit service in the project vicinity. Route 122 provides weekday and weekend service between the Colma Bay Area Rapid Transit (BART) station and the Stonestown Shopping Mall, running on Lake Merced Boulevard (SamTrans, 2014).

3.15.1.4 Bicycle/Pedestrian Circulation

Bikeways are typically classified as Class I, Class II, or Class III facilities, as defined in the California Streets and Highways Code. Class I bikeways are bike paths with exclusive right-of-way for use by bicyclists or pedestrians. Class II bikeways are bike lanes striped with the paved areas of roadways and established for the preferential use of bicycles, while Class III bikeways are signed bike routes that allow bicycles to share streets with vehicles.

A Class I-designated multi-use pathway (San Francisco Bicycle Route 885) and Class III bicycle route (Bicycle Route 85) run next to John Muir Drive and Lake Merced Boulevard (SFMTA, 2009). The two bicycle routes share the same alignment along Lake Merced and run along Lake Merced Boulevard, John Muir Drive, and SR 35 and back to Lake Merced Boulevard. Bicycle Route 86 travels west from Bicycle Route 84 at Ocean Avenue via Cerritos Avenue, Mercedes Way, Winston Drive, and Lake Merced Boulevard to its junction with Bicycle Route 91 (Skyline Boulevard). At Lake Merced Boulevard, bicyclists can connect with Bicycle Route 85 south to San Mateo County and north to both the Sunset and Richmond districts (SFMTA, 2009).

Bicycle Route 91 begins at Bicycle Route 50 at Sloat Boulevard and connects to Route 85 (Lake Merced Boulevard) via Skyline Boulevard and John Muir Drive on the west side of Lake Merced. It also provides a connection with Bicycle Route 95 (Skyline Boulevard/the Great Highway). As an alternative to this on-street route, bicyclists can use the paved pathway along Lake Merced (SFMTA, 2009).

In general, local roadways that would be affected by construction have pedestrian facilities, including raised concrete sidewalks, striped crosswalks, and curb ramps at intersections.

3.15.2 Regulatory Setting

3.15.2.1 Federal

There are no federal regulations that address transportation impacts associated with the Project.

3.15.2.2 State

Caltrans Plans and Policies

Caltrans manages interregional transportation, including management and construction of the California highway system. Caltrans generally assesses the impact of long-term, not short-term, traffic conditions. Plans and policies related to transportation seek to plan for and accommodate future growth and the vehicular, transit, pedestrian, and bicycle demand associated with that growth.

Caltrans’ construction practices require temporary traffic control planning “during any time the normal function of a roadway is suspended” (Caltrans, 2012). Furthermore, Caltrans requires that permits be obtained for transportation of oversized loads and transportation of certain materials, and for construction-related traffic disturbance. Project construction and maintenance activities would not occur on state highways or highway rights-of-way; state roadways would be used solely as access routes for construction workers and construction vehicles. Therefore, Caltrans encroachment permits would not be required. Further, oversized vehicles (by weight, height, length, or width) or vehicles carrying hazardous materials that require Caltrans permits would not be used. Caltrans’ facilities that are likely to be used as access routes by construction workers and construction vehicles to the planned work sites include: SR 1, SR 35, and I-280 (described above).

3.15.2.3 Local

Daly City 2030 General Plan

Circulation Element

The Circulation Element of the Daly City 2030 General Plan identifies policies for ensuring that adequate transportation facilities are maintained throughout the planning period, that the facilities in which Daly City plans to invest reflect the land uses contemplated by the Land Use Element, and that the transportation system provides a range of transportation choices (Daly City, 2013). However, those policies pertain to long-term, not short-term, traffic conditions. Because the Project is expected to affect short-term conditions only, as described in Section 3.15.5, Impact Analysis, these policies are not described further.

San Francisco

San Francisco coordinates all street activities through the SFMTA's Transportation Advisory Staff Committee (TASC), which includes representatives from the San Francisco Department of Public Works (SFDPW), the SFMTA, and the Fire, Planning, Police, Port, and Public Health Departments. As part of the TASC process, the City of Daly City, in consultation with the SFDPW and SFMTA, would develop and incorporate a detailed Construction Management Plan into its construction contract specifications, and further coordinate with SFMTA Street Operations division for any work on or near transit facilities.

San Francisco General Plan

The Transportation Element of the San Francisco General Plan contains objectives and policies that relate to the nine aspects of the citywide transportation system: general issues, regional transportation, congestion management, vehicle circulation, transit, pedestrian, bicycles, citywide parking, and goods management (San Francisco, 2010). However, those objectives and policies pertain to long-term, not short-term, traffic conditions. Because the Project is expected to affect short-term conditions only, as described in Section 3.15.5, Impact Analysis, these policies are not described further.

San Mateo County General Plan

The Transportation Chapter of the San Mateo County General Plan encompasses all types of travel including automobile, pedestrian, transit, bicycle, and air travel (San Mateo County, 2007). The Transportation Chapter develops policies which promote County goals and objectives and which are necessary to support other General Plan policies, particularly those related to land use. The scope of this chapter is countywide, but its policies do not preempt city general plans. However, like those for San Francisco and Daly City, the county's goals and policies pertain to long-term, not short-term, traffic conditions. Because the Project is expected to affect short-term conditions only, as described in Section 3.15.5, Impact Analysis, these policies are not described further.

3.15.3 CEQA Significance Criteria and NEPA Impact Thresholds

3.15.3.1 CEQA Significance Criteria

Based on CEQA Guidelines Appendix G Section XVI, a project would have a significant impact on transportation conditions if it would:

a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit, non-motorized travel, and relevant components of the circulation system (including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit);

b) Conflict with an applicable congestion management program, including but not limited to level of service (LOS) standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways;

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in locations that results in substantial safety risks;

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

e) Result in inadequate emergency access; or

f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

Additionally, while not included in CEQA Guidelines Appendix G, for purposes of analysis of the Project’s short-term construction-related impacts, the following criteria are taken into consideration:

g) The Project would have a significant effect if it would create potentially hazardous conditions for pedestrians and/or bicyclists, or otherwise interfere with pedestrian and/or bicycle accessibility.

h) The Project would have a significant effect if it would result in increased wear-and-tear on the designated haul routes, causing increased traffic safety hazards.

3.15.3.2 NEPA Impact Thresholds

Consistent with the NPS DO-12 Handbook Environmental Screening Form (NPS, 2001), the Project and alternatives are evaluated to determine whether they would have measurable impacts on traffic within and on routes and/or trails providing access to Fort Funston, with impact intensity based on the impact descriptions in the following table.

Impact Intensity	Impact Description
Negligible:	Effects considered not detectable which and would have no discernible effect on transit service, traffic flow, parking, and/or traffic safety conditions.
Minor:	Effects on transit service, traffic flow, parking, and/or traffic safety conditions that would be slightly detectable, but not expected to have an overall effect on those conditions.
Moderate:	Effects that would be clearly detectable, and could have an appreciable effect on transit service, traffic flow, parking, and/or traffic safety conditions.
Major:	Effects that would have a substantial, highly noticeable influence on transit service, traffic flow, parking, and/or traffic safety conditions and could permanently alter those conditions.

3.15.3.3 Criteria and Thresholds with No Impact or Not Applicable

Due to the nature of the Project, there would be no impact related to the following topics for the reasons described below:

b) ***Conflict with an applicable congestion management program, including but not limited to LOS standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.*** The Project site is located primarily in San Francisco and partially within Daly City (in San Mateo County). Both cities have established LOS standards that are intended for use in evaluating traffic impacts related to added vehicle trips during project operation and are generally not applicable to construction-related vehicle traffic. Additionally, each county has a congestion management plan (CMP) that is intended to monitor and address long-term traffic conditions related to future development that generate permanent (on-going) traffic increases, and that does not apply to temporary impacts associated with construction projects. Project construction would be transitory in nature and effects on roadway and intersection operations would be temporary. Following construction, Daly City would restore excavated areas to their general preconstruction conditions, and Project operation would only require periodic maintenance-generated trips (such as trips by vacuum trucks to empty the gross solids screening device of collected debris approximately twice per year), and would not result in a substantial change in vehicle trips. Therefore, the Project would generate minimal long-term traffic, and consideration of LOS impacts on CMP roadways or local roadways during operation of the project components is not applicable, and is not discussed further in this section.

c) ***Result in a change in air traffic patterns, including either an increase in traffic levels or a change in locations that results in substantial safety risks.*** The Project sites are not near an airfield; San Francisco International Airport is about 11 miles to the southeast, and Metropolitan Oakland International Airport is about 15 miles to the southeast. These distances are outside of the limit for objects near airports in the guidance published by the Federal Aviation Administration. Therefore, this criterion is not discussed further.

d) ***Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses***. The Project would not permanently change the existing or planned transportation network and would not include any design features or incompatible uses that would permanently increase the potential for traffic safety hazards. Therefore, this significance criterion is not applicable to the Project and is not discussed further.

3.15.4 Methodology and Assumptions

The analysis of Project effects related to transportation and traffic resources addresses temporary construction-related impacts as well as impacts during Project operation and maintenance. However, because Project operation activity would not generate permanent (on-going) increases in traffic on area roadways (being limited to periodic maintenance and repair activities), the main focus of the analysis is on the potential short-term effects of construction—including those on traffic and transit operations, pedestrian/bicycle accessibility and safety, and emergency access. In addition, as stated in Section 3.15.2, Regulatory Setting, policies in local General Plans pertain to long-term, not short-term, traffic conditions, and because the Project would affect short-term transportation and traffic conditions only, the Project would not conflict with an applicable plan, ordinance, or policy pertaining to the performance of the circulation system.

The construction-related information used for the analysis is based on current Project specifications, including construction durations (see Chapter 2, Project Description), and similar construction projects throughout the Bay Area. Project construction would generate vehicle traffic (construction workers' vehicles, equipment, and trucks) traveling to and from the work sites on area roads. All Project construction activities would generate daily commute trips by construction workers. Truck traffic would include deliveries of materials/equipment to the site and hauling of excavated or fill material, building debris from demolition away from the site. The analysis of potential impacts is based on periods when peak Project trip generation would occur; impacts would be less than reported herein during periods when less-than-peak Project trip generation would occur.

The transportation impacts identified below allow for a general assessment of the nature and magnitude of potential impacts associated with Project construction activities. The final construction scheduling of specific Project components could result in traffic impacts related to concurrent construction activities. However, because most of the transportation impacts associated with construction of the Project components would be specific to the work site, impacts associated with concurrent construction activities would be limited to construction-generated traffic using the same roads due to the relative proximity of the Project work sites.

3.15.5 Impact Analysis

3.15.5.1 Proposed Project

CEQA Analysis

a) **Impact TRA-1: Project construction would cause temporary increases in traffic volumes on area roadways, which could cause substantial conflicts with the performance of the circulation system, but would not conflict with applicable plans, ordinances, or policies pertaining to the performance of the circulation system. (Less than Significant with Mitigation)**

Traffic-generating construction activities would include trucks hauling equipment and materials to and from the work site, and the daily arrival and departure of construction workers to and from the work site. It is estimated that there would be a maximum of approximately 70 workers on any one day if the two tunnel drives are constructed concurrently (up to 140 one-way trips per day), or up to 35 workers (70 one-way trips) per day if tunnel drives are completed sequentially, with fewer (5 to 10) workers at various other times during Project construction (see Table 2-4). Work hours would vary depending on the nature of the construction activities occurring at any particular time and the status of the Project with respect to schedule. However, most construction generally would occur between 7:00 a.m. and 7:00 p.m., Monday through Friday. Tunneling activities could occur 24 hours per day with approval from NPS, resulting in some worker vehicle trips during nighttime construction. While construction worker trips could occur during peak traffic hours, it is expected that most of the time work hours would dictate that workers would arrive to and depart from the work site during non-peak traffic hours.

It is estimated that about 30 percent of the material excavated for Project components would be reused for backfill (see Table 2-5). Disposal of excess earthen materials from excavation is estimated to involve as many as 40 daily haul truck round trips (i.e., up to 80 one-way trips) during the Canal and wetland construction period, with fewer daily haul trips associated with other components (see Table 2-4). These truck trips would be spread over the course of the work day, with up to about 8 one-way trips per hour (one inbound truck, and one outbound truck, every 15 minutes). No haul trips would occur during overnight work hours, even if 24-hour tunneling is permitted to occur (materials excavated from the tunnel drives during overnight hours would be stockpiled on-site and hauled away between 7:00 a.m. and 7:00 p.m.). Additional truck trips would be necessary to deliver materials and equipment to the work site. Construction-generated trucks on Project area roadways would interact with other vehicles (including transit buses like Muni's Route 18 – 46th Avenue). Potential conflicts could also occur between construction traffic and bicyclists and pedestrians, potentially having an adverse effect on pedestrian/bicycle accessibility and on traffic safety conditions for pedestrians and/or bicyclists.

Increases in traffic associated with construction vehicle trips (truck trips and worker trips) could have an impact on the levels of congestion and delays because heavy traffic volumes already exist on roadways in the Project area.

Project construction would not require any lane or road closures, but John Muir Drive (including the bike lanes) would be temporarily realigned to the west to accommodate installation of the box culverts under the road (approximately four to six weeks). Once the box culverts have been installed and backfilled, John Muir Drive and its bike lanes would be restored to its current alignment. Traffic flow (vehicles and bicycles) would be maintained on John Muir Drive at all times; the impact would be *less than significant.*

As described in Chapter 2, *Project and Alternatives*, construction access to the Ocean Outlet structure on the beach below Fort Funston would be provided either through the newly constructed tunnel via the construction shaft or across the beach via an access point at Avalon Canyon, located about 2.5 miles south of the Ocean Outlet structure. Under the latter access scenario, improvements to the existing Avalon Canyon access road would be required so that the construction crews (5 workers) can bring heavy equipment and material to and from the beach. It is possible that materials that need to be removed from the beach could be temporarily stockpiled at the Ocean Outlet location for later removal via the tunnel and shaft once the tunnel drive has reached the beach. The Project-generated increased traffic on Avalon Drive and Westmoor Avenue (between SR 35 and the Avalon Canyon access road) would be noticeable to residents on those local streets, particularly construction trucks (5 daily round trips), but the traffic capacities of those local roads is adequate to accommodate the increase in traffic.

Project-generated traffic (trucks and worker vehicles) would increase the daily traffic volume on regional roadways, but that increase would not be substantial relative to existing traffic conditions (a temporary increase of no more than 1.0 percent), and Project traffic would not significantly disrupt daily traffic flow. However, the increase in traffic volume on local roads would be noticeable, especially the temporary and intermittent reduction of roadway capacities due to the slower movements of trucks compared to passenger vehicles. Drivers could experience minor delays if they were traveling behind a construction truck; those instances could include when a construction truck is exiting from Fort Funston Road onto Skyline Boulevard and needs to accelerate to merge with faster-moving traffic. The increased local congestion/delay and potential conflicts involving Project trucks is considered to be a *significant* impact. Implementation of Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards to a *less-than-significant* level.

Mitigation Measure 3.15-1: Construction Traffic Management Plan

Daly City and/or its contractor(s) shall prepare and implement a Construction Traffic Management Plan in accordance with professional traffic engineering standards to show methods for maintaining traffic flows on roadways directly affected by Project construction, which shall include, at a minimum, the following requirements:

a) Develop circulation plans to minimize impacts on local street circulation; use flaggers and/or signage to guide vehicles through and/or around the construction zone (including, as needed, for trucks turning into and out of Fort Funston at the intersection of SR 35 and Fort Funston Road). Circulation plans may be modified during construction, based on observed conditions.

b) Identify truck routes and, to the extent possible, use haul routes that minimize truck traffic on local roadways and residential streets.

c) Schedule truck trips to minimize trips during the peak morning and evening commute hours, and the peak hours of arrivals and departure from Fort Funston, to the extent possible.

d) Provide sufficient staging areas for trucks accessing construction zones to minimize disruption of access to adjacent land uses, particularly within residential neighborhoods.

e) Maintain pedestrian and bicycle access and circulation during Project construction where safe to do so. If construction activities encroach on a bicycle lane, post warning signs that indicate bicycles and vehicles are sharing the lane.

f) Store all equipment and materials in designated contractor staging areas on or adjacent to the worksite, in such a manner to minimize obstruction of traffic.

g) Implement roadside safety protocols and provide advance "Road Work Ahead" warning signs and speed control (including signs informing drivers of state-legislated double fines for speed infractions in a construction zone) to achieve required speed reductions for safe traffic flow through the work zone.

h) Coordinate construction with facility owners or administrators of sensitive land uses such as police and fire stations (including all fire protection agencies), transit stations, hospitals, and schools, as well as Fort Funston. Notify facility owners or operators in advance of the timing, location, and duration of construction activities.

i) Provide residents adjacent to Project construction areas (e.g., on Avalon Drive and Westmoor Avenue) with information regarding Project construction in their area, including anticipated start and end of construction activities.

j) Coordinate construction with local traffic agencies, SFMTA, NPS, and SamTrans, to minimize disruption and arrange for the temporary relocation of bus stops in work zones as necessary.

Significance after Mitigation: Less than Significant.

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a) Impact TRA-2: Project operation and maintenance would cause some temporary increases in traffic volumes on area roadways, but would not substantially conflict with the performance of the circulation system or with plans, ordinances, or policies pertaining to the performance of the circulation system. (Less than Significant)

Project operation would only require periodic maintenance-related trips (such as trips by vacuum trucks to empty the gross solids screening device of collected debris approximately twice per year). Regular operation and maintenance of other Project facilities would be performed by existing Daly City and SFPUC employees, or their contractors and is expected to be similar to current operation and maintenance activities, with the exception of some increased maintenance activity associated with the constructed treatment wetlands and expanded water quality monitoring activities within Lake Merced. Emergency repair and maintenance work (e.g., related to Canal overtopping) is expected to decrease. On balance, any increases in traffic generated by operation and maintenance of Project facilities would be minimal compared to existing conditions and would not result in a noticeable increase in traffic on area roads. Therefore, the Project would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system. Project operational impacts would be *less than significant*, and no mitigation is required.

Mitigation: None required.

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e) Impact TRA-3: Project construction would not impair access to adjacent roadways and land uses, or impede emergency access. (Less than Significant)

Project construction would not require any lane or road closures, and would not entail activities that could substantially affect access to adjacent land uses or impede emergency access. As described above, John Muir Drive would be temporarily realigned to the west to accommodate installation of the box culverts under the road, and it would be restored to its existing alignment once the box culverts have been installed and backfilled. Traffic flow would be maintained on John Muir Drive, as well as on other area roadways, at all times. Construction-generated trucks on Project area roadways (including Fort Funston Road) would interact with other vehicles. While the 20-foot width of Fort Funston Road is not standard, it is wide enough for a visitor or park vehicle to be accommodated in the opposite direction of a construction vehicle. Drivers could experience delays of an estimated 45 seconds if they were traveling behind a construction truck because a truck may be moving somewhat slower than a passenger vehicle (including when a construction truck is exiting from Fort Funston Road onto Skyline Boulevard and needs to accelerate to merge with faster-moving traffic), but access to roads and land uses would not be impaired in any substantial manner. This impact would be *less than significant*.

Mitigation: None required.

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f) Impact TRA-4: Project construction would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities. (Less than Significant)

The Project is located in an established urban area, and Project construction would not directly or indirectly eliminate alternative transportation corridors or facilities (e.g., bicycle lanes, bus routes/stops, etc.). In addition, the Project would not include changes in policies or programs that support modes of alternative transportation. Therefore, the Project would not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities. This impact would be *less than significant.*

Mitigation: None required.

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h) Impact TRA-5: Project construction would result in increased wear-and-tear on the designated haul routes. (Less than Significant with Mitigation)

The use of large trucks to transport equipment and material to and from the Project work site(s) for construction could affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear. Although haul routes have not been designated, logical routes would include I-280, SR 35, John Muir Drive, John Daly Boulevard, Brotherhood Way, Fort Funston Road, and Avalon Drive.

The degree to which this impact would occur depends on the design (pavement type and thickness) and existing condition of the road. Freeways and major arterials are designed to accommodate a mix of vehicle types, including heavy trucks; consequently, no *significant* wear and tear from trucks would be expected on I-280, SR 35, John Daly Boulevard, or Brotherhood Way. Local streets (e.g., Avalon Drive and Fort Funston Road) generally are not built with a pavement thickness that will withstand substantial truck traffic volumes. The wear-and-tear effects on road conditions and driving safety is considered to be a *significant* impact. Implementation of Mitigation Measure 3.15-2, which would establish requirements for restoring roads damaged by construction, would reduce potential impacts to a *less-than-significant* level.

> **Mitigation Measure 3.15-2:** Daly City, San Francisco, and the National Park Service shall enter into an agreement prior to construction that shall detail pre-construction conditions and the post-construction requirements of a roadway rehabilitation program. Daly City and/or its contractors shall repair roads damaged by construction to a structural condition equal to that which existed prior to construction activity.
>
> **Significance after Mitigation:** Less than Significant.

NEPA Analysis

As described above in the CEQA analysis, Project-generated traffic (trucks and worker vehicles) would increase the daily traffic volume on area roadways (which include roads providing access to Fort Funston). In comparison to the No Action Alternative, traffic generated by the up to 70 construction workers (some of whom could access the Project site during peak traffic hours) and as many as 40 haul trucks (which would be spread over the course of the day) on any one day would be slightly detectable on regional roads, but is not expected to have an overall effect on transit service, traffic flow, and traffic safety conditions because of the low (no more than 1.0 percent) increase to existing traffic volumes on those roadways. However, the same Project-generated traffic would be clearly detectable on local roads based on the relative percent increase in existing traffic volumes on those roads, and could have an appreciable effect on transit service, traffic flow, and traffic safety conditions. Implementation of Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards. Implementation of Mitigation Measure 3.15-2, which would establish requirements for restoring roads damaged by construction, would reduce potential impacts to a less-than-significant level. With implementation of these measures, the Project would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.

As described above in the CEQA analysis, Project construction would not require any lane or road closures, and would not entail activities that could substantially affect access to adjacent land uses. For example, the staging area at Fort Funston (shown on Figure 2-2b) would not displace any spaces in the Fort Funston visitor parking lot or impede visitor access to the parking lot or emergency access to any area of Fort Funston. Drivers could experience delays of about 45 seconds if they were traveling behind a construction truck when entering or leaving Fort Funston because a truck may be moving somewhat slower than a passenger vehicle (including when a construction truck is exiting from Fort Funston Road onto Skyline Boulevard and needs to accelerate to merge with faster-moving traffic), though the posted speed limit on Fort Funston Road is 25 mph, and the differential between vehicle speeds (trucks versus passenger vehicles) would not be substantial on this road. The delays experienced by drivers traveling behind a slow-moving construction truck would be slightly detectable, but would not have an overall effect on access to Fort Funston, as visitors could access the parking lot regardless of the presence of slow-moving trucks. While the 20-foot width of Fort Funston Road is not standard, it is wide enough for a visitor or park vehicle to be accommodated in the opposite direction of a construction vehicle. In addition, the maximum estimate daily traffic of up to 117 round trips per day would occur for a maximum of 30 days (see Table 2-4); for the rest of the tunnel construction period, the maximum number of trucks would be 17 per day, along with the up to 70 worker vehicles (arriving and departing at the start and end of their shifts). Truck trips would be spread over the 7:00 a.m. to 7:00 p.m. work day (i.e., not a substantial number of trips per hour). Tunneling activities could occur 24 hours per day if permitted by NPS, and so some worker vehicle trips could occur at night, but no truck trips would occur during overnight hours, even if 24-hour tunneling is permitted. Both worker vehicles and haul trucks could access the Fort Funston staging area on weekends in support of tunneling, if weekend work occurs. The maximum number of construction trips accessing Fort Funston during the 30 work days on which concrete trucks access the site would represent an increase of between 18 and 40 percent of ADT on Fort Funston Road, depending on the season. At all other times during the 17- to 37-month tunnel construction period, the maximum number of construction trips would represent an increase of between 13 and 29 percent, and a majority of these trips would be worker vehicles rather than trucks. The Project-generated increased traffic on Fort Funston Road would be a noticeable change to the daily traffic volume, but Project trips would be spread over the course of the day, and the traffic capacity of Fort Funston Road is adequate to accommodate the increase in traffic. In comparison to the No Action Alternative, the Project staging area and construction activities would have a slightly detectable effect on access to, and no discernible effect on parking at, Fort Funston. The Project would have short-term, minor effects on access and negligible effects on parking.

As described above in the CEQA analysis, Project operation would only require periodic maintenance-generated trips on roads providing access to aboveground facilities (e.g., John Muir Drive and Avalon Drive), which are expected to be slightly increased compared to the No Action Alternative due to the potential additional maintenance associated with the constructed treatment wetlands and increased lake water quality monitoring. Emergency repairs and maintenance associated with Canal overtopping during peak storm flows would be expected to decrease. No maintenance trips to the upland portion of Fort Funston would be required, and so no operational traffic on Fort Funston Road is anticipated. On balance, any increases in traffic generated by operation and maintenance of Project facilities would not be detectable compared to the No Action Alternative and would have no discernible effect on transit service, traffic flow, access, parking and traffic safety conditions.

3.15.5.2 Tunnel Alignment Alternative

The following describes the transportation effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.15.5.1, Proposed Project, or Section 3.15.5.3, Canal Configuration Alternative, depending on the option selected. Thus, transportation effects for the canal portion would be as described in those sections.

CEQA Analysis

The Tunnel Alignment Alternative is in a similar location to the Project but would be located within an area between the existing tunnel and a line approximately 50 feet to the south. The methods and duration to construct this alternative would not change compared to the proposed Project, and daily traffic generated by construction workers and haul/delivery trucks accessing the work site would not change compared to the proposed Project. Although traffic would increase on regional roadways, the increase would not significantly disrupt traffic flow. Similar to the Project, the increase in traffic volume on local roads would be noticeable, especially due to the slower movements of trucks compared to passenger vehicles, and the increased local congestion/delay and potential conflicts involving trucks is considered to be a *significant* impact.

Like with the Project, construction would not require any lane or road closures, and would not entail activities that could affect access to adjacent land uses or impede emergency access; the impact would be *less than significant*.

Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a *significant* impact.

Implementation of Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards. Implementation of Mitigation Measure 3.15-2, which would establish requirements for restoring roads damaged by construction, would reduce potential impacts to a *less-than-significant* level.

Like with the Project, operation activity under the Tunnel Alignment Alternative would only require periodic maintenance-generated trips. On balance, any increases in traffic generated by operation and maintenance under this alternative would be minimal compared to existing conditions and would not result in a noticeable increase in traffic on area roads. Therefore, operational impacts related to the Tunnel Alignment Alternative would be *less than significant*, and no mitigation is required.

NEPA Analysis

Traffic generated under the Tunnel Alignment Alternative would be similar to traffic generated by the proposed Project. In comparison to the No Action Alternative, that traffic would be slightly detectable on regional roads, but is not expected to have an overall effect on transit service, traffic flow, and traffic safety conditions because of the low percent increase to existing traffic volumes on those roadways. The traffic increase on local roads would be clearly detectable (based on the relative percent increase in existing traffic volumes on those roads), and could have an appreciable effect on transit service, traffic flow, and traffic safety conditions. Implementation of Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards. The Tunnel Alignment Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.

Construction under the Tunnel Alignment Alternative would not require any lane or road closures, and would not entail activities that could affect access to adjacent land uses. The staging area at Fort Funston (shown on Figure 2-6) would be the same as that proposed for the Project and would not displace any spaces in the Fort Funston parking lot or impede visitor access to the parking lot or emergency access to any area of Fort Funston. Drivers could experience delays if they were traveling behind a construction truck when entering or leaving Fort Funston because a truck may be moving somewhat slower than a passenger vehicle (including when a construction truck is exiting from Fort Funston Road onto Skyline Boulevard and needs to accelerate to merge with faster-moving traffic), though the posted speed limit on Fort Funston Road is 25 mph, and the differential between vehicle speeds (trucks versus passenger vehicles) would not be substantial on this road. The delays experienced by drivers traveling behind a slow-moving construction truck would be slightly detectable, but would not be expected to have an overall effect on access to Fort Funston, as visitors could access the parking lot regardless of the presence of slow-moving trucks. Truck trips would be spread over the 7:00 a.m. to 7:00 p.m. work day (i.e., not a substantial number of trips per hour). Tunneling activities could occur 24 hours per day during the tunneling period, and so some worker vehicle trips likely would occur at night, but haul truck trips would occur only during the work day. Both worker vehicles and haul trucks could access the Fort Funston staging area on weekends in support of tunneling, if weekend work occurs. In comparison to the No Action Alternative, the staging area and construction activities would have a slightly detectable effect on access to, and no discernible effect on parking at, Fort Funston. The Tunnel Alignment Alternative would have short-term, negligible effects on Fort Funston access and parking. As described above in the CEQA analysis, operation activity under the Tunnel Alignment Alternative would only require periodic maintenance-generated trips. No maintenance trips to the upland portion of Fort Funston would be required, and so no operational traffic on Fort Funston Road is anticipated. On balance, any increases in traffic generated by operation and maintenance under this alternative would not be detectable compared to the No Action Alternative and would have no discernible effect on transit service, traffic flow, access, parking, and traffic safety conditions.

3.15.5.3 Canal Configuration Alternative

The following describes the transportation effects associated with construction and operation of an alternative canal configuration. The tunnel components would be the same as described in Section 3.15.5.1, Proposed Project, or Section 3.15.5.2, Tunnel Configuration Alternative, depending on the option selected. Thus, transportation effects for the tunnel portion would be as described in those sections.

CEQA Analysis

The Canal Configuration Alternative would entail less construction than the Canal portion of the proposed Project. The methods and duration to construct the Canal Configuration would not change substantially compared to the proposed Project, and daily traffic generated by construction workers and haul/delivery trucks accessing the work site would be somewhat less than for the proposed Project. Traffic increases on regional roadways would not significantly disrupt traffic flow, but similar to the Project, the increase in traffic volume on local roads would be noticeable, especially due to the slower movements of trucks compared to passenger vehicles, and the increased local congestion/delay and potential conflicts involving trucks is considered to be a *significant* impact.

Like with the Project, construction would not require any lane or road closures, and would not entail activities that could affect access to adjacent land uses or impede emergency access; the impact would be *less than significant*.

Like with the Project, the use of large trucks to transport equipment and material to and from the Project work site(s) for construction could significantly affect road conditions and driving safety on the designated haul routes by increasing the rate of road wear, which would be considered a *significant* impact.

Implementation of Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards to a *less-than-significant* level. Implementation of Mitigation Measure 3.15-2, which would establish requirements for restoring roads damaged by construction, would reduce potential impacts to a *less-than-significant* level.

Like with the Project, operation activity under the Canal Configuration Alternative would only require periodic maintenance-generated trips which are expected to be slightly increased compared to the No Action Alternative due to the potential additional maintenance associated with the constructed treatment wetlands and increased lake water quality monitoring. Emergency repairs and maintenance associated with Canal overtopping during peak storm flows would be expected to decrease. On balance, any increases in traffic generated by operation and maintenance under this alternative would be minimal compared to existing conditions and would not result in a noticeable increase in traffic on area roads. Therefore, operational impacts related to the Canal Configuration Alternative would be *less than significant*, and no mitigation is required.

NEPA Analysis

Traffic generated under the Canal Configuration Alternative would be similar to traffic generated by the Project. In comparison to the No Action Alternative, that traffic would be slightly detectable on regional roads, but is not expected to have an overall effect on transit service, traffic flow and traffic safety conditions because of the low percent increase to existing traffic volumes on those roadways. The traffic increase on local roads would be clearly detectable (based on the relative percent increase in existing traffic volumes on those roads), and could have an appreciable effect on transit service, traffic flow, and traffic safety conditions. Implementation of

Mitigation Measure 3.15-1, Construction Traffic Management Plan, would reduce traffic flow impacts and reduce potential traffic safety hazards. The Canal Configuration Alternative would have short-term, minor effects on regional roads, and short-term, moderate effects on local roads.

Construction under the Canal Configuration Alternative would not require any lane or road closures, and would not entail activities that could affect access to adjacent land uses. Impact on access to and parking at Fort Funston would be as described for the proposed Project or Tunnel Alignment Alternative, depending on the selected alternative. Operational activity under the Canal Configuration Alternative would only require periodic maintenance-generated trips, which are expected to be slightly increased compared to the No Action Alternative due to the potential additional maintenance associated with the constructed treatment wetlands and increased lake water quality monitoring. Emergency repairs and maintenance associated with Canal overtopping during peak storm flows would be expected to decrease. On balance, any increases in traffic generated by operation and maintenance under this alternative would not be detectable compared to the No Action Alternative and would have no discernible effect on transit service, traffic flow, access, parking and traffic safety conditions.

3.15.5.4 No Project/No Action Alternative

Under the No Project/No Action alternative, no physical component of the proposed Project would be constructed, and there would be no construction-related impacts to existing transportation conditions on area roadways. However, there would be continued maintenance activities and occasional emergency repairs and other traffic-generating activities when the canal floods, causing damage to roads (such as John Muir Drive) and houses in nearby neighborhoods.

3.15.6 Cumulative Effects

3.15.6.1 Geographic Extent/Context

The geographic scope for the analysis of cumulative traffic impacts includes the local and regional roadways and highways that would be used for Project construction activities and for access by construction workers and vehicles.

Past, Present, and Reasonably Foreseeable Projects

Existing conditions reflect the contributions to local and regional traffic conditions of past projects. The following present and reasonably foreseeable projects may result in impacts to transportation and traffic conditions and are included in the analysis of the Project's cumulative impacts. In addition to project-related construction impacts identified, construction activities would contribute incrementally to cumulative traffic increases from a number of other projects in the area that could be under construction at the same time and using the same roads to access work sites.

For example, as indicated in Figure 3.1-1, and presented in Table 3.1-1, construction of the following cumulative projects is expected to occur within the same vicinity and timeframe as other planned and proposed projects.

- *San Francisco Westside Recycled Water Project* (SFPUC) Construction is expected to occur between 2016 and 2019. Construction in the vicinity of the Oceanside Water Pollution Control Plant could increase traffic temporarily on roadways used by project-generated traffic.

- *Regional Groundwater Storage and Recovery Project* (SFPUC) Construction is expected to occur between late 2014 and fall 2017. Construction of one of the groundwater basins could increase traffic temporarily on roadways used by project-generated traffic.

- *Groundwater Supply Project* (SFPUC) Construction began in fall 2014 and is expected to be complete in early 2016. Construction at the Lake Merced Pump Station could increase traffic temporarily on roadways used by project-generated traffic.

- *2800 Sloat Boulevard* (Private Developer) construction schedule to be determined, but construction could increase traffic temporarily on roadways used by project-generated traffic.

- *Parkmerced Project* (Private Developer) could extend through 2030. Construction of this project could increase traffic temporarily on roadways used by project-generated traffic. The first phase of the Parkmerced project is expected to result in the highest level of construction activities, with Lake Merced Boulevard, Brotherhood Way, 19th Avenue, and Junipero Serra serving as the primary construction access routes.

- *Pacific Road and Gun Club Upland Soil Remediation Project* (SFPUC) Construction is anticipated to begin in early 2015. Construction in vicinity of the Lake Merced Tunnel Portal could increase traffic temporarily on roadways used by project-generated traffic.

3.15.6.2 Construction

As analyzed in Section 3.15.5, Impact Analysis, after implementation of Mitigation Measures 3.15-1 and 3.15-2, the Project and alternatives would have a *less-than-significant* impact with respect to temporary increases in traffic volumes, impairment of access to adjacent roadways and land uses, and increased wear and tear on the designated haul routes.

Roadways adjacent to and within the vicinity of the above-cited planned projects could experience an increase in traffic volumes and reduced roadway capacities due to combined construction activities, which could substantially worsen traffic conditions. Given that the above-cited planned projects are not located within Fort Funston, traffic volumes on Fort Funston Road would not be affected by combined construction activities. While the effects of the detours and the additional construction-related vehicles could be accommodated within the capacity of the roadways and intersections, the increased traffic volumes, detours, and road and lane restrictions associated with the overlapping and concurrent projects could increase potential traffic hazards for vehicles, bicycles, and pedestrians on affected roadways during construction of each facility.

However, as discussed in Section 3.15.5, Impact Analysis, the required Project-specific Construction Traffic Management Plan would address potential transportation disruptions. Thus, the Project's contribution to cumulative traffic impacts on local and regional roads would not be cumulatively considerable, and no additional mitigation is required.

3.15.6.3 Operation and Maintenance

The Project and alternatives would have negligible contributions to cumulative traffic conditions during operation and maintenance and therefore, impacts from the operation and maintenance phase would not be cumulatively considerable.

References

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3.16 Utilities and Service Systems

This section assesses the Project's potential impacts on utilities and service systems, including natural gas, electricity, telecommunications, stormwater drainage, water supply pipelines, wastewater collection, and solid waste disposal. The analysis provides mitigation measures to reduce potential impacts, as appropriate.

Because utilities and service systems are considered under CEQA, but not by NPS under NEPA, this analysis focuses solely on potential CEQA impacts. Additionally, although the CEQA Guidelines do not identify conflicts with exiting utility lines as a topic of concern, this section provides information about the existing utilities in proximity to the Canal and Tunnel and an analysis of the Project's potential effects on those utilities.

3.16.1 Affected Environment

The Project site is located in the southwestern side of San Francisco, generally along the southern side of John Muir Drive. The southern end of the Vista Grande Canal is situated in unincorporated San Mateo County. The subsections below describe known utility systems and related infrastructure located in the vicinity of the Vista Grande Canal and Tunnel as well as solid waste disposal facilities within the greater San Francisco Bay Area that could receive construction-related wastes.

3.16.1.1 Utilities

As described in Chapter 2, Project and Alternatives, existing utility lines near the Vista Grande Canal and Tunnel include AT&T communication cables and Pacific Gas and Electric (PG&E) gas lines within the John Muir Drive right-of-way, a 33-inch treated wastewater effluent gravity pipeline, two Olympic Club sewer pipelines, and several aboveground utilities. An approximately 24-foot-wide San Francisco Public Utilities Commission (SFPUC) sewer line also runs parallel to John Muir Drive. **Table 3.16-1** summarizes these and other existing utilities (type and size if known) located in the immediate vicinity of the Vista Grande Canal and Tunnel.

TABLE 3.16-1
EXISTING ABOVEGROUND AND UNDERGROUND UTILITIES LOCATED ALONG AND ACROSS VISTA GRANDE CANAL AND TUNNEL

Utility	Size	Utility	Size
Sewer manholes	unknown	Gas line	unknown
Electric Box	unknown	Water line (within John Muir Drive)	unknown
Overhead power poles (6 total)	unknown	Telephone vault	unknown
Sewer line	6-inch diameter	Fire hydrant	unknown
Sewer line	30-inch diameter	Effluent sewer	33-inch diameter
Sewer line	18-inch diameter	Electric HV station	unknown
Sewer line	12-inch diameter	Combined stormwater/sewer	9-foot x 24-foot
Sewer force main	27-inch diameter	AT&T communication cable	unknown

SOURCE: City of Daly City, 2013

3.16.1.2 Water Supply

The SFPUC provides water service to both San Francisco and Daly City. While a large portion of Daly City's water supply comes from SFPUC, Daly City supplements the SFPUC supply with groundwater pumped from six local wells. Daly City also uses tertiary recycled water from the North San Mateo County Sanitation District wastewater treatment plant wherever feasible to offset potable/aquifer water demands. The Daly City's Department of Water and Water Resources is responsible for operating its water supply sources (City of Daly City, 2011). As indicated in Table 3.16-1, a water line beneath John Muir Road runs adjacent to the Vista Grande Canal.

3.16.1.3 Wastewater and Stormwater

In Daly City, the North San Mateo County Sanitation District provides wastewater collection service. The Daly City Wastewater Treatment Plant (WWTP) provides wastewater treatment services for the majority of Daly City residents and businesses, along with the Broadmoor Village, a portion of the Town of Colma, the Westborough County Water District in South San Francisco, and the San Francisco County jail in San Bruno (City of Daly City, 2014a). The WWTP is located at 153 Lake Merced Boulevard and the Plant's secondary treatment capacity is currently 10.3 million gallons per day (mgd). As described in Chapter 2, Daly City operates a wastewater effluent discharge system which conveys treated effluent from the WWTP to an offshore diffuser located in the Pacific Ocean. During dry weather, effluent is conveyed via a gravity system that parallels the Vista Grande Canal and Tunnel. During wet weather (whenever rainfall from a storm exceeds about 0.25 inch or when substantial runoff is observed), the effluent (up to 12 mgd) is pumped through a separate 24- to 27-inch force main pipeline that traverses the Olympic Club and Fort Funston to a drop structure located on the bluff above the Tunnel's west portal in Fort Funston, which routes effluent to the ocean outlet.

As described in Chapter 2, the Vista Grande Canal and Tunnel divert stormwater from the northwestern portion of Daly City and an unincorporated portion of San Mateo County. The Vista Grande Canal collects stormwater from three main culverts, then discharges stormwater through the Tunnel. At the Tunnel's west portal, flows discharge through the Daly City outlet structure's south-facing flap gates where they flow across the beach to the Pacific Ocean.

The SFPUC maintains and operates a Combined Sewer System, which combines stormwater runoff and wastewater flows in the same network of pipes and conveys flows to facilities for treatment prior to discharge through outfalls into San Francisco Bay or Pacific Ocean. Discharges are regulated under National Pollutant Discharge Elimination System (NPDES) permits, which are described in Section 3.9, Hydrology and Water Quality. The collection system comprises about 976 miles of underground pipes throughout city streets. Within the Project area, wastewater is conveyed to treatment facilities including the Oceanside Water Pollution Control Plant (located at 3500 Great Highway) before eventual discharge to the Pacific Ocean. The Oceanside plant treats an average of 15 million gallons per day (gpd), and has a wet weather capacity of up to 175 million gpd (SFPUC, 2014). Stormwater runoff from the western portions of San Francisco drains to the city's combined stormwater and sewage system, or one of seven separate sewer systems administered by the SFPUC. The western basin stormwater inlets on the streets surrounding Lake Merced and within the Canal construction area (as detailed in Section 2.4 and summarized in Table 2-1) collect stormwater runoff, and route it to the Lake through dedicated drainage pipes. This system consists of catch basins that do not provide stormwater treatment prior to discharge to the lake.

3.16.1.4 Solid Waste Disposal

San Francisco

Recology (formerly Norcal Waste Systems, Inc.) provides solid waste collection, recycling, and disposal services for residential and commercial garbage, recycling, and composting in San Francisco through its subsidiaries San Francisco Recycling and Disposal, Golden Gate Disposal and Recycling, and Sunset Scavenger. Materials collected are hauled to the Recology transfer station/recycling center on Tunnel Avenue, near San Francisco's southeastern city limit, for sorting and subsequent transportation to other facilities. Recyclable materials are taken to Recology's Pier 96 facility, where they are separated into commodities (e.g., aluminum, glass, and paper) and transported to other users for reprocessing. Compostables (e.g., food waste, plant trimmings, soiled paper) are transferred to a Recology composting facility in Solano County, where they are converted to soil amendment and compost. The remaining material that cannot otherwise be reprocessed ("trash") is transported to, and disposed of at, the Altamont Landfill in Alameda County.

The Altamont Landfill has a permitted peak maximum daily disposal of 11,150 tons per day and accepted 1.05 million tons in 2013 (CalRecycle, 2014a). The landfill has an estimated remaining capacity of approximately 46 million cubic yards or 74 percent of its permitted capacity. The estimated closure date of the landfill is January 2025 (CalRecycle, 2014b). In 2012, San Francisco generated approximately 454,500 tons of solid waste and sent approximately 375,000 tons to the Altamont Landfill, about 35 percent of the total volume of waste received at that facility (CalRecycle, 2014c).

In 1988, San Francisco contracted for the disposal of 15 million tons of solid waste at the Altamont Landfill. San Francisco's contract with the Altamont Landfill expires in 2015. Through August 1, 2009, San Francisco had used approximately 12.5 million tons of this contract capacity. In 2009, San Francisco announced that it could award its landfill disposal contract to a Recology subsidiary for shipment of solid waste by truck and rail to the Recology Ostrom Road Landfill in Yuba County. This facility has an expected closure date of 2066 with a total design capacity of over 41 million cubic yards.[1] The ultimate determination with respect to future landfill contracting will be made by the Board of Supervisors on the basis of solid waste planning efforts being undertaken by San Francisco's Department of the Environment.

1 San Francisco is currently participating as a responsible agency in the environmental review process that Yuba County has begun for the Recology Ostrom Road Green Rail and Permit Amendment Project and to conduct CEQA review of San Francisco's proposal to enter into one or more new agreements with Recology. On March 28, 2013, Yuba County and San Francisco entered into a Cooperative Agreement to designate Yuba County as the lead agency for this project and to outline their cooperative efforts concerning environmental review.

Daly City

Allied Waste Services provides residential and commercial garbage collection services for Daly City. Collected garbage that is not compostable is directed to the Daly City Mussel Rock Transfer Station located at Skyline Drive and Westline Drive in Daly City, and eventually the Corinda Los Trancos Landfill (formerly Ox Mountain Sanitary Landfill), located 3 miles east of Half Moon Bay off of Highway 92. This facility has a ceased operational date of January 2018 with a permitted capacity of 69 million cubic yards, and total remaining capacity of approximately 26.9 million cubic yards as of May 2011 (Davies, 2014). In 2012, Daly City generated approximately 54,000 tons of solid waste and directed approximately 53,000 tons to the Corinda Los Trancos Landfill (CalRecycle, 2014d).

3.16.2 Regulatory Setting

3.16.2.1 Federal

No federal regulations related to utilities and service systems apply to the Project.

3.16.2.2 State

California Public Utilities Commission

The California Constitution vests the California Public Utilities Commission (CPUC) with the sole authority to regulate privately owned and investor-owned public utilities, such as PG&E. This exclusive power extends to all aspects of utility regulation, including facility location, design, construction, maintenance, and operation. CPUC requires regulated utilities to work closely with local governments and give due consideration to local government concerns. The CPUC does not regulate publicly owned utilities such as the SFPUC.

California Integrated Waste Management Act of 1989

The California Integrated Waste Management Act (CIWMA) of 1989 (Public Resources Code Division 30), enacted through Assembly Bill (AB) 939, required all California cities and counties to implement programs to reduce, recycle, and compost at least 50 percent of solid wastes by the year 2000 (Public Resources Code Section 41780). Senate Bill (SB) 1016, enacted in 2008, replaced the complicated AB 939 waste diversion percentage measurement process by implementing a simplified measure of jurisdictions' performance that measures the per-capita disposal rate using a jurisdiction's population (or in some cases employment) and its disposal as reported by disposal facilities. This measurement allows for population and employment growth in a jurisdiction while maintaining a reduction target consistent with the CIWMA. Daly City has met the employment-based per capita disposal rate target most years since 2011, and although it has not met the population-based per capital disposal rate target, in 2015, CalRecycle found that for the 2012-2013 Jurisdiction Review cycle, Daly City has implemented effective diversion programs and has made reasonable and feasible efforts to implement them (CalRecycle, 2015a, 2015b). San Francisco has met its per capital disposal rate targets on both a population and employment basis (CalRecycle, 2015c).

Utility Notification Requirements

Title 8, Section 1541 of the California Code of Regulations requires excavators to determine the approximate locations of subsurface installations such as sewer, telephone, fuel, electricity, and water lines (or any other subsurface installations that may reasonably be encountered during excavation work) prior to opening an excavation.

California law (Government Code Section 4216 et seq.) requires owners and operators of underground utilities to become members of and participate in a regional notification center, such as USA North. USA North receives reports of planned excavations from public and private excavators and transmits the information to all participating members that may have underground facilities at the location of an excavation. USA members mark or stake their facilities, provide information, or give clearance to dig (USA North, 2014).

3.16.2.3 Local

Daly City Construction and Demolition Recycling Program

Daly City's Recycling and Diversion of Construction and Demolition Debris Ordinance (Section 15.64) requires a minimum of 60 percent of debris generated by certain construction and demolition projects be recycled. Before starting an applicable demolition, construction, or remodeling project, the applicant must determine how to manage construction and demolition debris and any excess building materials such as taking them to an approved facility for recovery/recycling or reusing the materials (City of Daly City, 2014b).

San Francisco Construction and Demolition Ordinance

San Francisco Ordinance No. 27-06 mandates the recycling of construction and demolition (C&D) debris generated[1] in the city of San Francisco. This ordinance affects all construction projects such as new construction and partial demolitions. Full demolition of an existing structure requires that a Demolition Debris Recovery Plan be submitted and approved by the San Francisco Department of the Environment before a full demolition permit is issued by the Department of Building Inspection. It requires the property owner to make sure that all C&D materials removed from the project are properly recycled. This ordinance prohibits any C&D materials from being placed in trash or sent directly to a landfill. C&D materials must be taken by a registered transporter to a registered facility that reuses or recycles those materials. At the registered facility, a minimum of 65 percent of the material must be diverted from the landfill (SFDE, 2014b).

3.16.3 CEQA Significance Criteria

Based on the CEQA Guidelines Appendix G Section XVII, a project would cause adverse impacts to utilities and service systems if it would:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;

c) Require or result in the construction of new stormwater drainage facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects;

d) Have insufficient water supply available to serve the project from existing entitlements and resources, or require new or expanded water supply resources or entitlements;

e) Result in a determination by the wastewater treatment provider that would serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments;

f) Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs; or

g) Be out of compliance with federal, state, and local statutes and regulations related to solid waste.

Because of the nature of the proposed Project and its proximity to existing utilities, this EIR/EIS applies the following criterion, in addition to those described above, and considers that the Project may have a significant effect on utilities and service systems if it were to:

h) Disrupt operation or require relocation of regional or local utilities.

3.16.3.1 Criteria and Thresholds with No Impact or Not Applicable

This section describes the impacts that have been screened out from further analysis. Because of the nature of the proposed Project, this report does not analyze the following criteria for the reasons described below:

Criterion b, listed above, *Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects*; relates to the proposed Project, which includes construction and relocation of wastewater pipelines. As described in Chapter 2, Project Description, portions of an existing 30-inch and 33-inch wastewater effluent gravity pipeline would be removed and relocated outside the limits of the constructed treatment wetlands, and two new 24-inch wastewater pipelines would be installed within the Vista Grande Tunnel to replace the existing force main and would connect to the existing 33-inch pipeline. Construction of these components would cause significant effects as identified in this EIS/EIR; refer to Sections 3.2, Aesthetics, through 3.15, Transportation, for more information. With respect to water treatment facilities, Daly City does not propose to construct or expand water treatment facilities as part of the proposed Project. Therefore, the portion of the significance criterion related to water treatment is not applicable to construction or operation of the proposed Project and is not discussed further.

Criterion c, above, *Require or result in the construction of new stormwater drainage facilities or the expansion of existing facilities, the construction of which could cause significant environmental effects,* relates to the primary purpose of the proposed Project, which includes improvements to the Vista Grande Canal and Tunnel, both of which would be improved to alleviate flooding potential along John Muir Drive and to protect the ocean outlet from ongoing coastal erosion. The primary purpose of this EIS/EIR is to evaluate the potential impacts of implementing the Project. Its construction would cause significant effects as identified in this EIS/EIR; refer to Sections 3.2, Aesthetics, through 3.15, Transportation, for more information.

3.16.4 Methodology and Assumptions

The analysis of Project effects related to utilities and service systems addresses temporary construction-related impacts as well as impacts during Project operation and maintenance. This analysis assumes that Daly City would comply with all applicable permit requirements throughout construction, operation, and maintenance.

This analysis evaluates the potential effects of the landfill disposal requirements of the Project with respect to the available capacity of local landfills and Daly City's ability to comply with solid waste diversion rates.

3.16.5 Impact Analysis

3.16.5.1 Proposed Project

a, e) Impact UTIL-1: The Project would not exceed wastewater treatment requirements of the San Francisco Regional Water Quality Control Board nor result in a determination by a wastewater treatment provider that it has inadequate capacity to serve the Project's projected demand in addition to the provider's existing entitlements. (Less than Significant)

As described in Chapter 2, excavation of the box culvert, diversion structure, Lake Merced Portal, and Tunnel could require dewatering. Dewatering typically involves pumping water out of the excavation area into holding tanks, and following appropriate on-site treatment, discharging the water over land or into San Francisco's combined sewer system or the Vista Grande Canal. Regardless of which dewatering discharge method is used, if necessary, Daly City would obtain a Wastewater Batch Discharge Permit from SFPUC Wastewater Enterprise Collection System Division. In the event that discharged water is directed to San Francisco's combined sewer system, this water would be pumped to the Oceanside Treatment Plant, located off the Great Highway under the San Francisco Zoo north of the Project site. In addition, as described in Chapter 2, discharge to an open channel or over land must be performed in accordance with municipal stormwater permits (e.g., a SFPUC Construction Site Runoff and Control Permit) and the requirements of the Statewide General Construction Permit. The Construction Site Runoff and Control Permit and Statewide General Construction Permit require preparation and implementation of an erosion and sediment control plan and a storm water pollution prevention plan (SWPPP), respectively. If applicable, compliance with both of the above-mentioned permits would ensure that any discharged water directed overland is properly controlled.

Additionally, during construction of the new Tunnel, base flows and the initial hour of storm flows in the Canal following an extended antecedent dry period would be diverted, retained, and pumped into the SFPUC combined stormwater sewer system for treatment and disposal. The rate of pumping would be a maximum of 20 cfs (8,980 gpm) for several hours at a time during storms with extended antecedent dry periods, and would otherwise be less than 0.3 cfs (135 gpm).

Because Daly City would comply with SFPUC Wastewater Enterprise's permit conditions for dewatering and, if applicable, with conditions of the SFPUC Construction Site Runoff and Control Permit and a Statewide General Construction and/or Construction Site Runoff Control Permit, the Project would not exceed wastewater treatment requirements issued by the San Francisco Bay Regional Water Quality Control Board. Additionally, SFPUC has indicated that the Oceanside Treatment Plant has adequate capacity to serve the temporary incremental increases in wastewater flows. A rate of 185 gpm (dewatering plus base flows) would represent less than 0.5 percent of the plant's average daily dry weather treatment volume. During wet weather conditions, contributions from retained initial storm flows in the Canal also would represent less than 0.5 percent of the plant's wet weather treatment capacity. No dewatering or other new wastewater discharges are anticipated during operation and maintenance of the Project. Therefore, the proposed Project would have a *less-than-significant* impact related to increased demand for wastewater or stormwater treatment facilities.

Mitigation: None required.

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d) Impact UTIL-2: The Project would not require more water supply than would be available through existing entitlements and resources, nor would it require new or expanded water supply resources or entitlements. (Less than Significant)

As described in Chapter 2, Project Description, Project construction would require up to 5 gallons per minute (gpm) for dust control purposes including wheel washing and ground application. Assuming that above-ground construction would typically occur between 7:00 a.m. and 7:00 p.m., Monday through Friday, throughout a 24- to 44-month construction phase, the Project would require approximately 2 million to 3.5 million gallons of water total. If 24-hour tunneling is not permitted, construction at Fort Funston would occur for an additional year or more, resulting in a longer duration of construction-related dust control needs and greater overall water use. The source of construction water has not yet been determined, but it is likely to be provided by Daly City's Department of Water and Wastewater Resources or SFPUC. Given the short-term nature of Project construction and the incremental demand for water during the construction period, the Project would be unlikely to require new water entitlements nor would it require new or expanded local water supplies.

Project operation would have a beneficial effect on water supply resources as the diversion of stormwater and authorized non-stormwater flows to Impound Lake would help the SFPUC operate Lake Merced within desired water levels. This would also help the SFPUC meet its goal in providing reliable emergency water supply for firefighting and sanitation purposes. For the above-described reasons, potential impacts related to water supply would be *less than significant*.

Mitigation: None required.

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f) Impact UTIL-3: Project construction would not result in a substantial adverse effect related to landfill capacity. (Less than Significant)

As described in Section 2.5.7, Construction Wastes, construction activities would result in an estimated 47,110 cubic yards of excess spoils (post-excavation volume) from various Project components including the Tunnel, Fort Funston shaft, Lake Merced Portal, box culvert, and diversion structure. Materials would be stored on-site and tested periodically. If any soil is found to contain hazardous materials, excess spoils would be characterized, transported from the Project site in lined container trucks, and disposed of at an appropriate landfill in compliance with federal, State, and local regulations. Refer to Section 3.8, Hazards and Hazardous Materials, for information regarding disposal of hazardous materials. As described in Chapter 2, Daly City would coordinate with the NPS to determine whether any excavated materials could be used on site for restoration. However, this analysis conservatively assumes that the total 47,110 cubic yards of excess spoils would be disposed of off-site.

As described in Section 3.16.3, Local Regulatory Setting, Daly City's Recycling and Diversion of Construction and Demolition Debris Ordinance requires that at least 60 percent of waste tonnage is recycled. San Francisco's 2006 C&D ordinance requires that a minimum of 65 percent of the material be diverted from the landfill. Since much of the Project construction activities would occur within San Francisco, this analysis assumes that the Project would comply with San Francisco's C&D ordinance, ensuring that at least 65 percent of the excess material (approximately 30,600 cubic yards) is diverted from landfills and that all C&D material is sent to a registered facility that reuses or recycles those materials. Approved facilities that accept mixed C&D debris include the following: Blue Line Transfer Inc. in South San Francisco, San Bruno Garbage Co, Inc., Allied San Carlos Transfer Station in San Carlos, and Recology's transfer station. As a result, the receiving landfill would receive up to 16,500 cubic yards of C&D materials over the construction period. The Project's contribution to the receiving landfill would be equal to less than 0.06 percent of the remaining capacity of the Corinda Los Trancos Landfill. However, as described in Section 3.16.1.6, operation of the Corinda Los Trancos Landfill is scheduled to be closed in January 2018, and Project construction could extend through mid-2018. Therefore, Daly City would need to find an alternative landfill for disposal of any additional construction waste generated from January 2018 through the end of the Project construction phase. It is possible that some Project-related waste could be off-hauled to the landfill that gets selected (possibly the Recology Ostrom Road Landfill in Yuba County). Other landfills in the San Francisco Bay Area that could accept waste include the Keller Canyon Landfill, which is located in Pittsburg and has an estimated remaining capacity of 63,408,410 cubic yards, and the Acme Landfill, which is located in Martinez and has a remaining capacity of approximately 175,000 cubic yards (CalRecycle, 2014e and 2014f). Because adequate capacity exists at the Corinda Los Trancos Landfill and because any additional construction waste generated beyond 2018 could be accommodated by other Bay Area landfills, potential impacts related to exceeding permitted landfill capacity during construction would be *less than significant.*

Additionally, annual and as-needed maintenance of the debris screening device would result in the need for solid waste disposal. It is anticipated that as much as 100 cubic yards of debris could be removed at each cleaning, and debris would be disposed of at Corinda Los Trancos Landfill located in Half Moon Bay. For the reasons described above, it is expected that this landfill would have adequate capacity to accommodate this infrequent disposal, and impacts during operation and maintenance would be *less than significant.*

Mitigation: None required.

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g) Impact UTIL-4: The Project would not result in a substantial adverse effect related to compliance with federal, State, and local statutes and regulations pertaining to solid waste. (Less than Significant)

Project implementation would generate waste materials, including construction debris, demolition materials, and excavated spoils that could exceed the local waste diversion goals or daily tonnage limit of local landfills, which would be a potentially *significant* impact. However, San Francisco's Construction and Demolition Ordinance prohibits C&D materials from being placed into the trash or sent directly to a landfill. Compliance with this ordinance would ensure that all Project-related waste is taken to a registered facility, which would arrange for the proper recycling, reuse, and disposal of the C&D materials that the Project produces. The registered facilities are required to divert a minimum of 65 percent of C&D materials from the landfill. Therefore, potential impacts related to compliance with federal, State, and local solid waste statutes and regulations would be *less than significant*. Disposal of debris screened from stormwater flows would comply with all applicable regulations for disposal of solid waste.

Mitigation: None required.

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h) Impact UTIL-5: Project construction could result in a substantial adverse effect related to disruption of utility operations or accidental damage to existing utilities. (Less than Significant)

Project construction could result in damage to or interference with existing water, sewer, storm drain, natural gas, electricity, and/or telecommunication lines. As shown in Table 3.16-1, above, a majority of these utility lines are located adjacent to the Vista Grande Canal either within or near the John Muir Drive right-of-way. Although the exact locations of some of the underground utilities is not known at this time, utility lines of varying sizes are located along and across several portions of the Vista Grande Canal.

As previously described, proposed improvements to the Vista Grande Canal would require relocation of AT&T communication cables, a PG&E gas line, the 33-inch treated wastewater effluent sewer line, and two Olympic Club sewer lines and other aboveground utilities. Specifically, excavation work necessary to accommodate construction of the new box culvert would require relocation of the following: an electric box, sewer manhole, several overhead power poles, a 30-inch sewer line, PG&E gas line, and 18-inch sewer line. In addition, construction of the new box culvert would require removal of approximately 1,400 feet of the existing Vista Grande Canal, which would in and of itself result in disruption to the operation of the canal. Some exposed pipes would be protected in place, including a PG&E gas line. Overhead utility poles and underground utility lines along the roadways could be damaged accidentally from the movement of large construction equipment and vehicles throughout the project area. Accidental rupture of or damage to these utility lines during project construction could temporarily disrupt utility services and, in the case of high-priority utilities, could result in significant safety hazards for construction workers and the public. For the above reasons, potential impacts on existing utilities and utility services during project construction could be potentially *significant*. However, compliance with the following existing regulations and codes established to avoid or minimize the potential for disrupting utilities and utility services by identification and protection or temporary disconnection of utility lines, notification and coordination with emergency response providers, and reconnection of utilities, would reduce potential impacts to a *less-than-significant* level.

Prior to construction activities, Daly City or its contractor(s) would determine the locations of overhead and underground utility lines, such as natural gas, electricity, sewer, telephone, cable, fuel, water, and MUNI lines, that may be encountered during construction work. Pursuant to various provisions of California law, Daly City or its contractor(s) is required to notify USA North so that utility companies may be advised of the work and may field-mark or otherwise protect and warn the contractor of their existing utility lines. Information regarding the location of existing utilities shall be reviewed before construction activities begin. Utilities may be located by customary techniques such as geophysical methods and hand excavation.

The project would adhere to Article 2.4 (Excavation in the Public Right of Way) of the San Francisco Public Works Code, which requires coordination of projects by entering project information into the SFDPW 5-year plan as well as issuing a Notice of Intent (NOI) letter.[2] Daly City and its contractors are bound to the CULCOP (Committee on Utility Liaison on Construction and other Projects), and the utility coordination process. Daly City is also required, to the extent possible, to coordinate with other agencies to identify conflicts and opportunities for coordination of excavations. In 2013, the SFDPW, Bureau of Street Use & Mapping launched the new Envista Utility Coordination tool. Using this tool, all governmental and private utilities enter their projects into the five year plan. In addition, the new Envista Utility Coordination tool is used to issue and track (NOI) & Request for Information tickets as well as to issue and track

[2] The purpose of the 5-year plan and NOI letter is to provide information to all Governmental Agencies and private utility companies about the upcoming project. The 5-year plan and NOI letter also provides the project engineer or responsible party an opportunity to coordinate with other projects that may fall within the project's schedule and limits and identify potential conflicts that requires further coordination (potholing, adjustment of utilities, redesign of project's alignment, etc).

Transmittal of Final Preliminary Plan (TFPP) tickets. All agencies have been informed to respond to the tickets through the Envista Utility Coordination tool.

Contract specifications generally include procedures for the excavation, support, and fill of areas around subsurface utilities, cables, and pipes. If the project encounters overhead electric and/or telephone lines during pipeline construction, Daly City or its contractor(s) would coordinate with SFMTA and appropriate telecommunication service providers to de-energize overhead electric lines as required by the federal and State Occupational Safety & Health Administration (OSHA) regulations.

As required by OSHA regulations (29 CFR §1926.651), while any excavation is open, Daly City or its contractors would protect, support, or remove underground utilities as necessary to safeguard employees. If construction activities result in damage to high-priority utility lines, Daly City or its contractor(s) would immediately notify the San Francisco Fire Department to protect worker and public safety.

As part of contract specifications, the contractor(s) would be required to provide updates on excavations planned for the upcoming week and to specify when construction will occur near a high-priority[3] utility. At the beginning of each week when this work will take place, per Cal/OSHA, the contractor is required to hold safety tailgate meetings and to document contents of meeting. Daly City or its contractor(s) would promptly notify utility providers to reconnect any disconnected utility lines as soon as it is safe to do so.

As required by Cal/OSHA, Daly City or its contractor(s) would develop an emergency response plan prior to commencing construction activities. The emergency response plan would identify measures to be taken in response to a leak or explosion resulting from a utility rupture. In addition, Daly City or its contractor(s) would notify the appropriate emergency response department whenever damage to any utility results in a threat to public safety.

Based on Project compliance with relevant provisions of the San Francisco's Public Works Code, Cal/OSHA requirements, and SFDPW's Envista Utility Coordination tool, there would be a *less-than-significant* impact to existing utilities.

Mitigation: None required.

3.16.5.2 Tunnel Alignment Alternative

The following describes the utilities and service systems effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.16.5.1, Proposed Project, or Section 3.16.5.3, Canal Configuration Alternative, depending on the option selected. Thus, utilities and service systems effects for the canal portion would be as described in those sections.

[3] Electric, water, and/or sewer lines.

Similar to the proposed Project excavations, excavation of the Lake Merced Portal, Tunnel, and Ocean Outlet under the Tunnel Alignment Alternative could require dewatering. The extent of excavation potentially requiring dewatering for the new tunnel alignment would be similar to that required for the Tunnel portion of the proposed Project. If necessary, Daly City would obtain a Wastewater Batch Discharge Permit from the SFPUC Wastewater Enterprise Collection System Division. Any discharged water directed to San Francisco's combined sewer system would be pumped to the Oceanside Treatment Plant. As with the proposed Project, it is anticipated that the Oceanside Treatment Plan has adequate capacity to serve this potential temporary incremental increase in wastewater. Discharge to an open channel or over land would be performed in accordance with municipal stormwater permits and the requirements of the Statewide General Construction Permit. Compliance with applicable permits would ensure that the Tunnel Alignment Alternative would not exceed wastewater treatment requirements issued by the San Francisco RWQCB. Therefore, as for the proposed Project, the Tunnel Alignment Alternative would have a *less-than-significant* impact related to exceeding wastewater treatment requirements of the San Francisco RWQCB or increasing demand for wastewater or stormwater treatment facilities.

The Tunnel Alignment Alternative is expected to use approximately the same amount of water as the proposed Project for dust suppression during construction activities, because the extent of surface disturbance for this alternative would be approximately the same. The source of the water also would be the same as for the proposed Project. Given the short-term nature of construction for the Tunnel Alignment Alternative and the incremental demand for water during the construction period, this alternative would be unlikely to require new water entitlements nor would it require new or expanded local water supplies. Therefore, potential impacts related to water supply would be *less than significant.*

The Tunnel Alignment Alternative would require disposal of a similar amount of excess spoils to the proposed Project, because a similar amount of excavation would be required, as described previously. As for the proposed Project, if any soil is found to contain hazardous materials, excess spoils would be characterized, transported from the project site in lined container trucks, and disposed of at an appropriate landfill in compliance with federal, State, and local regulations. Daly City would coordinate with the NPS to determine whether any excavated materials could be used on site for restoration. Furthermore, the Tunnel Alignment Alternative would be constructed in compliance with the San Francisco C&D ordinance for recycling of construction and demolition debris. A minimum of 65 percent of construction and demolition material from this alternative would be diverted from the landfill. Nearby landfills could accommodate the anticipated landfill waste generated from this alternative. Therefore, the potential impacts related to exceeding permitted landfill capacity would be *less than significant*. Compliance with San Francisco's C&D ordinance would ensure that potential impacts related to compliance with federal, State, and local solid waste statutes and regulations would be *less than significant.*

Construction of the Tunnel Alignment Alternative could result in damage to or interference with existing utility lines. The exact location of some of the underground utilities within the potential area of tunnel excavation (Figure 2-6) is not known at this time. If underground utility lines exist within the alternative alignment excavation area, potential impacts on these utilities could be *significant*. However, as for the proposed Project, compliance with existing regulations and codes established to avoid or minimize the potential for disrupting utilities and utility services by identification and protection or temporary disconnection of utility lines, notification and coordination with emergency response providers, and reconnection of utilities, would reduce potential impacts to a *less-than-significant* level.

3.16.5.3 Canal Configuration Alternative

The following describes the utilities and service systems effects associated with construction and operation of an alternative tunnel alignment. The canal components would be the same as described in Section 3.16.5.1, Proposed Project, or Section 3.16.5.3, Canal Configuration Alternative, depending on the option selected. Thus, utilities and service systems effects for the canal portion would be as described in those sections.

Similar to the proposed Project excavations, excavation of the diversion structure, including the box culvert below John Muir Drive, could require dewatering. The amount of dewatering would be expected to be less than the Canal portion of the proposed Project, because the extent of excavation would be less. Regardless, all permits mentioned for the proposed Project would apply to the Canal Configuration Alternative. As with the proposed Project, it is anticipated that the Oceanside Treatment Plan has adequate capacity to serve this potential temporary incremental increase in wastewater. Discharge to an open channel or over land would be performed in accordance with municipal stormwater permits and the requirements of the Statewide General Construction Permit. Compliance with applicable permits would ensure that the Canal Configuration Alternative would not exceed wastewater treatment requirements issued by the San Francisco RWQCB. Therefore, as for the proposed Project, the Canal Configuration Alternative would have a less-than-significant impact related to exceeding wastewater treatment requirements of the San Francisco RWQCB or increasing demand for wastewater or stormwater treatment facilities.

The Canal Configuration Alternative is expected to use less water than the Canal portion of the proposed Project for dust suppression during construction activities due to the decreased extent of surface disturbance associated with this alternative. The source of the water also would be the same as for the proposed Project. Given the short-term nature of construction for the Canal Configuration Alternative and the incremental demand for water during the construction period, this alternative would be unlikely to require new water entitlements nor would it require new or expanded local water supplies. Additionally, as for the proposed Project, the proposed alternative Canal configuration would have a beneficial effect on water supply resources during operation as the diversion of stormwater and authorized non-stormwater flows to Lake Merced would help the SFPUC operate Lake Merced within desired water levels and meet its goal in providing a reliable emergency water supply. Therefore, potential impacts related to water supply would be less than significant.

The Canal Configuration Alternative would generate a smaller amount of excess spoils requiring disposal than the proposed Project because of a reduction in the amount of excavation necessary. As for the proposed Project, if any soil is found to contain hazardous materials, excess spoils would be characterized, transported from the project site in lined container trucks, and disposed of at an appropriate landfill in compliance with federal, State, and local regulations. Furthermore, the Canal Configuration Alternative would be constructed in compliance with the San Francisco C&D ordinance for recycling of construction and demolition debris. A minimum of 65 percent of construction and demolition debris would be diverted from the landfill. Nearby landfills could accommodate the anticipated landfill waste generated from this alternative. Therefore, for the reasons stated above, the potential impacts related to exceeding permitted landfill capacity would be less than significant. Additionally, as for the proposed Project, compliance with San Francisco's C&D ordinance would ensure that potential impacts related to federal, State, and local solid waste statutes and regulations would be less than significant.

Construction of the Canal Configuration Alternative could result in damage to or interference with existing water, sewer, storm drain, natural gas, electricity, and/or telecommunication lines. This alternative would result in less excavation along the existing Vista Grande Canal alignment where utility lines of varying sizes are located along and across the canal, but could result in similar types of impacts as the proposed Project in this area. The exact location of some of the underground utilities is not known at this time. Potential impacts on existing utilities and utility services during alternative project construction could be significant. However, as for the proposed Project, compliance with existing regulations and codes established to avoid or minimize the potential for disrupting utilities and utility services by identification and protection or temporary disconnection of utility lines, notification and coordination with emergency response providers, and reconnection of utilities, would reduce potential impacts to a less-than-significant level.

3.16.5.4 No Project/No Action Alternative

The No Project/No Action Alternative would result in no impact to utilities and service systems, because no components of the proposed Project or of an alternative would be constructed or operated. The existing conditions at the proposed Project site would continue to persist, including periodic flooding of low-lying residential areas and along John Muir Drive during peak storm flows. As under existing conditions, the No Project/No Action Alternative would result in conditions during peak storm flows that would require the construction of new stormwater drainage facilities or the expansion of existing facilities in order to avoid flooding; however, no such construction or expansion could be authorized without additional environmental review.

3.16.6 Cumulative Effects

3.16.6.1 Geographic Extent/Context

The geographic scope of potential cumulative utilities and service systems impacts consists of the Project area, immediate vicinity, and the service areas of regional service/utility providers. For landfill capacity, the geographic scope includes the service areas of San Francisco, Alameda, San Mateo, and Contra Costa Counties where recycling, reuse and disposal of construction-related waste could occur. For compliance with solid waste statutes and regulations, the geographic area encompasses San Francisco. Section 3.1.4 describes the approach to the cumulative analysis used throughout this EIR/EIS; Table 3.1-1 summarizes cumulative projects in the vicinity of the Project. Existing significant adverse cumulative conditions relating to utilities and service systems in the Project vicinity consist of periodic exceedances of stormwater drainage facilities during peak storm flows.

3.16.6.2 Past, Present, and Reasonably Foreseeable Projects

As described in Table 3.1-1, there are several projects proposed in the Project vicinity, including groundwater and recycled water projects, and commercial and residential developments. More specifically, the following projects would be located near the Project site: the Pacific Rod and Gun Club Upland Soil Remediation Project, the San Francisco Westside Recycled Water Project, Lake Merced Pump Station Essential Upgrade, San Francisco Groundwater Supply Project, Regional Groundwater Storage and Recovery Project, the Parkmerced development, and the San Francisco State University Campus Master Plan 2007-2020.

3.16.6.3 Construction

Damage to or Disruption of Existing Utilities and Relocation of Utilities. Most of the above-described projects either would not overlap geographically with the proposed Project or alternatives or would not occur within the same timeframe as the proposed Project or alternatives; therefore, the likelihood for potential disruption of the same utility lines would be minor. Two projects in the near vicinity also could damage existing utilities or disrupt utility services, or cause relocation of utilities. In particular, the Regional Groundwater Storage and Recovery Project includes groundwater well construction just south of the proposed Project and could disrupt existing utilities or cause relocation of utilities. The Pacific Rod and Gun Club Upland Soil Remediation Project, proposed across John Muir Drive from the Lake Merced Tunnel Portal, also could require utility removal and replacement but this likely would occur prior to construction of the proposed Project. Concurrent implementation of either of these projects could cause service disruptions for the same set of customers within a short timeframe. Therefore, during construction, potential cumulative impacts related to disruption of utility operations or accidental damage to existing utilities and relocation of regional or local utilities could be significant; however, with compliance with existing regulations and codes established to avoid or minimize the potential for disrupting utilities and utility services by identification and protection or temporary disconnection of utility lines, notification and coordination with emergency response providers, and reconnection of utilities, the Project’s incremental contribution to this potential impact would not be cumulatively considerable.

Landfill Capacity and Compliance with Solid Waste Statutes and Regulations. As discussed in Section 3.16.5.1, Proposed Project, the Project would generate an estimated 11,780 cubic yards of excess spoils that would be deposited in a landfill (assuming compliance with San Francisco’s 75 percent diversion requirement). Most of the cumulative projects listed in Table 3.1-1 also would generate construction-related waste, as would other reasonably foreseeable projects throughout the service areas of San Francisco, Alameda, San Mateo, and Contra Costa counties where recycling, reuse and disposal of construction-related waste could occur. For the purposes of this analysis, it is conservatively assumed that if all of these wastes were disposed of in offsite disposal facilities, there could be a significant cumulative impact on landfill capacity. Most of the projects in Table 3.1-1, with the exception of the Regional Groundwater Storage and Recovery Project, would occur within San Francisco and would be required to divert at least75 percent of construction waste. The Regional Groundwater Storage and Recovery Project would be located in Daly City and other portions of San Mateo County and would be subject to the diversion goals of Daly City (60 percent diversion) as well as San Mateo County. Because the Corinda Los Trancos Landfill and other landfills in the Bay Area such as the Acme Landfill and the Keller Canyon Landfill have adequate capacity to accept construction waste generated by the Project, the Project's contribution to cumulative demand on landfill capacity would not be cumulatively considerable. In addition and similar to the proposed Project, all of the cumulative projects in San Francisco would be required to use a registered facility in compliance with the San Francisco C&D Ordinance and green building requirements. Therefore, the potential cumulative impact related to compliance with solid waste statutes and guidelines would be less than significant.

3.16.6.4 Operation and Maintenance

As described in Section 3.16.5.1, Proposed Project, the Project would not result in water supply impacts in the long-term as it would divert stormwater and authorized non-stormwater flows to Impound Lake, which would help the SFPUC operate Lake Merced within desired water levels. The Project would have no operational or maintenance impacts related to utility disruption and/or relocation. Finally, the amount of solid waste disposal anticipated during operation and maintenance (up to 100 cubic yards annually or as needed to clean the debris screening device) would be minimal and would not contribute to adverse cumulative impacts on landfill capacity. For these reasons, the Project's contribution to cumulative operation and maintenance-related impacts would not be cumulatively considerable.

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CHAPTER 4
Other CEQA/NEPA Considerations

4.1 Growth-Inducing Impacts

Section 15126.2(d) of the CEQA Guidelines requires that an environmental impact report (EIR) discuss "the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth…. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment."

As discussed in Section 3.14, Socioeconomics and Environmental Justice, the Project would not construct new housing or generate new permanent jobs to attract new residents or workers to the area, and therefore would not increase Daly City's or San Francisco's population. The Project would generate from 50 to 85 construction jobs over a period of about 24 to 44 months. This number of construction jobs represents from 0.1 percent to 0.2 percent of the construction jobs in the area (based on data for Marin, San Francisco and San Mateo counties) in 2012, and most jobs (with the exception of any specialized jobs) would be drawn from the local labor pool.

While the Project would improve storm drainage in a currently developed area, it would not extend public utility infrastructure to an area not already served by it. In addition, the periodic flooding that occurs along the Vista Grande Canal and nearby low-lying neighborhoods has not been an obstacle to past growth in these areas: the areas that would experience reduced flooding under the Project are already well established, developed neighborhoods (with both urban development and established open space). Therefore, the Project would not remove an obstacle to growth in the Vista Grande or Lake Merced neighborhoods of Daly City and San Francisco or in the cities overall. The Project would not be growth inducing according to CEQA provisions.

4.2 Energy Conservation

CEQA §21100(b) requires that an EIR discuss and consider mitigation measures for the potential energy impacts of proposed projects, with emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Appendix F of the CEQA Guidelines provides guidance for assessing the significance of potential energy impacts. It provides three objectives for achieving the ultimate goal of conserving energy:

1. Decreasing overall per capita energy consumption,

2. Decreasing reliance on natural gas and oil, and
3. Increasing reliance on renewable energy sources.

As provided below, this Project would not conflict with these objectives and would not result in changes in overall per capita energy consumption.

4.2.1 Environmental Setting

4.2.1.1 California's Energy System

Electricity

With a relatively mild Mediterranean climate and strict energy efficiency and conservation requirements, California has lower energy consumption rates per capita than other parts of the country. California has the fifth lowest annual electrical consumption rate per person, at approximately 70 percent of the national average (USEIA, 2014a). Nevertheless, with a population of 38 million people, California is the second largest energy-consuming state in the U.S. (USEIA, 2014b).

The production of electricity requires the consumption or conversion of energy resources including water, wind, oil, gas, coal, solar, geothermal, and nuclear sources. Of the electricity generated in California, 61.1 percent is generated by natural gas-fired power plants, 0.8 percent is generated by coal-fired power plants, 11.7 percent comes from large hydroelectric dams, and 9.3 percent comes from nuclear power plants. The remaining 17.1 percent in-state total electricity production is supplied by renewable sources including solar and wind power (CEC, 2013).

California's Renewable Portfolio Standard (RPS) requires retail electricity sellers to procure 33 percent of retail sales per year from eligible renewable sources by 2020. As of 2013, California receives 15.4 percent of its electricity from renewable sources including small hydroelectric generation (1.5 percent), biomass (2.3 percent), geothermal (4.4 percent), solar (0.9 percent), and wind (6.3 percent) (CEC, 2013). California leads the nation in electricity generation from non-hydroelectric renewable energy sources including geothermal power, wind power, fuel wood, landfill gas, and solar power. The state is also a leading generator of hydroelectric power (USEIA, 2012). The electricity generated and used in California is distributed via a network of transmission and distribution lines commonly called the power grid.

Petroleum

Approximately 38.2 percent of California's petroleum supply comes from in-state sources while 49.9 percent is imported from foreign sources and 11.8 percent is imported from Alaska (CEC, 2011). California is the fourth-largest petroleum producing area in the United States, behind federal off-shore production, Texas, and Alaska. Crude oil is moved within California through a network of pipelines that carry it from both on-shore and off-shore oil wells to the refineries that are located in the San Francisco Bay Area, the Los Angeles area, and the Central Valley. Currently, 20 petroleum refineries operate in California (USEIA, 2012).

Most crude oil produced in California is refined within California to meet state-specific formulations required by the California Air Resources Board. The major categories of petroleum fuels are gasoline and diesel for passenger vehicles, transit, rail vehicles, and construction equipment; and fuel oil for industry and electrical power generation.

In 2011, California consumed approximately 642.9 million barrels (27 billion gallons) of petroleum (USEIA, 2014b). Most of this is used in on-road motor vehicles. To meet transportation-related energy demand, the state relies almost exclusively on petroleum products.

4.2.1.2 Local Energy Systems

The Project is located within the service area of PG&E. PG&E provides electricity and natural gas service to approximately 15 million people and 600,000 commercial and industrial accounts throughout its 70,000-square-mile service area in northern and central California (PG&E, 2013a).

PG&E produces and purchases its energy from a mix of conventional and renewable generating sources. **Table 4-1** shows the electric power mix that was delivered to PG&E's retail customers in 2012.

TABLE 4-1
PG&E ELECTRIC POWER MIX 2012

Power Source	Percent (%) of Total Power Mix Delivered
Natural Gas	27
Nuclear	21
Coal	0
Large Hydroelectric	11
Other Fossil Fuels	0
Unspecified Sources	21
Eligible Renewables (19%):	
Biomass and Waste	4
Geothermal	5
Small Hydroelectric	2
Solar	2
Wind	6

SOURCE: PG&E, 2013b

4.2.2 Direct and Indirect Effects

4.2.2.1 Energy Consumption and Effects on Local and Regional Energy Supplies

The precise amount of petroleum fuel demand that would be required to construct the Project is uncertain; however, it is anticipated that gasoline and diesel would be used for construction equipment and worker and haul vehicles comparable to similar construction projects and that this consumption would not have a measurable effect on local and regional energy supplies. During operation, consumption of diesel and/or gasoline would be limited to infrequent maintenance trips and generators to operate the diversion structure pumps and gates.

This energy use would be necessary to implement the Project, and none of the proposed energy-consuming activities associated with each phase would be a wasteful, inefficient, or unnecessary use of energy. The Project would not have a significant impact with respect to fuel and electrical energy requirements or on local or regional energy supplies.

Mitigation: None required.

4.2.2.2 Compliance with Energy Standards

The permitting process for the Project would require compliance with all applicable energy-saving policies and standards. As discussed in Section 3.7, Greenhouse Gases, CALGreen includes a mandatory set of minimum guidelines, as well as more rigorous voluntary measures, for energy efficiency and material conservation. Moreover, pursuant to the *San Francisco Construction and Demolition Debris Recovery Ordinance*, the Project would be required to divert 65 percent of its construction and demolition debris from the landfill. Re-use of this diverted debris, as opposed to manufacture of new materials for new construction, would lower energy use. No adverse impact on efforts to achieve existing energy standards would result.

Mitigation: None required.

4.3 Significant and Unavoidable Effects

4.3.1 Proposed Project

The analysis in Sections 3.2 through 3.16 indicates that the potential environmental effects of the Project would cause significant impacts, although most of those can be reduced to less than significant with mitigation measures. However, one impact on cultural resources cannot be reduced to less than significant even with implementation of all feasible mitigation measures and is unavoidable because it cannot be alleviated without imposing an alternative design. Additionally, impacts related to coastal landforms and processes; and associated impacts associated with land use plans and policies, could remain significant and unavoidable even after the incorporation of available and feasible mitigation.

As described in Section 3.5, Cultural Resources, the Project would demolish and replace about 1,500 feet of the Vista Grande Canal and all of the Tunnel, causing a substantial part of the historic Vista Grande Canal and Tunnel system to be materially impaired, which would result in a substantial adverse change in the significance of the historical resource. Implementation of Mitigation Measure 3.5-1 (HABS/HAER Recordation) and 3.5-2 (Public Interpretation) would reduce the impact through compliance with the National Park Service Historic American Building Survey/Historic American Engineering Record program requirements and the preparation of public interpretation materials; however, there are no measures available that would avoid the loss of the structure below a less-than-significant level. Therefore, additional mitigation measures are not recommended by the lead agencies, and the demolition impact would be considered significant and unavoidable.

As described in Section 3.9, Hydrology and Water Quality, the Project could have substantial adverse effects on local shoreline sand supply and shoreline processes and localized rates of erosion, and would continue to preclude the bluffs and shoreline from eroding naturally, resulting in a significant impact on coastal landforms and processes. Implementation of Mitigation Measure 3.9-2 (Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies) would reduce potential adverse effects of the Project on these coastal resources by requiring design compliance with the California Coastal Act and NPS Management Policies regarding the protection of coastal resources. However, even with implementation of Mitigation Measure 3.9-2, elements of the Project necessary to ensure structural integrity may still conflict with the policies in Coastal Act Sections 30235 and 30253(b) due to potentially reduced local shoreline sand supply and altered shoreline processes. Therefore, even with implementation of Mitigation Measure 3.9-2, certain Project features associated with the Ocean Outlet structures may still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act Sections 30235 and 30253. As a result, this impact could remain significant and unavoidable even after the incorporation of available and feasible mitigation. For the same reason, the Project could conflict with an applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect, and Impact LU-1 also remains significant and unavoidable even after the incorporation of available and feasible mitigation.

4.3.2 Tunnel Alignment Alternative

The Tunnel Alignment Alternative could be paired with either the Canal improvements under the proposed Project or with the Canal Configuration Alternative. Paired with the Canal improvements under the proposed Project, the Tunnel Alignment Alternative would not avoid the significant impacts to the Vista Grande Canal and Tunnel as a historical resource, as the combination of these options would still demolish and replace a portion of the Canal and would fill the entire length of the Tunnel with concrete, affecting more than half of the Vista Grande Canal and Tunnel system. As this combination of alternatives would result in the physical demolition of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a significant impact. This impact could be reduced with implementation of Mitigation Measure 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). Even with implementation of Mitigation Measures 3.5-1 and 3.5-2, the impact of the Tunnel Alignment Alternative combined with the Canal improvements under the proposed Project would remain significant and unavoidable, as there are no measures available which would fully mitigate the partial loss of the Canal structure to a less-than-significant level.

Similarly, paired with the Canal Configuration Alternative, the Tunnel Alignment Alternative would demolish only about 500 feet of the existing Canal (150 for the temporary portal construction access ramp and 350 for the alternative debris screening device and diversion structure), but would fill the entire length of the Tunnel with concrete, affecting more than half of the Vista Grande Canal and Tunnel system. Although this combination would result in a more limited extent of physical demolition and permanent alteration, it would not substantially reduce the likelihood that the significance of the historical resource would be materially impaired. As this combination of alternatives would result in the physical demolition and alteration of a resource such that the significance of the historical resource would be materially impaired, it would cause a substantial adverse change in the significance of a historical resource, which is considered a significant impact. This impact could be reduced with implementation of Mitigation Measure 3.5-1 (HABS/HAER Documentation) and 3.5-2 (Public Interpretation). However, even with implementation of Mitigation Measures 3.5-1 and 3.5-2, the impact of the Canal Configuration Alternative combined with the Tunnel Alignment Alternative would remain significant and unavoidable, as there are no measures available which would fully mitigate the total loss of the Tunnel and partial loss of the Canal structure to a less-than-significant level.

Under this alternative, the new tunnel would terminate in a new or rehabilitated Ocean Outlet structure. The potential impact on coastal landforms and processes would be similar to that of the proposed Project. This impact could be reduced with implementation of Mitigation Measure 3.9-2 (Avoidance and Minimization of Conflicts with California Coastal Act and NPS Management Policies), but even with implementation of this measure, the Tunnel Alignment Alternative may still result in inconsistency with the policies governing local shoreline sand supply and alteration of landforms due to the construction of shoreline protective devices, provided in California Coastal Act Sections 30235 and 30253. As a result, this impact and Impact LU-1 could remain significant and unavoidable even after the incorporation of available and feasible mitigation.

The Tunnel Alignment Alternative would not result in additional significant and unavoidable impacts compared to the proposed Project, nor would it avoid any other significant impacts of the proposed Project.

4.3.3 Canal Configuration Alternative

The Canal Configuration Alternative could be paired with either the Tunnel improvements under the proposed Project or with the Tunnel Alignment Alternative. For the same reasons described above for the proposed Project and Tunnel Alignment Alternative, the Canal Configuration Alternative in combination with either Tunnel option would result in a significant and unavoidable impact on a historical resource (the Vista Grande Canal and Tunnel system) and on coastal landforms and processes, and associated land use impacts.

Additionally, as described in Section 3.11, Noise, construction activities along the Canal that would be necessary to construct the Canal Configuration Alternative may have the potential to exceed the significance threshold of 70 dBA L_{eq} speech interference for greater than two weeks. Implementation of Mitigation Measures 3.11-1 and 3.11-2 would reduce construction-related noise levels by approximately 5 to 15 dBA; however, if a noise reduction of at least 12 dBA is not achieved, the combined construction noise level would continue to exceed the speech interference significance threshold. Therefore, short-term construction-noise levels could remain significant after mitigation. Additionally, during impact pile driving for the Canal improvements under this alternative, the vibration level would be approximately 85 VdB and 0.007 in/sec peak particle velocity (PPV) at the nearest residential receptors. These vibration levels are above the FTA's construction vibration impact thresholds for residential land uses, and therefore would be considered significant. Implementation of Mitigation Measure 3.11-4 would reduce the potential impact, but not to a less-than-significant level. These noise and vibration impacts differ from those of the proposed Project (which is less than significant with mitigation) because, as a result of reconfiguring the Canal improvements to avoid approximately 1,000 feet of Canal demolition that would contribute to the significant unavoidable impacts of the proposed Project on historical resources, the location of impact pile driving for construction of the John Muir Drive crossing, Lake Merced Outlet, and debris screening device and diversion structure is moved closer to residences

Other than the above-described impacts, the Canal Configuration Alternative would not result in additional significant and unavoidable impacts compared to the proposed Project. Furthermore, this alternative would not avoid any other significant impacts of the proposed Project.

4.4 Significant Irreversible Environmental Changes

In accordance with CEQA Section 21100(b)(2)(B) and CEQA Guidelines Sections 15126(c) and 15126.2(c), the purpose of this section is to identify significant irreversible environmental changes that would be caused by the proposed Project.

Project construction would result in a significant irreversible commitment of natural resources through the use of fossil fuels and construction materials. The Project would require the commitment of energy resources to fuel and maintain construction equipment (such as gasoline, diesel, oil, and lubricants) during the construction period. Project construction would commit resources, such as concrete, steel, and other materials to be used for the proposed Canal and Tunnel improvements.

As described in Section 3.5, Cultural Resources, the Project and alternatives would cause a substantial part of the historic Vista Grande Canal and Tunnel system to be materially impaired through the demolition of up to 1,500 feet of the Vista Grande Canal and demolition or permanent fill of the Tunnel, which would be a significant irreversible impact.

Accidents, such as the release of hazardous materials during construction, could trigger irreversible environmental damage. As discussed in Section 3.8, Hazards and Hazards Materials, Project construction would involve limited quantities of miscellaneous hazardous substances, such as gasoline, diesel fuel, oils and lubricants, paints and thinners, solvents, and other chemicals. On the Project site, hazardous materials such as lead could be present in excavated soil or dewatered groundwater. Inadvertent releases could expose the environment (such as stormwater and downstream receiving water bodies), construction workers, and/or the public to contaminants. However, construction activities must comply with numerous hazardous materials and stormwater regulations designed to ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect worker safety, and to reduce the potential for a release of construction-related fuels or other hazardous materials to affect stormwater and downstream receiving water bodies (see Section 3.8.2, Regulatory Setting). Therefore, significant irreversible changes from accidental releases are not anticipated.

4.5 Irreversible or Irretrievable Commitments of Resources

In accordance with NEPA Section 102(c)(v) and the NPS DO-12 Handbook section 8(b), the purpose of this section is to identify any irreversible or irretrievable commitments of resources that would be involved if any of the alternatives were implemented. Irreversible impacts are those effects that cannot be changed over the long term or are permanent. An irretrievable commitment of resources refers to the effects to resources that, once gone, cannot be replaced.

The proposed Project and the Tunnel Alignment Alternative would increase the diameter of the existing Tunnel or build a new tunnel, respectively, and therefore would result in an irretrievable commitment of an underground area currently not occupied by the existing Tunnel. Construction of the proposed Project or an action alternative would irretrievably commit on-site geologic material and off-site materials, such as concrete, steel, and other building materials. Off-site fuel sources would also be irretrievably committed to power construction equipment. Furthermore, the time needed from NPS staff for review of the proposed Project and monitoring of construction and maintenance compliance would be irretrievably committed.

As discussed in Section 3.5, Cultural Resources, and above in Section 4.4, Significant Irreversible Environmental Changes, the Project would demolish a portion of the historic Vista Grande Canal and the entire Tunnel, and therefore would irreversibly affect these historic resources.

4.6 Short-term Uses and Long-term Productivity

In accordance with NEPA Section 102(c)(iv) and the NPS DO-12 Handbook section 8(a), the purpose of this section is to discuss the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. DO-12 Handbook Section 8(a) asks: are any long-term management possibilities, or the productivity of park resources, being traded for the immediate use of land? Will taking action in this case in combination with other actions have an impact on a particular ecosystem? Is the action being taken something that will affect future generations—is it a sustainable action that can continue over the long term without environmental problems?

Short-term uses of the environment resulting from the proposed Project or alternatives are described in Chapter 3, Environmental Analysis. Some short-term uses could result in temporary adverse impacts to resources such as air quality, water quality and hydrology, biological resources and therefore will not impact the long-term productivity of the environment. Mitigation measures are proposed to avoid, minimize, or mitigate activities that impact long term productivity. Short-term uses of park resources include the temporary use of land for construction and staging within Fort Funston and on the beach below. The effects of these uses are described throughout Chapter 3, and in particular in Sections 3.2, Aesthetics; 3.4, Biological Resources; 3.11, Noise; 3.13, Recreation; and 3.16, Traffic and Transportation. The Project also would result in the removal and/or physical disturbance of geologic resources in the Merced Formation as a result of drilling the Tunnel shaft and new Tunnel. These uses would not affect long-term management possibilities for Fort Funston. Disturbed land would be restored in contour and vegetation with NPS approval.

The proposed Project is intended to promote long-term resource enhancement and sustainability by beneficially reusing stormwater and authorized non-storm flows that currently are discharged to the Pacific Ocean to provide a sustainable source of water for management of Lake Merced water levels. As described in Section 3.9, Hydrology and Water Quality, this is expected to enhance the long-term productivity of the lake as a recreational and habitat resource, and enhance the long-term productivity of the SFPUC's water delivery system by reducing or eliminating the need to find alternative sources of water for Lake Merced management. Additionally, the Project would enhance recreational resources at Fort Funston over the long term by removing a barrier to beach access (the Ocean Outlet structure) and maintaining it over time to maintain that access. Over the long term, the Project would beneficially affect Fort Funston compared to continued operation of the existing Vista Grande infrastructure.

4.7 Areas of Known Controversy

CEQA Guidelines Section 15123(b) requires that an EIR include a description of areas of controversy known to the lead agency, including issues raised by agencies and the public and issues to be resolved, such as the choice among alternatives and whether or how to mitigate the significant impacts. Based on verbal input received during public scoping meetings and written input received during the comment period for the notice of preparation (NOP), there are no areas of known controversy. However, through the public scoping process several areas of interest were identified, primarily focusing on the physical, biological, cultural, socioeconomic, and other resources that could be affected by the proposed Project and alternatives. See Section 1.7, Issues Addressed in the Analysis.

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CHAPTER 5
Consultation and Coordination

Section 15129 of the CEQA Guidelines requires that an environmental impact report (EIR) shall identify all federal, state, or local agencies, or other organizations, and private individuals consulted in preparing the draft EIR, and the persons, firm, or agency preparing the draft EIR. The NPS NEPA guidelines (Director's Order No. 12 and Handbook) indicate that a Consultation and Coordination section should include a brief history of public involvement, a list of preparers and their expertise, and a list of recipients of the EIS.

The brief history of public involvement, including a description of public scoping sessions and other public involvement efforts, and a summary of issues raised during the scoping process, is included in Chapter 1, Introduction.

5.1 Consultation and Coordination with Federal and State Agencies

5.1.1 U.S. Army Corps of Engineers

Daly City prepared and submitted a Preliminary Delineation of Waters of the United States (Preliminary Delineation) to the USACE in January 2014. Following a field verification with in April 2014, Daly City submitted a revised Preliminary Delineation in September 2014.

Daly City representatives attended an interagency meeting hosted by the USACE on August 13, 2014 and gave a presentation describing the proposed Project; and met with USACE staff in November 2014 and May 2015 to discuss the proposed Project components, review the agency's jurisdiction, identify resource issues that should be considered in the EIR/EIS, and discuss potential permitting approaches and requirements. Of primary interest to USACE staff were effects on jurisdictional wetlands and other waters of the United States, and alternatives that would reduce effects to these resources.

5.1.2 CCC

Daly City staff met with California Coastal Commission (CCC) staff three times during the preparation of the EIR/EIS. The first meeting occurred during the August 13, 2014 USACE interagency meeting described above. The second and third meetings were held on October 27, 2014 and May 5, 2015, respectively, at the CCC's San Francisco Office. The purpose of these meetings was to provide CCC staff with an overview of the Project, review the agency's jurisdiction, identify resource issues that should be considered in the EIR/EIS, and discuss potential permitting approaches and requirements. The Project schedule was also discussed at the meetings. Of primary interest to CCC staff were issues of public access, environmentally sensitive habitat areas, sea level rise and shoreline erosion, and geologic stability of the bluff.

5.1.3 CSLC

Daly City staff met with California State Lands Commission (CLSC) staff once during preparation of the EIR/EIS. The meeting was conducted via teleconference on October 29, 2014. The purpose of the meeting was to provide CLCS staff with an overview of the Project, review the agency’s jurisdiction, identify resource issues that should be considered in the EIR/EIS, and to discuss permitting requirements. The Project schedule was also discussed at the meeting. Of primary interest to CLSC staff was determining the landward extent of CLSC jurisdiction (given the inland migration of shoreline with bluff erosion) and ensuring that resources within that jurisdiction are protected.

5.1.4 CDFW

Daly City staff met with California Department of Fish and Wildlife (CDFW) staff twice during preparation of the EIR/EIS. The first meeting occurred during the August 13, 2014 USACE interagency meeting described above. The second meeting was held on October 15, 2014 and consisted of a project site visit with Suzanne Deleon of the CDFW to introduce the CEQA/NEPA Lead Agencies and their roles, provide a summary of the project components and proposed schedule, identify sensitive resources, identify anticipated CDFW permits and approvals needed, and discuss any additional key regulatory issues.

5.1.5 NAHC

ESA contacted the Native American Heritage Commission (NAHC) on November 6, 2012 to request a database search for sacred lands or other cultural properties of significance within or adjacent to the APE. ESA received a response on November 21, 2012. The NAHC database search of the sacred lands file failed to identify the presence of cultural resources in the vicinity of the APE. The NAHC provided a list of Native American contacts that might have further knowledge of cultural resources in the vicinity of the APE. NPS sent letters to the list of contacts on October 29, 2014 requesting knowledge of resources in the APE to which they may attach cultural or religious significance. No responses from these contacts have been received as of the publication of this Draft EIR/EIS.

5.1.6 SHPO

As discussed in Section 3.5, Cultural Resources, the Section 106 process has been initiated between the NPS and SHPO, and historical properties eligible for inclusion in the National Register have been identified (NPS, 2014). The SHPO has offered preliminarily concurrence with NPS that the Vista Grande Canal and Tunnel is eligible for listing in the National Register under Criteria A and C with a period of significance of 1877 to 1934, and has requested additional information regarding the character-defining features and contributing components of the system before considering official concurrence (California SHPO, 2015). Immediately following publication of the Draft EIR/EIS, the NPS and SHPO intend to assess the effects of the Project (or "undertaking") on historic properties within the APE, and will resolve adverse effects in accordance with 36 CFR 800.6.

5.1.7 RWQCB

Consultation with the San Francisco RWQCB regarding for the proposed Project regarding proposed reuse of stormwater to augment Lake Merced levels began in 2011. In collaboration with the SFPUC and RWQCB, Daly City designed and implemented dry and wet season monitoring programs for Lake Merced and the Canal and prepared the Water Quality Assessment.

5.2 Coordination with Interested Parties

Coordination with parties interested in management of Lake Merced began in 2011 and includes individual briefings and invitation to attend and participate in many of the agency meetings described above.

5.3 List of Recipients

The following recipients received copies of the Draft EIR/EIS by mail. Additional recipients received notifications of the availability of the Draft EIR/EIS by mail, with instructions for accessing an electronic version via the internet or for accessing a copy of the document at a local library or at the City of Daly City offices. A complete list of all document and notification recipients is available by request from Daly City.

Federal Agencies	
• U.S. Army Corps of Engineers San Francisco District • USFWS Region 8	• USEPA Region 9
State and Local Agencies	
• Bay Area Air Quality Management District • California Coastal Commission • California Department of Fish & Wildlife • California Department of Transportation, District 4 • California Department of Water Resources • California Native American Heritage Commission • California OPR - State Clearinghouse • California Public Utilities Commission • California State Coastal Conservancy	• California State Historic Preservation Officer • California State Lands Commission • Daly City Public Library, Westlake Branch • Regional Water Quality Control Board, San Francisco Bay Region • San Francisco City Attorney's Office • San Francisco Mayor's Office • San Francisco Public Utilities Commission • San Francisco Public Library, Merced Branch

Indian Tribes	
• Ohlone/Costanoan • Amah Mutsun Tribal Band of Mission San Juan Bautista of the Ohlone/Costanoan • Amah Mutsun Tribal Band of Mission San Juan Bautista of the Ohlone/Costanoan • Coastanoan Rumsen Carmel Tribe of the Ohlone/Costanoan	• Indian Canyon Mutsun Band of Costanoan of the Ohlone/Costanoan • Muwekma Ohlone Indian Tribe of the SF Bay Area of the Ohlone/Costanoan • The Ohlone Indian Tribe of the Ohlone/Costanoan, Bay Miwok, Plains Miwok, Patwin • Trina Marine Ruano Family of the Ohlone/Costanoan, Bay Miwok, Plains Miwok, Patwin
Organizations	
• Cal Trout	• Olympic Club

5.4 List of Preparers

Name	**Position/Qualifications**	**Primary Responsibility**
Daly City – Project Proponent and CEQA Lead Agency		
Patrick Sweetland	Director of Water and Wastewater Resources	Daly City Project Manager
Patricia Martel	City Manager	Project Oversight
Rose Zimmerman	City Attorney	Project Oversight
National Park Service – NEPA Lead Agency		
Steve Ortega	Planning Division	NPS Project Manager
Stephen Haller	Historian	Cultural Resources
Bob Holloway		Cultural Resources
Stephen Kasierski	Fort Baker Real Estate Project Manager	Real Estate
Kristen Ward	Golden Gate Research Coordinator	Natural Resources
Tania Pollak		Recreation and Transportation
Will Elder	Golden Gate National Recreation Area Interpretative Ranger	Geology and Paleontology
Daphne Hatch	Chief of Natural Resources Management & Research	Paleontology
Christopher Carpenter	Golden Gate National Recreation Area Civil Engineer	Geology and Soils
San Francisco Public Utilities Commission – Responsible Agency		
Obi Nzewi	Project Manager	SFPUC Project Manager
Greg Bartow	Groundwater Program Manager	Project Oversight
Kelley Capone	SFPUC Environmental Project Manager	Project Oversight
Paula Kehoe	Director of Water Resources	Project Oversight
Joshua Milstein	City Attorney	Project Oversight
John Roddy	City Attorney	Project Oversight

Name	Position/Qualifications	Primary Responsibility
McMillen Jacobs Associates, Inc. – Project Engineers		
Blake Rothfuss, PE, D.WRE		Project Manager
Shawn Spreng, PE		Project Engineer
Environmental Science Associates – Environmental Consultant		
Luke Armbruster	Associate, Engineer-In-Training; B.S. Environmental Resources Engineering	Utilities and Service Systems
Stan Armstrong	Noise and Air Quality Analyst; B.A., Civil Engineering	Noise and Vibration
Rebecca Allen	Cultural Resources Director, Registered Professional Archeologist; Ph.D., Historical Archeology	Cultural Resources
Joshua Boldt	Managing Associate/Botanist/Arborist, International Society of Arboriculture Certified Arborist; B.S., Biology	Biological Resource (Botany)
Brad Brewster	Architectural Historian/Preservation Planner; M.S.; Urban Design and Planning and M.S. Certificate, Historic Preservation	Historic Resources
Michael Burns	Director of the Geology-Hydrology-Hazardous Materials Technical Services Group, Certified Engineering Geologist (C.E.G.), Professional Geologist (P.G.); B.S. Geology	Geology and Soils, Paleontology, Hazards and Hazardous Materials
Allisa Carlson	Senior Associate; Professional Landscape Architect, Leadership in Energy and Environmental Design (LEED) AP	Aesthetics
Rachel Danielson	Senior Associate Biologist; B.S., Public Affairs	Biological Resources (Wildlife)
Eli Davidian	Managing Associate; M.S., Natural Resources and Environment; M.U.P.	Recreation, Coastal Zone policy
Michelle Giolli-Hornstein	Senior Associate; B.S. Ecology and Systematic Biology	Wetlands and Water Resources
Todd Gordon	Associate, LEED AP; B.S., Animal Science & Management	Geology and Soils
Erin Higbee-Kollu	Managing Associate; M.S., Resource Policy and Behavior	Land Use and Planning, Recreation
Peter Hudson	Senior Geologist/Hydrogeologist, P.G., C.E.G.; B.A., Geology	Hydrology and Water Quality
Jack Hutchison	Senior Transportation Engineer, Professional Engineer; M.E., Transportation Engineering	Transportation and Traffic
Heidi Koenig	Senior Archaeologist; M.A., Cultural Resources Management	Archaeological and Paleontological Resources
Alisa Moore	Bay Area Water Business Group Director; B.S., Biology	Project Manager; Aesthetics, Land Use, Recreation
Chris Mueller	Technical Associate; M.C.P., Environmental Policy and Planning	Socioeconomics and Environmental Justice
Tim Rimpo	Air Quality Program Manager; M.S., Economics	Noise and Vibration

Name	Position/Qualifications	Primary Responsibility
Environmental Science Associates – Environmental Consultant (cont.)		
Chris Rogers	Senior Ecologist/Director of Biological Resources; B.S., Biology	Biological Resources
Chris Sanchez	Senior Technical Associate; B.S., Environmental Science	Air Quality, Greenhouse Gas Emissions and Climate Change, Noise and Vibration
Megan Steer	Associate; B.A., Environmental Studies and B.A., Geography	Hazards and Hazardous Materials
Justin Taplin	Technical Associate; M.S., Environmental Management	Hydrology and Water Quality, Fisheries Resources
Alexandra Thompson	Managing Associate; M.A., Urban Planning	Deputy Project Manager; Project and Alternatives, Quality Assurance/Quality Control
Eric Zigas	Principal Associate; B.A., Geography	Project Director, Quality Assurance/Quality Control
Downey Brand - CEQA/NEPA Legal Consultant		
Nicole Granquist		Consulting Attorney
Arielle Harris		Consulting Attorney
Christian Marsh		Consulting Attorney

References

California State Historic Preservation Officer (SHPO), 2015. Letter dated January 28, 2015 Re: Vista Grande Drainage Basin Improvement Project.

National Park Service (NPS), 2014. Letter dated December 15, 2014 Re: Identification Efforts under National Historic Preservation Act Section 106 for the Vista Grande Drainage Basin Improvement Project.

CHAPTER 6
Acronyms and Abbreviations

µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
°F	degrees Fahrenheit
°C	degrees Celsius
AADT	annual average daily traffic
AB	Assembly Bill
AB 939	California Integrated Waste Management Act
ABAG	Association of Bay Area Governments
ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ADT	average daily traffic
AMR	American Medical Response
APE	area of potential effects
ARDTP	Archaeological Research Design and Treatment Plan
ASCE	American Society of Civil Engineers
AWW	Arroyo Willow Wetland
BAAQMD	Bay Area Air Quality Management District
BART	Bay Area Rapid Transit
Basin	Vista Grande Drainage Basin
Basin Plan	San Francisco Bay RWQCB Water Quality Control Plan
bgs	below ground surface
BLM	Bureau of Land Management
BMP	best management practice
BW	bullrush wetland
BOD	biological oxygen demand
C&D	construction and demolition
CAA	Clean Air Act
CAAQS	California ambient air quality standards
Cal EPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
Cal/OSHA	California Occupational Safety and Health Administration
Cal Trout	California Trout, Inc.
Cal Water	California Water Service Company

CalEMA	California Geological Survey, California Emergency Management Agency
CALGreen	California Green Building Standards Code
California Register	California Register of Historical Resources
Caltrans	California Department of Transportation
CAP	Clean Air Plan
CAP	Climate Action Plan
CARB	California Air Resources Board
CBC	California Building Code
CCAA	California Clean Air Act
CCAMP	California Coastal Analysis and Mapping Project
CCAR	California Climate Action Registry
CCC	California Coastal Commission
CCH	Consortium of California Herbaria
CDC	California Department of Conservation
DOGGR	Division of Oil, Gas, and Geothermal Resources
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDMG	California Department of Mines and Geology
CDP	Coastal Development Permit
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGP	Construction General Permit
CGS	California Geological Survey
CH_4	methane
City Datum	San Francisco City Datum
CIWMA	California Integrated Waste Management Act
CMP	congestion management plan
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPPA	California Native Plant Protection Act
CNPR	California Rare Plant Ranking
CNPS	California Native Plant Society
CO	carbon monoxide
CO-CAT	Coastal and Ocean Working Group of the California Climate Action Team
CO_2	carbon dioxide
CO_2e	CO_2 equivalents

COLD	Cold Freshwater Habitat
COD	chemical oxygen demand
Corps	U.S. Army Corps of Engineers
CPUC	California Public Utilities Commission
CRPR	California Rare Plant Rank
CRSR	Cultural Resources Survey Report
CSLC	California State Lands Commission
CSMD	California State Military Department
CSO	Combined Sewer Overflow
CT	Census Tract
CULCOP	Committee on Utility Liaison on Construction and other Projects
CUPA	Certified Unified Program Agencies
CWA	Clean Water Act
CWC	California Water Code
cy	cubic yard
CZMA	Coastal Zone Management Act
dB	decibels
dBA	A-weighted decibels
DBI	Department of Building Inspection
DCPD	Daly City Police Department
DEC	Division of Emergency Communications
DES	Division of Emergency Services
DLRP	Division of Land Resource Protection
DO	Director's Order
DO	Dissolved Oxygen
DPH	Department of Public Health
DPM	diesel particulate matter
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EA	Environmental Assessment
Eds.	Editors
EDD	California Employment Development Department
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
El.	Elevation
EMS	Emergency Medical Services
EO	Executive Order
ESA	federal Endangered Species Act or Environmental Science Associates
E. coli	*Escherichia coli*
ESHA	Environmentally Sensitive Habitat Area
FEMA	Federal Emergency Management Agency
FHSZ	Fire Hazard Severity Zone

FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FTA	Federal Transit Administration
FUDS	Formerly Used Defense Sites
FWCA	Fish & Wildlife Coordination Act
FY	fiscal year
g	gravity
GFNMS	Gulf of the Farallones National Marine Sanctuary
GGNRA	Golden Gate National Recreation Area
GHG	greenhouse gas
GIS	geographic information system
GMP	General Management Plan
gpm	gallons per minute
GPS	Global Positioning System
gsf	gross square feet
GSP	Groundwater Supply Project
GSR	Regional Groundwater Storage and Recovery
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HAPs	Hazardous Air Pollutants
Harding Park	Tournament Players Cup Harding Park and Fleming Golf Courses
HFC	hydrofluorocarbon
hp	horsepower
HRT	hydraulic residence time
HTL	high tide line
HUD	U.S. Department of Housing and Urban Development
Hz	hertz
I-280	Interstate 280
IBC	International Building Code
Interior	Department of the Interior
IPCC	International Panel on Climate Change
kW	kilowatts
KW	Knotweed Wetland
LCP	local coastal program
L_{dn}	day-night noise levels
LID	Low Impact Development
LMP	Lake Management Plan
LOS	level of service
LRP	Legally Responsible Person
LSAA	Lake and Streambed Alteration Agreement
LUST	Leaking Underground Storage Tank

MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant levels
MEP	Maximum Extent Practicable
mg	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MLD	most likely descendant
mm	millimeters
MM	Modified Mercalli
MMI	Modified Mercalli Intensity
MMPA	Marine Mammal Protection Act
Model	Lake Merced Lake-Level Model
mph	miles per hour
MRP	Municipal Regional Stormwater Permit
MS4	Municipal Separate Stormwater System
MSAA	Master Streambed Alteration Agreement
MSDS	material safety data sheets
MTBM	micro-tunnel boring machine
MTC	Metropolitan Transportation Commission
MUN	Municipal and Domestic Supply
Muni	San Francisco Municipal Railway system
N_2O	nitrous oxide
N:P	nitrogen-to-phosphorous ratio
AAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NAL	numeric action limit
National Register	National Register of Historic Places
NAVD88	North American Vertical Datum of 1988
NCCOS	National Centers for Coastal Ocean Science
NEL	numeric effluent limitation
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NGVD 29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOP	Notice of Preparation

NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NTU	Nephelometric Turbidity Units
NWIC	Northwest Information Center
Ocean Plan	Water Quality Control Plan, Ocean Waters of California
OEHHA	Office of Environmental Health Hazard Assessment
OGCC	Olympic Golf and Country Club
OHP	Office of Historic Preservation
OHWM	Ordinary High Water Mark
OMB	Office of Management and Budget
OPR	Office of Planning and Research
Organic Act	Organic Act of 1916
OSHA	Occupation Safety and Health Administration
OWPCP	Oceanside Water Pollution Control Plant
pcf	pounds per cubic foot
PFC	perfluorocarbon
PFYC	Potential Fossil Yield Classification
PG&E	Pacific Gas & Electric
PGA	peak ground acceleration
pH	hydrogen potential
PI	plasticity index
Plan	Flood Management Plan
PM2.5	fine particulate matter
PM10	particulate matter
Porter-Cologne	Porter-Cologne Water Quality Control Act
ppm	parts per million
PPV	peak particle velocity
Project	Vista Grande Drainage Basin Improvement Project
PRD	Permit Registration Document
PRPA	Paleontological Resources Preservation Act
PSD	Prevention of Significant Deterioration
psf	pounds per square foot
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
RCNM	Road Construction Noise Model
RCRA	Resource Conservation and Recovery Act of 1976
REC1	Body-contact Recreation
REC2	Noncontact Water Recreation
RMS	root mean square

ROD	Record of Decision
ROG	reactive organic gases
ROW	rights-of-way
RPS	Renewable Portfolio Standard
RPW	Relatively Permanent Water
RWQCB	Regional Water Quality Control Board
SMAQMD	Sacramento Metropolitan Air Quality Management District
SamTrans	San Mateo County Transit District
SB	Senate Bill
SDC	seismic design category
SF_6	sulfur hexafluoride
SF Zoo	San Francisco Zoo
SFBAAB	San Francisco Bay Area Air Basin
SFDE	San Francisco Department of the Environment
SFDPW	San Francisco Department of Public Works
SFEI	San Francisco Estuary Institute
SFFD	San Francisco Fire Department
SFHA	Special Flood Hazard Area
SFMTA	San Francisco Municipal Transportation Agency
SFRPD	San Francisco Recreation and Parks Department
SFPD	San Francisco Police Department
SFPUC	San Francisco Public Utilities Commission
SFSU	San Francisco State University
SFUSD	San Francisco Unified School District
SHPO	State Historic Preservation Officer
SMCSPPP	San Mateo Countywide Stormwater Pollution Prevention Program
SNRAMP	Significant Natural Resources Areas Management Plan
SO_2	sulfur dioxide
SPUR	San Francisco Planning and Urban Research Association
SPWN	Fish Spawning
SR	State Route
SR 1	19th Avenue
SR 35	Skyline Boulevard
SSIP	Sewer System Improvement Program
SVP	Society of Vertebrate Paleontology
SVWC	Spring Valley Water Company
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
TASC	Transportation Advisory Staff Committee

TDS	total dissolved solids
TFPP	Transmittal of Final Preliminary Plan
TIN	Total Inorganic Nitrogen
TMDL	Total Maximum Daily Load
TNW	Traditionally Navigable Water
TPC	Tournament Players Cup
TPZ	Tree Protection Zone
TSS	Total suspended solids
UCMP	University of California Museum of Paleontology
USA North	Underground Services Alert
USEIA	U.S. Energy Information Administration
USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
Vdb	Decibel notation
VFWD	Vermont Fish and Wildlife Department
VOC	volatile organic compounds
VSS	volatile suspended solids
WARM	Warm Freshwater Habitat
WBWG	Western Bat Working Group
WDR	Waste Discharge Requirement
WEAP	Worker Environmental Awareness Program
WGCEP	Working Group on California Earthquake Probabilities
WILD	Wildlife Habitat
WQA	Water Quality Assessment
WQO	Water Quality Objective
WSE	water surface elevation
WSIP	Water System Improvement Program
WWTP	Wastewater Treatment Plant

CHAPTER 7
Glossary

Adventitious. Not arising from or growing in the typical location on a plant, such as roots growing on stem nodes or leaf tissue.

Applicability thresholds. Federally defined pollutant emission rates specific to a given air basin's attainment status that, if exceeded, would require a detailed General Conformity Assessment to determine if the proposed action would be consistent with the State Implementation Plan and the federal Clean Air Act.

Arbovirus. A term used to refer to a group of viruses that are transmitted by arthropod vectors.

Authorized non-stormwater. Flows conveyed via stormwater systems that are in compliance with RWQCB requirements.

Bacterial methods. Bacteria that infect and kill mosquito larvae. These bacteria are highly selective, killing only mosquitoes and their close relatives like gnats and black flies, and do not harm other kinds of insects, fish, birds, or mammals.

Bioregion. An area defined by a combination of ecological, geographic, and social criteria and consists of a system of related, interconnected ecosystems.

California fully protected species. The "fully protected" classification was California's initial effort in the 1960s to identify and provide additional protection to those animals that were rare or faced possible extinction. The designation can be found in the Fish and Game Code.

California species of special concern. One that: has been extirpated from the state; meets the state definition of threatened or endangered but has not been formally listed; is undergoing or has experienced serious population declines or range restrictions that put it at risk of becoming threatened or endangered; and/or has naturally small populations susceptible to high risk from any factor that could lead to declines that would qualify it for threatened or endangered status.

CO_2e (Carbon Dioxide Equivalent). Carbon dioxide equivalent is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO2 that would have the same global warming potential (GWP), when measured over a specified timescale.

Colluvium. A loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.

Cyclic densification (also referred to as differential compaction). A phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground surface settlement.

Dissolved Oxygen (DO). The amount of oxygen dissolved in a body of water as an indication of the degree of health of the water and its ability to support a balanced aquatic ecosystem, usually expressed in milligrams per liter, parts per million, or percent of saturation.

Endemism. Refers to the degree to which organisms or taxa are restricted to a geographical region or locality and thus are individually characterized as endemic to that area.

Energy-equivalent sound level (Leq). Used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

Environmentally sensitive area. Section 30107.5 of the Coastal Act provides the following definition: "Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments. Section 30240 of the California Public Resources Code states: (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas [and] (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

Epilimnion. The upper, warmer layer of water in a lake.

Generated waste. Includes waste that is both disposed of and diverted.

Geomorphic province. An area that possesses similar bedrock, structure, history, and age.

High-priority utility. Electric, water, and/or sewer lines.

Hydrophytic vegetation. Defined by the USFWS as plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hypolimnion. The lower, colder layer of water in a lake. Also called the thermocline.

Lake stratification. The separation of a lake into three layers: the top of the lake, referred to as the epilimnion; the middle of the lake, referred to as the metalimnion; and the bottom layer of the lake, referred to as the hypolimnion. The amount of lake stratification can vary over the day as well as seasonally, depending on a number of factors.

Lateral spreading. A phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

Ldn (also abbreviated DNL). A 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

Liquefaction. A transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

Littoral Zone. The near-shore area where sunlight penetrates all the way to the sediment and allows aquatic plants to grow.

L_{max}. The instantaneous maximum noise level for a specified period of time.

Local register of historical resources. A list of historical or archaeological properties officially adopted by ordinance or resolution by a local government (Pub. Res. Code §5020.1[k]).

Marginal nonattainment area. An area designated marginal nonattainment for the one (1) hour national ambient air quality standard for ozone.

Metric ton. Equal to 1,000 kilograms; it is equal to approximately 1.1 U.S. tons and approximately 2,204.6 pounds.

Midden. Earth mounds and shell heaps. Culturally darkened soil.

Moment magnitude. An energy-based scale and provides a physically meaningful measure of the size of a faulting event.

NAVD88. The vertical control datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988.

Non-potable. Water that is not for drinking.

Ordinary high water mark. Defined by the U.S. Army Corps of Engineer for purposes of the Clean Water Act jurisdiction as "…that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."

Particulate Matter (PM10 and PM2.5). PM10 and PM2.5 are also termed respirable particulate matter and fine particulate matter, respectively, and are a class of air pollutants that consists of heterogeneous solid and liquid airborne particles from manmade and natural sources.

Peak ground acceleration (PGA). The PGA for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. PGA is expressed as the percentage of the acceleration due to gravity (g), which is approximately 980 centimeters per second squared.

pH. A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The pH scale ranges from 0 to 14.

Photochemical pollutants. Air pollutants that are formed in the atmosphere under the presence of sunlight from precursor molecules that are directly emitted.

Peak Particle Velocity (PPV). The maximum instantaneous peak of the vibration signal.

Propagule. A plant structure capable of dispersing from the parent plant and establishing in a new location. Root, rhizome, and stem fragments with buds are common propagules as are bulbs, corms, and tubers. Seeds are also considered propagules.

Relative compaction. Refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557 laboratory compaction procedure.

Right-lateral strike-slip. Refers to relative motion on either side of a fault that is primarily horizontal (as opposed to vertical).

Root mean square (RMS) amplitude. The average of the squared amplitude of the signal.

San Francisco City Datum (City Datum). Set at 6.7 feet above the city's former high water mark and is 11.38 feet higher than NAVD 88 and 8.62 feet higher than NGVD 29.

Secchi depth. A measure of the cloudiness or turbidity of surface water. Can be affected by algae production and suspended solids.

Sharrows. Shared roadway bicycle pavement markings within traffic lane.

Slickensides. Polished and striated rock surfaces that result from friction along a fault or bedding plane.

Special animals. This list includes species that CDFW considers "those of greatest conservation need."

Speech Interference. Speech interference is an indicator of impact on typical daytime and evening activities. A speech interference threshold, in the context of impact duration and time of day, is used to identify substantial increases in noise from temporary construction activities.

Spoils. Refers to soil remaining from an excavation after backfilling is completed.

Subsidence inversion. An increase in temperature with height that develops aloft as a result of air gradually sinking over a wide area and being warmed by compression.

Take. The ESA defines the term as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Thermal Stratification. The separation of water layers within a lake system, wherein warm, less dense surface waters (epilimnion) float over a deeper layer of cooler, denser waters (hypolimnion).

Toxic Air Contaminants (TACs). Air pollutants that may lead to serious illness or increased mortality, even when present in relatively low concentrations.

Underground Storage Tank (UST). A storage tank, not including any underground piping connected to the tank, that has at least 10 percent of its volume underground.

Waste diversion. Diversion requirements set forth under Daly City Municipal Code 15.64.020.

Xeric. Vegetation communities in which plants require little moisture to survive or have adapted to dry habitat conditions.

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APPENDIX A

Lake Management Plan

Draft

VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Lake Management Plan

Prepared for
City of Daly City

December 2015

for:

Draft

VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

Lake Management Plan

Prepared for
City of Daly City

December 2015

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1. Introduction

The City of Daly City (Daly City) is proposing the Vista Grande Drainage Basin Improvement Project (Project) to address storm-related flooding in the Vista Grande Drainage Basin (Basin) while providing the additional benefit of augmenting the level of Lake Merced. The Vista Grande storm drain system drains the northwestern portion of Daly City and an unincorporated portion of San Mateo County – areas originally within the watershed of Lake Merced. In the 1890s, the Vista Grande Canal and Tunnel were built to divert stormwater away from the lake to an outlet at the Pacific Ocean. The Ocean Outlet and a portion of the Tunnel are located within Fort Funston, part of the Golden Gate National Recreation Area (GGNRA), which is operated under the authority of the National Park Service (NPS). The existing Canal and Tunnel do not have adequate hydraulic capacity to convey storm flows, and this periodically causes backup of Tunnel flows into the Canal and flooding during peak storm events in adjacent low-lying residential areas and along John Muir Drive.

As noted, the proposed Project has two primary, mutually supporting objectives: to address storm-related flooding that periodically occurs as a result of inadequate storm drainage capacity in Daly City's Vista Grande Canal and Tunnel, and to augment water surface levels and manage water quality in San Francisco's Lake Merced. Both Daly City and San Francisco independently are obligated to address these respective issues. The proposed Project represents an approach that would jointly address both jurisdictions obligations while minimizing disturbance, maximizing the beneficial reuse of stormwater, and reconnecting a significant portion of the Lake Merced Watershed to Lake Merced.

Lake Merced is made up of four individual but connected lakes (East, North, South, and Impound Lakes) and is owned by the City and County of San Francisco. The San Francisco Public Utilities Commission (SFPUC) maintains the Lake as a non-potable emergency water supply for the San Francisco and is a responsible agency for this project.

Daly City considered a number of engineering alternatives as a means to alleviate flooding in the Basin by increasing the tunnel capacity. However, in coordination with the SFPUC, the Proposed (known as the Lake Merced Alternative in engineering alternatives consideration process) emerged as the preferred alternative for the project, based on its "green infrastructure" approach of capturing and beneficially reusing stormwater to manage the level of Lake Merced, which declined in the late 1980s and early 1990s and has not fully recovered. Daly City has worked closely with the SFPUC and the San Francisco Bay Regional Water Quality Control Board (RWQCB) in the development of this project. The project would involve partial replacement of the existing Canal, replacement of the existing Tunnel, and replacement of the existing ocean outlet structure. Additionally, operational components of the project would include management of water elevations in Lake Merced by routing some screened wet-weather storm flows from the Canal to Lake Merced, and year-round authorized non-storm flows to a constructed treatment wetland which would subsequently discharge flows to Lake Merced. Daly City and SFPUC are in coordination regarding the proposed design and operation of the proposed project and management of the Lake under a range of potential Lake Merced water surface elevations (WSEs).

Daly City and SFPUC agreed to develop the Lake Management Plan (LMP) as part of the project to demonstrate how Daly City and SFPUC would coordinate to maintain or improve the water quality of Lake Merced. This LMP includes an overview of the initial operational plan for the diversion of stormwater from the Canal to Lake Merced, a Lake monitoring plan to assess trends in hydrology and water quality, and a prioritized suite of best management practices (BMPs) that would be implemented by Daly City and SFPUC, in conjunction with regulatory adjustments to reflect site-specific conditions. The principal diversion routing options are presented in Section 3.2.1. More detailed diversion criteria would be developed further during design of the diversion facilities, and further refined following the first wet season of operation, and as part of the ongoing adaptive management of the project. The operational plan and LMP would then be incorporated into an Operational Agreement executed between Daly City and SFPUC.

The development of the LMP has been conducted in consultation with the RWQCB consistent with the "Proposed Regulatory Approach for Vista Grande Drainage Basin Improvement Project, Lake Merced Alternative" as described in the March 12, 2013 letter from Daly City to the RWCQB, and the May 9, 2013 letter of concurrence from the RWQCB to Daly City (**Appendix A**).

The document is organized as follows:

> **Lake Management Plan Goals and Objectives:** The goals and objectives developed for the LMP focus on the jointly desired endpoints of restoring and maintaining Lake WSEs while maintaining or improving water quality.
>
> **Vista Grande Operational Plan:** This section describes the monitoring and management of lake levels, operation of the Canal diversions to the Lake, constructed treatment wetlands, and Pacific Ocean, and circulation of non-stormwater flows and Lake water through the constructed treatment wetlands.
>
> **Lake Monitoring Plan:** This section outlines the monitoring, reporting and assessment plan for hydrology and water quality in the Lake, Canal, and the constructed treatment wetlands.
>
> **BMP Implementation Plan:** This section describes the list of Watershed and Lake BMPs that could be implemented by Daly City and/or SFPUC to potentially benefit Canal water quality and/or DO and pH levels in the Lake.

2. Lake Management Plan Goals and Objectives

The intent of the LMP is to protect and enhance the beneficial uses of Lake Merced and to monitor for hydrologic and water quality changes, if any, associated with Lake management actions. The following goals and objectives have been collaboratively developed by Daly City and SFPUC for the LMP.

Goal 1. Manage and maintain water surface elevation of Lake Merced

Objective1a: Increase surface water input to the Lake

Objective 1b: Capture and manage stormwater as a resource

Goal 2. Maintain or improve water quality in Lake Merced

Objective 2a: Maintain or improve Dissolved Oxygen (DO) and pH

Objective 2b: Minimize watershed nutrient inputs

Objective 2c: Minimize internal nutrient sources

Objective 2d: Reduce trash input to the Lake

Goal 3. Maintain or improve aquatic habitat quality and availability

This goal will be achieved through attainment of Objectives 1a, 2a, 2b, and 2c.

3. Vista Grande Operational Plan

This section outlines the operational elements of the plan for Lake level management, primarily focusing on potential scenarios for diversion of stormwater from the Canal to Lake Merced. Daly City would have the ability to divert a range of flows from the Canal to South Lake Merced. The water surface elevation would fluctuate depending on seasonal and climatic variations and other influences in addition to Canal diversion operations.

3.1 Project Operation and Lake Level Management Overview

The project would divert stormwater and authorized non-stormwater flows that are currently conveyed to the Pacific Ocean to Lake Merced to aid the SFPUC in operating Lake Merced within desired water levels. More detail about the project's diversion operation is provided below in Section 3.2.

The WSE of Lake Merced has fluctuated historically from Elevation (El.) 13 feet (San Francisco City Datum) in the 1940s to a low of El. -3.2 feet in 1993. Since then, the WSE of Lake Merced has risen due to increases in average rainfall and water additions by the SFPUC (SFPUC, 2011). From 2006 to 2010, the WSE ranged from El. 4.8 feet to El. 6.9 feet with an average of approximately El. 5.8 feet (City Datum). The range of potential WSE scenarios considered initially for the purposes of analysis includes mean WSEs of 6.5 to 8.5 feet, with a maximum high WSE of 9.5 feet. However, the actual proposed operation WSE range would be determined by the SFPUC, following completion of the CEQA/NEPA review process and may be further refined as part of adaptive management of the project following project implementation should monitoring and operational activities identify the need to adjust the target operational WSE.

The three representative operational scenarios are identified by the target maximum WSE: El. 7.5, 8.5, and 9.5 feet (see **Figure 1**). This is the elevation at which the Lake Merced overflow structure would be set under each scenario. Accordingly, the operational water levels represent an increase of the annual mean by 0.5, 1.5, and 2.5 feet. After winter rains taper off, about 1.5 feet of water is lost each year, primarily due to evaporation. Thus, for each scenario, there is a corresponding target normal minimum WSE. The term normal is used to refer to normal and wet year conditions. Under dry year and multiple dry year conditions, it is assumed that WSE of Lake Merced would fall below the target normal range. During a storm event, the Lake's WSE may temporarily rise above the target maximum WSE, as the flow of stormwater being diverted into the Lake exceeds the capacity of the overflow outlet, thus providing short-term water storage for flood events. The project includes provisions to extend the duration of elevated WSE conditions to improve Lake water quality. Adaptively managing elevated WSE conditions in conjunction with the overflow structure and a siphon would allow for regular dilution and overflow or displacement of high alkalinity Lake water to the ocean outfall to reduce the background pH of the Lake (discussed in more detail below).

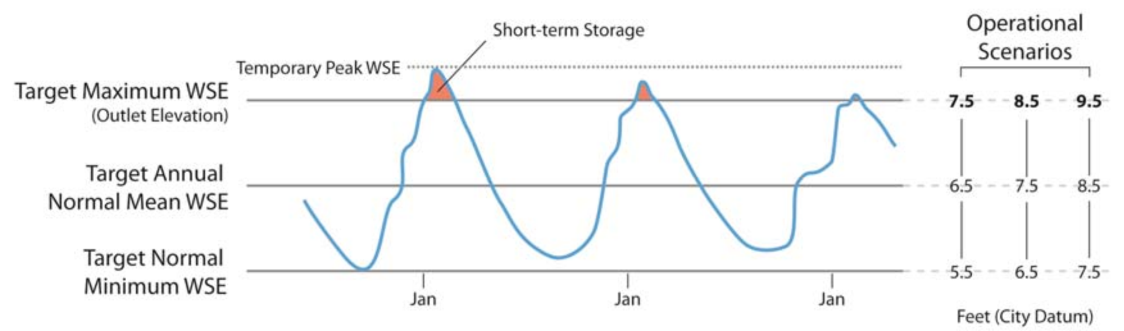

Figure 1
Lake Level Operational Scenarios

3.2 Diversion Operation

The project proposes several measures for balancing the goals of restoring the surface elevation of the Lake while maintaining or improving Lake water quality through the conveyance of flows from the Canal to Lake Merced. This section outlines the initial conceptual thresholds that would be used to determine when to divert flows directly to the Lake, to the constructed treatment wetland, and to the Pacific Ocean.

When the project is operational, stormwater and authorized non-stormwater flows would flow by gravity through a box culvert located beneath one of two constructed treatment wetland cells, flow through a gross solids screening device, then enter a diversion structure where it could be pumped to the proposed constructed treatment wetlands, directed to Lake Merced through a box culvert under John Muir Drive, or allowed to continue through the Canal and Tunnel to the ocean outlet. Variable control would be available at the diversion structure gates so that all or only portions of the flow may be directed in either direction. Flows that are directed into Lake Merced would be conveyed via the box culvert to an outlet at the northwestern portion of the Impound Lake shoreline.

The box culvert under John Muir Drive to the Lake Merced outlet would be designed to accommodate the peak flows generated by the 4-hour 25-year design storm (1070 cfs); however, since a portion of the total flow could be directed through the Canal to the Tunnel, only approximately 570 cfs of the box culvert's and discharge structure's total 1070 cfs capacity would be needed to accommodate peak flows generated by the design storm.

After passing through the solids screening device, year-round low flow stormwater and authorized non-storm flows would be pumped at rates of up to approximately 400 gallons per minute (gpm) to the start of one of two constructed treatment wetland cells. Water would flow by gravity to the terminus of the constructed treatment wetland, where it would typically drop into a box culvert below and continue to flow into Lake Merced. Treated water from the wetland would also have the capability of dropping into the diversion structure and continuing through the Canal and Tunnel in order to bypass Lake Merced if requested by the SFPUC, such as during maintenance of the treatment wetland system or other related components.

3.2.1 Diversion Criteria

In order to maintain lake levels within target WSEs and to ensure protection of water quality within Lake Merced, the proposed operating model includes provisions for routing stormwater to Lake Merced. To provide the greatest protection to Lake Merced water quality, the initial storm event of the winter season and other storm events with long antecedent dry periods would flow through the Canal to the Tunnel and then to the ocean outlet due to storms with long antecedent dry periods containing increased particulate and associated constituent levels within runoff. The Project also has the capability to continue to route runoff from various types of events to the Pacific Ocean. Stormwater would be routed to Lake Merced dependent on stormwater flow rate, Lake Merced levels, and other diversion criteria, including rainfall frequency, predicted rainfall duration and magnitude, canal flow rates, and other factors. Additional details relating to the diversion criteria would be developed and further refined during detailed design of the diversion facilities and following the first wet season of operation as part of the adaptive management approach (see Section 4.4). However, the principal diversion routing options are:

1. **Summer and Winter Low-Flow Routing, Lake Merced below target WSE.** Screened dry weather flows (authorized non-stormwater) and low-volume stormwater flows would be routed through the treatment wetlands, after which the treated water would drain into the Lake Merced Outlet to Impound Lake. These flows would help to maintain overall lake level and sustain the proposed treatment wetlands throughout the year. There would be no flow through the tunnel or beach discharge.

2. **Summer and Winter Low-Flow Routing, Lake Merced at target WSE.** Screened dry weather flows (authorized non-stormwater) and low-volume stormwater flows would be routed through the treatment wetlands after which the treated water would drain into the

Lake Merced Outlet to Impound Lake. These flows would help to maintain overall lake level and sustain the proposed treatment wetlands throughout the year. Inflows into Impound Lake would increase the WSE above the Lake Merced Overflow elevation, resulting in outflows from South Lake to the Vista Grande Tunnel via the Lake Merced Overflow. Overflows would be conveyed via the Vista Grande Tunnel to the Ocean Outlet.

3. **Winter Storm Routing, Lake Merced below target WSE.** Screened initial stormwater flows would be routed through the canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake, and there may be no flow through the tunnel or beach discharge.

4. **Winter Storm Routing, Lake Merced at target WSE.** Screened initial stormwater flows would be routed through the canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake. Inflows into Impound Lake would increase the WSE above the Lake Merced Overflow elevation, resulting in outflows from South Lake to the Vista Grande Tunnel and Ocean Outlet via the Lake Merced Overflow.

5. **Winter Storm Exceeding 25-year, 4-hour criteria, Lake Merced at target WSE.** Screened initial stormwater flows would be routed through the canal and discharged via the Vista Grande Tunnel and Ocean Outlet. After initial storm event, if screened storm flows meet diversion criteria, flows exceeding the capacity of the treatment wetlands would be routed directly to Impound Lake. In addition, if storm water flows from the Vista Grande watershed exceed the combined capacity of Lake Merced and the Vista Grande Canal and Tunnel, canal flows could overtop the canal and flow across John Muir Drive to Lake Merced. Flows would cross the existing hardscape areas (riprap) between John Muir Drive and South Lake and discharge into Lake Merced via existing riprap Canal overflow discharge structures along the shoreline. Inflows into either Impound Lake or South Lake would result in overflows back to the tunnel as capacity is available and would be discharged via the Ocean Outlet. This option would temporarily raise lake levels above the target WSE, providing short-term storage during major storm events to reduce flooding in the Vista Grande Basin.

3.2.2 Lake Level Management

Filling Period

Five diversion thresholds were modeled to estimate the potential contribution of stormflows diverted to Lake Merced. These are: > 0 cfs (i.e., all flows would be diverted into the Lake), > 35 cfs (all flows greater than 35 cfs would be diverted into the Lake), > 75 cfs, > 150 cfs, and > 1070 cfs. The maximum predicted runoff reaching the Vista Grande Canal is approximately 1070 cfs,[1] so this threshold does not divert any stormwater from routine rain events to Lake Merced. The amount of time required to fill Lake Merced to the target WSE is dependent upon the diversion threshold. The lower non-zero diversion thresholds (i.e., > 35 and > 75 cfs) require multiple seasons to reach the target WSE, during which time a large volume of water is lost to evaporation and transpiration. Accordingly, the base flows running through the treatment

[1] Maximum predicted runoff based on a design storm event with a 4-hour duration and a 25-year recurrence interval.

wetlands constitute a greater percentage of the Lake Merced contributions than storm water compared to the > 0 cfs threshold. Due to evaporation and transpiration, the highest diversion thresholds (i.e., > 150 and > 1070 cfs) would never achieve the target WSE due to the infrequency of events. **Figure 2** illustrates the annual average contribution patterns under the five diversion thresholds for the 9.5-foot maximum WSE operational target. Because Figure 2 is based on the average year, it does not account for annual variability. The 9.5-foot target maximum WSE could be reached in a minimum of approximately 1.5 years under the > 0 cfs diversion threshold, 3.5 years under the > 35 cfs threshold, and 8.5 years under the > 75 cfs threshold. As shown in Figure 2, the 9.5-foot target maximum WSE would not be achieved under the > 150 cfs and > 1070 cfs diversion thresholds.

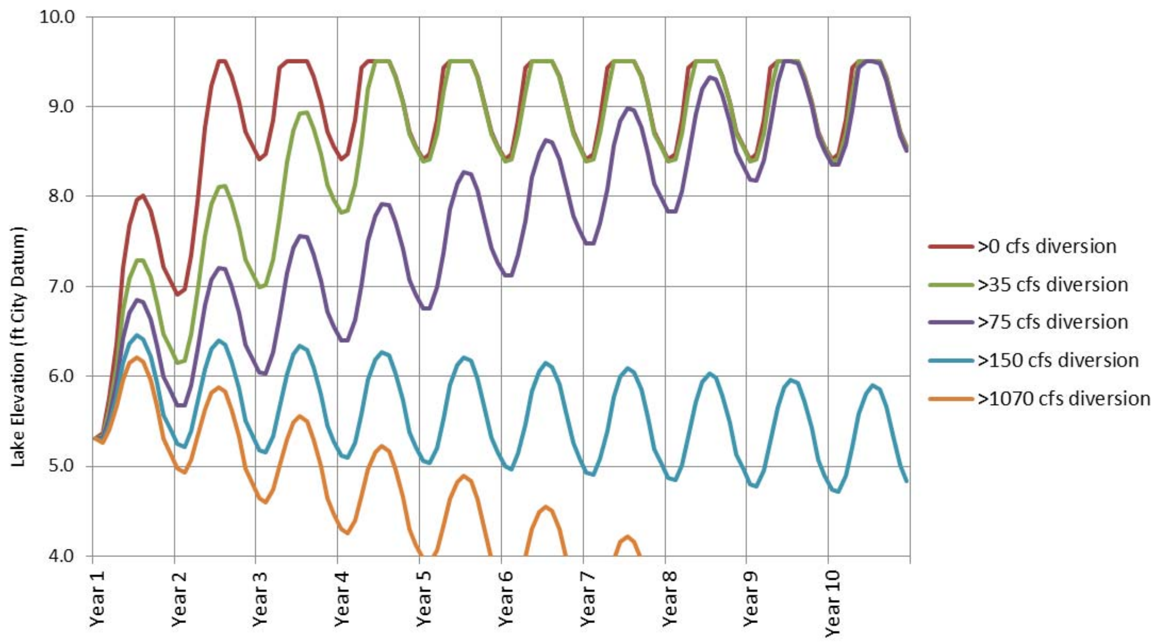

Figure 2
Lake Filling Scenarios, 9.5-Foot Target Maximum Water Surface Elevation

Steady State

Once the Lake is ultimately raised to the target WSE, smaller annual contributions of flow from the Canal would be required to maintain the Lake within the target WSE range. Because the surface area of the Lake changes only slightly in the El. 6.5 to 8.5 foot range, the maintenance contributions would be approximately the same for all operational scenarios (6.5, 7.5, and 8.5 foot target annual normal mean WSE). Contributions from the constructed treatment wetland and the Canal, ranging from 403 acre-feet (> 75 cfs threshold) to 474 acre-feet (> 0 cfs threshold) would contribute to maintaining the target WSE range, in addition to smaller contributions from precipitation, current stormwater flows entering the Lake from local catch basins, and groundwater inflow. The relative contribution conveyed through the treatment wetlands varies according to the stormwater diversion threshold, but is substantial (45 to 60 percent).

3.2.3 Stormwater and In-Lake Water Quality Management

Collection Box and Debris Screening Device

A collection box would replace the headworks of the existing Canal to collect flows from the contributing storm drains. An approximately 275-foot-long linear radial debris screening device would be installed downstream of the collection box. Stormwater would enter the device through several cylindrical casings and exit through louvers perforated in the casings, trapping all debris larger than 5 mm within the casings. Debris would be removed from the casings with vacuum trucks on a scheduled basis. A schedule for cleaning, monitoring, and maintenance would need to be reviewed and refined during and following the first year of implementation. Depending on how quickly the casings fill up with debris, cleaning could occur as often as after every storm event, with inspections occurring on a bi-weekly basis between storm events. After the first year of implementation, this schedule would be reevaluated for its effectiveness. In the collection box, sediment build-up would also be monitored at the same schedule as the debris screening device. Accumulated sediment would be removed to ensure continued functioning of the debris screening device.

Debris screening is expected to have a minor influence on DO and pH. However, to the extent that there were nutrients and organic oxygen demanding constituents associated with the debris, that would result in less loadings to the Lake and lower the potential for enhanced algal growth.

Constructed Treatment Wetland

A constructed treatment wetland would be developed along John Muir Drive to treat year-round low flows from the watershed in order to reduce sediment, suspended solids, metals, microbiological constituents (bacteria and other organisms), and nutrients. Low volume stormwater flows, authorized non-storm flows, and recirculated Lake water would be treated prior to release to Lake Merced. The wetland would consist of two cells (A and B), with areas totaling approximately 2.75 acres. A portion of Wetland Cell A would overlie the box culvert. Wetland Cell B would be located between the existing Canal and John Muir Drive. The wetland would treat year-round low flows from the watershed (also referred to as base flows), which can consist of authorized non-stormwater flows such as residential irrigation runoff. Low flows would drain to the wetland pump station from the flow diversion structure via a 12-inch drain where two motorized pumps would pump water to one of the wetland cells. Stormwater and authorized non-stormwater flows exceeding the treatment wetland capacity (1.4 cfs) would pass through a solids screening device and then, depending on operational protocols, would either be routed to Lake Merced or be allowed to continue through the Canal and Tunnel to the ocean outlet.

Water pumped to the treatment wetlands would flow by gravity through the wetland at a rate of approximately 1.4 cfs. The wetland cells would be planted with emergent reeds such as cattails or bulrush that would provide water quality improvement by intercepting and settling out suspended particulates and providing attachment surfaces for beneficial bacteria. After passing through the wetland, the treated water would flow by gravity through the diversion structure to the Lake Merced Outlet. During periods of very low or no flow (typically during summer months), a recirculating pump would draw water from Lake Merced to maintain the treatment wetlands. Summer maintenance flows would be adaptively managed to filter algae skimmed directly from the lake surface and pumped to the wetlands. The direct removal of concentrated surface algae by skimming would effectively achieve substantial decreases in chlorophyll, to the extent that concentrated, localized surface scums exist in the lake. The skimmer would have a floating structure with wind protection that draws water from the upper few inches of the lake surface via a piped connection (flexible hose) from the natural algae concentration site(s) within South Lake into the constructed treatment wetlands. Operation of the treatment wetlands to maximize removal of nuisance algal blooms in Lake Merced, when present, would be refined and adjusted as part of the adaptive management approach of the project following implementation to best achieve the LMP goals and objectives.

Controlled Overflow of Lake to Tunnel

The elevated pH level in Lake Merced is likely due to the historical accumulation of alkaline minerals following the permanent closure of the outlet to the Pacific Ocean, which created a terminal lake (i.e., no outflow to other water bodies). As described above, the project would include adaptive management of an adjustable-height overflow structure that would be used to control the lake level and allow water from Lake Merced to be diverted back into the Vista Grande Canal just upstream of the tunnel to flow to the Ocean Outlet. A potential benefit of this control measure is that it would improve some of the original hydrology of the Lake, which once had an outlet to the Pacific Ocean. Further, the project would include a siphon that would be adaptively managed to divert lake water from the hypolimnion to the Canal via the overflow structure to improve lake water quality by flushing higher alkalinity water from near the lake bottom.

When feasible, overfilling and thereby flushing the Lake with low-alkalinity stormwater could reduce the background pH of the Lake by diluting salts in the Lake and displacing higher alkalinity water. Additionally, bottom water would be displaced through the use of the siphon, to the extent that heavier, higher TDS and higher alkalinity water tends to be in the bottom layer when low-salinity stormwater flows into the top layer in winter (Horne, 2012). Adaptive management of the siphon would allow the higher TDS and higher salinity bottom water to be displaced, increasing the benefit of flushing water out of the lake. Operation of the siphon to flush out the highest alkalinity water from Lake Merced to the maximum extent practicable based on available water supply, Lake WSE, and Lake water quality conditions, and without compromising maintenance of target water surface elevations, would be refined and adjusted as part of the adaptive management approach of the project following implementation to best achieve the LMP goals and objectives. Further, the siphon would be adaptively managed and operated, when feasible, to reduce Lake WSE to below or to the lower end of the target elevation range prior to storm events to proactively remove higher TDS and higher salinity bottom water before wind mixing results in the Lake being more fully mixed and reducing the potential benefit of diverting bottom waters as compared to periods of isothermal or chemical stratification.

4. Lake Merced Monitoring Plan

This section describes a hydrology and water quality monitoring plan to evaluate the water quality in Lake Merced (particularly DO and pH), and to provide data to support adaptive management decision making. The monitoring plan has been formulated to provide the information necessary to answer the following questions:

- Have Lake water levels been successfully increased to target mean WSE levels and sustainably maintained as a result of Canal diversion and Lake management actions?
- Has Lake water quality been maintained or improved as a result of Canal flow diversions, use and management of treatment wetlands, and Lake management actions as compared to the historic norms established during the pre-Project period (baseline conditions)?
- If adverse water quality change trends begin to show in the Lake as compared to baseline conditions, can such changes be definitively linked to the addition of treated stormwater or explained by other phenomena (e.g., unusually dry/warm year, reduced fog cover, watershed disturbance, etc.)?
- Are identified initial changes in water quality likely to adversely impact beneficial uses (e.g., fisheries), or contribute to nuisance conditions within Lake Merced if the trend continues?
- If so, what are the most appropriate available BMPs or adaptive management measures that could be implemented to offset or correct these potential adverse water quality changes before substantial effect occurs?
- Are sufficient DO, pH, and ancillary data being collected in Lake Merced to support a request for future removal of the Lake from the Clean Water Act (CWA) Section 303(d) impaired waterbodies list?

4.1 Lake Merced and Canal Water Quality

4.1.1 Summary of Current Conditions

There are two primary data sets describing baseline water quality conditions at Lake Merced: approximately quarterly sampling conducted by SFPUC staff from 1997 through the present, and continuous (hourly) monitoring using data sondes performed by Daly City at four stations in South Lake Merced at multiple depths from August 2011 through January 2013. The SFPUC data set documents long-term trends in water quality and the range in variability of constituents such as nutrients and chlorophyll. The more recent Daly City data document the diurnal, seasonal, and depth related variations in DO, pH, and temperature due to factors such as climatic change, wind induced mixing, phytoplankton photosynthesis and respiration, and sediment oxygen demand induced hypoxia/anoxia in the hypolimnion.

The long-term SFPUC data indicate that water quality in the Lake has been relatively stable since at least 2004. Water quality within Lake Merced represents that of a terminal, eutrophic, shallow stratified lake in a cool, foggy climate. During the rainy, cool winter months, temperatures in the

Lake rarely exceed 15 °C, while summer-fall temperatures can regularly exceed 20 °C. The Lake is only weakly stratified by temperature during the summer and fall due to its moderate depths (less than 30 feet deep) and location at the heart of San Francisco's "fog belt." Monitoring data from Daly City and SFPUC indicate that the typical temperature difference between surface and bottom waters during these seasons is less than 5 °C, often less than 2 °C. As a result of weak temperature stratification, the Lake mixes (in the vertical direction) approximately once every 9 to 11 days (Horne, 2012), making the Lake *polymitcic* (mixes multiple times in one year). When the Lake mixes, it typically mixes throughout its entire water column, a process called *holomixis*.

Though Lake Merced only weakly stratifies with respect to temperature, it is frequently stratified with respect to DO, particularly in the late spring through early fall when a majority of algal blooms occur. This stratification results in periods of low DO (< 5 mg/L) in the bottom waters (hypolimnion) and periods of elevated pH (> 8.5) in the near surface waters (epilimnion). Dissolved oxygen levels in the hypolimnion are frequently hypoxic (DO < 5 mg/L) or functionally anoxic (DO < 2 mg/L) during the summer and fall due to the effect of oxygen demand from the decomposition of dead algae and other organic matter in bottom sediments. Dissolved oxygen levels in the epilimnion (surface waters) can become supersaturated (> 12 mg/L) during daylight hours due to algal photosynthesis. The benthic sediment oxygen demand exerts such a significant influence that the current intermittent (9-11 days) mixing throughout the water column is not adequate to significantly raise DO levels in the hypolimnion. From November through March when cooler air temperatures prevail and the Lake is continually well mixed from top to bottom, DO levels average well above 5 mg/L.

Lake Merced is an alkaline lake with a widely fluctuating and elevated pH range, particularly in the portion of the water column near the Lake surface. Importantly, the Lake's range of pH (approximately 7.5 to 9.3) is always on the alkaline side and never reaches neutrality (pH 7). Due to the elevated alkalinity in this terminal lake, the carbonate chemistry results in an equilibrium pH in the 8 to 8.5 range. The higher pH values in Lake Merced are not typical for a system such as Lake Merced. Although high pH occurrences are common in eutrophic lakes in the later morning and early afternoon, the frequency, duration, and temporal patterns of high pH found in Lake Merced are not consistent with the Lake's eutrophic state and algal abundance (chlorophyll an approximately 28 micrograms per liter [µg/L]). Typically, higher high values would be expected in the day and lower pH values would be expected at night or on cloudy days (Straskraba, 1986). The pH levels appear to be the result of photosynthesis from algal activity, combined with the elevated alkalinity within the Lake due to it being a terminal lake, with no regularly occurring outflow since it lost connection to the Pacific Ocean in the late 1900s (Horne, 2012b). The removal of acidic carbon dioxide on summer afternoons by algal photosynthesis frequently raises the pH of surface water layers above 8.5, typically occurring for about 6 hours, corresponding to peak sunlight periods, and ranging from about 1 to 24 hours in duration. The cycles of high pH in Lake Merced are due to the combination of algal photosynthesis in the day and respiration by algae, zooplankton, and fish at night, on top of a high background pH due to the high concentration of salts like carbonates or alkaline salts.

Monitoring conducted by Daly City in 2011-2012 in the Canal at a range of storm and base flows has documented that Canal stormwater and authorized non-stormwater flows generally have characteristics typical of urban runoff in Bay Area communities for a broad range of constituents (such as nutrients, metals, and bacteria). The water quality of storm flows in the Canal is similar to that of Lake Merced surface waters during corresponding seasonal periods in terms of temperature, DO, and pH.

The levels of water quality constituents in Canal flows (such as metals, nutrients, and bacteria and other organisms) need to be considered in the context of the relative short-term duration and the annual average contribution (volume and loading) of Canal diversions as compared to overall lake volume. Hydrologic monitoring in the Canal conducted by Daly City during the wet and dry seasonal periods between 2011 and 2012 demonstrated that typical storm events in the Basin generate a volume equivalent to a fraction of one percent of the total Lake storage volume. (**Table 1**). The design hydrograph (i.e. peak storm event) for the project is a 25-year recurrence interval, 4-hour event with a peak flow of 1070 cfs. Assuming 100 percent diversion of the design storm flow, the maximum volume contribution from the Canal to Lake Merced during that single storm event would be approximately 190 acre-feet, or approximately 3 percent of the total volume of Lake Merced (5,625 acre-feet).

TABLE 1
STORM MONITORING SUMMARY

	Storm Event Date (2012)					
	1/19	**1/22**	**2/29**	**3/13**	**3/14**	**3/16**
Total Event Precipitation (in)	0.11	0.55	0.36	0.38	1.02	1.09
Antecedent Dry Period (Days)	19	<1	13	11	<1	<1
Peak Flow (cfs)	18	257	184	33	115	193
No. of Aliquots Collected	48	48	36	24	71	48
Storm Event Volume (acre-feet)	3.2	37.9	17.3	21.6	79.7	42.7
Storm Event Capture Volume (acre-feet)	2.8	16.0	16.7	18.8	54.4	38.8
Percent of Hydrograph Sampled[a]	87	42[b]	96	87	68	91
Storm Volume as % of LM Storage[c]	0.06	0.67	0.31	0.38	1.42	0.76

NOTES:

[a] Based on calculation of the volume of the event hydrograph sampled as a percentage of the entire event hydrograph volume above base flow conditions. However, base flow somewhat arbitrarily determined for each storm event due to base flow conditions being under continuous fluctuation. Additionally, not all storms resulted in a return to pre-storm base flow levels following a sample even. In these cases, percent capture derived from base flow during pre-storm condition to the point of lowest flow following sample completion before the subsequent storm event and rising limb of next event hydrograph.

[b] Although total event capture did not meet requirements for storm event monitoring representativeness (percent capture), sample collection successfully captured representative flow-paced samples from base flow to peak flow (and partially beyond) on the event hydrograph. The Event Mean Concentration (EMC) calculated for this event is therefore likely higher (more conservative) than the actual EMC, but is conservatively representative for purposes of characterizing the seasonal mean for various pollutant loads.

[c] Based on Lake volume of 5,625 acre-feet.

4.1.2 Clean Water Act Section 303(d) Support

Lake Merced currently does not meet the generally applicable Basin Plan Water Quality Objectives (WQOs) for DO and pH. There are currently no provisions in the Basin Plan that acknowledge the potential effects of diurnal and/or seasonal stratification nor of the effects of natural conditions, such as eutrophication, on ambient DO and pH. The DO and pH WQOs are also assumed to apply throughout the water column, at all locations within the Lake, and at all times, diurnally and seasonally. As a result, the USEPA in 2003 included Lake Merced on the CWA Section 303(d) list of impaired waterbodies for these constituents, notwithstanding the RWQCB’s and State Water Board’s recommendation not to include those listings.

Due to the unique conditions that exist in Lake Merced, the RWQCB is pursuing a Basin Plan amendment to incorporate site-specific implementation provisions for the DO and pH WQOs to address the Lake’s unique conditions (Appendix A). These unique conditions include that the Lake is polymictic, a terminal lake, subject to marine coastal influences, and has both an artificially maintained coldwater fishery and a self-sustaining warmwater fishery. The additional DO and pH data collected under this LMP could be used in a future water quality assessment, once the revised Basin Plan implementation provisions are fully approved, to support a request to remove Lake Merced from the CWA Section 303(d) list as being impaired for DO and pH. The approach detailed below for long term water quality monitoring in Lake Merced is based, in part, on the early assumption that the Basin Plan Amendment addressing how DO and pH WQOs would be implemented in Lake Merced would involve some type of integrated water column averaging or other statistical approach, similar to that employed by the State of Colorado. The long-term water quality monitoring approach would be subject to change once work begins on the actual Basin Plan Amendment implementation provision language.

4.2 Constituents, Parameters, and Locations to be Monitored

This section describes the hydrologic parameters and water quality constituents that would be monitored to further assess baseline conditions and to track the long-term trends of lake hydrology and water quality, as well as treatment wetland efficacy, including trends associated with introducing treated Canal baseflows and stormwater to Lake Merced. This monitoring would be implemented in parallel with the existing multi-parameter quarterly monitoring program currently conducted by SFPUC in the Lake, which includes sampling of temperature, DO, pH, nutrients, and other constituents at multiple depths plus phytoplankton counts, chlorophyll a and Secchi disc measurements (see example report in **Appendix B**). SFPUC samples at eight stations, two in South Lake (Pump House and Pistol Range) and three each in North Lake and North East Lake. Routine monitoring is not currently conducted in Impound Lake, located south of South Lake and would not be monitored as part of the LMP due to its smaller volume and greater amount of shoreline influences (wetlands), as compared to South Lake, likely resulting in a high degree of water quality variability. Additionally, there are many stormwater inlets to Impound Lake, which would make it problematic to separate out any observed water quality deviations from the adjacent watershed contributions from Canal contributions. For these reasons, it was determined that Impound Lake, as a water quality monitoring location, was not representative of the main water mass of Lake Merced as compared to the Pump House monitoring station in South Lake. The SFPUC monitoring stations are shown in **Figure 3**.

Figure 3
Lake Merced SFPUC Water Quality Monitoring Sites

This section also describes short-term water quality monitoring that would be conducted during the first year of implementation of Canal diversions to Lake Merced. The project is not expected to be completed until 2017 or soon after, 4 or more years after water quality data was collected concurrently in Canal and Lake Merced between 2011 and 2013. The short-term monitoring would be conducted when the Project is implemented to confirm whether key water quality parameters in Lake Merced are consistent with the current characterization of baseline conditions. This would ensure that baseline conditions at time of Project implementation are accurately incorporated into the monitoring and analysis program and that factors resulting in changes to baseline conditions within the Lake are understood and accounted for.

The proposed monitoring plan is based on a simplified version of the previous wet- and dry-weather monitoring program that was initiated by Daly City in 2011 (**Appendix C**). This approach maintains consistency with previous monitoring efforts and analyses reviewed by the RWQCB and carried out by SFPUC and Daly City, to maximize available data for the assessment of long-term water quality trends. The overall framework of the monitoring plan consists of four components:

1) long-term hydrologic monitoring of Canal flows, diversions, and Lake WSE to understand how Canal diversions are affecting lake depth;

2) long-term continuous monitoring of DO, pH, and temperature at multiple depths at the Lake Merced Pump Station monitoring location, as well as quarterly secchi disk depth, chlorophyll a measurements and a broad suite of key water quality constituents and parameters, in various locations and at a range of depths within Lake Merced to assess long-term trends of key water quality indicator parameters;

3) long-term monitoring of treatment wetlands efficacy at removal of key water quality constituents; and,

4) short-term Lake Merced diversion event based monitoring conducted during the first year of implementation of Canal diversions to confirm that Lake water quality concentrations have remained within the general ranges previously assessed during and immediately following storm runoff contributions to Lake Merced.

4.2.1 Hydrologic Monitoring

Hydrologic monitoring is necessary to relate water quality dynamics in Lake Merced to hydrological drivers such as rainfall, lake depth, and stormflow contributions. Additionally, hydrologic monitoring provides data critical for assessing whether lake management is achieving success in regards to Goal 1 and supporting objectives 1a and 1b, as detailed in Section 2. Hydrologic monitoring to help assess successful water surface elevation management and long-term trends of Lake Merced water quality include:

- **Water surface elevation (WSE) monitoring.** Water levels should continue to be monitored daily year round in Lake Merced using the existing SFPUC pressure transducers installed at the Lake Merced Pump Station.

- **Meteorology.** Rainfall, wind speed and direction, temperature, and solar radiation should continue to be monitored at the meteorological station installed in 2011 at the North San Mateo County Sanitation District wastewater treatment plant to help confirm estimated relationships between rainfall, runoff, and Canal flows.

- **Total Canal flow.** Total Canal flow should be monitored and quantified to confirm estimated relationships between rainfall, runoff, and Canal flows. Canal flow data would also be needed to provide information for operation of the diversion structure control system, such as the stage-discharge relationship.

- **Canal flow into Lake Merced.** Canal volumes diverted directly into Lake Merced should be monitored and recorded on an event basis.

- **Canal flow through Treatment Wetlands.** Diversions of low volume stormwater runoff and authorized non-stormwater flows passing through the treatment wetlands should be continuously monitored and recorded so that event-based (low-volume stormwater), seasonal, and annual contributions of treated Canal flows to Lake Merced can be quantified.

- **Canal Flow to Pacific Ocean.** Diversions of Canal flow into the Pacific Ocean should be monitored and recorded to quantify the proportion of annual and seasonal Canal flows that do not meet diversion criteria.

- **Lake Merced Overflow to Pacific Ocean.** Outlet structure overflows of Lake Merced water to the Pacific Ocean should be monitored and recorded to quantify annually the volume of Lake water displaced through temporary storage of peak storm flows that aid in flushing the Lake and re-establishing historic hydrologic connection to the Pacific Ocean.
- **Lake Merced Evaporation.** Continue to calculate estimated evaporation from Lake Merced.

4.2.2 Long Term Water Quality Monitoring

Continuous Water Quality Monitoring

Readings of various water quality parameters collected on an hourly basis, as was done for the 2011-2012 dry and wet season Lake Merced monitoring (see Appendix C for more details) should be implemented to capture diurnal and seasonal variations. Continuous monitoring refers to measurements captured by automatically recording water quality data sondes. The frequency of monitoring (such as hourly) is adjustable. Continuous water quality monitoring would include the following key parameters: temperature, pH, and DO. The focus of the 2011-2012 monitoring was on collecting sufficient DO and pH data to document in part, the extent, by depth and seasonal duration, that DO levels were below the Basin Plan water quality objective (WQO) of 5.0 mg/L and above the upper pH WQO of 8.5. Temperature data were used to help track the location of the thermocline, the onset and duration of mixing events, and to calculate DO percent saturation (another Basin Plan WQO). The proposed long-term LMP monitoring would continue that same focus with the intent to provide additional baseline information on the extent and duration of DO and pH conditions based on a longer term historical record to better understand ongoing interannual variability. The long-term monitoring would also provide information to help evaluate the extent to which, if at all, the addition of Canal flows can be shown to significantly improve ambient DO and pH conditions outside the range of normal seasonal and interannual variability.

It is recommended that the initial long-term data sonde deployment be conducted at the historic South Lake Pump Station site (Figure 3), which would ensure long-term water quality data collection is consistent with historic data collection. Continuous monitoring data was previously collected at the SFPUC Pump Station site in South Lake for the 2011-2012 dry and wet season (identified as Station LM-4 in Appendix C). Two sondes would be deployed at the South Lake Pump Station water quality monitoring location; one near the mid-point of the epilimnion and one near the mid-point of the hypolimnion. The intent would be for these locations to capture values approximating the average of the DO and pH conditions at the approximate mid-point of the epilimnion and the hypolimnion. Since the surface elevation of Lake Merced varies as does the location of the thermocline, the sondes would have to be deployed in a way that allows their elevation to change with lake levels (e.g., attached to a float or buoy).

Data from the sondes would be downloaded on a monthly basis to examine for errors related to sensors, to conduct calibrations, and address other issues such as the need for potential depth changes relative to the current locations of the epilimnion and hypolimnion. During each monthly download and maintenance visit, chlorophyll a and Secchi disk readings and a manual depth profile for DO, pH and temperature would be taken to inform the need for depth adjustments (discussed in more detail below).

Grab Sample Water Quality Monitoring

As part of the Lake Merced long-term water quality monitoring under the LMP, SFPUC would continue to conduct approximately quarterly monitoring within Lake Merced for the suite of parameters and at the multiple depths from which they have historically been collected (Appendix B). This long-term dataset (quarterly monitoring has occurred since 1997) provides a reasonable framework from which to identify and track potential changes in trends of constituents of concern (e.g., nutrients) as Lake management actions are implemented and Lake levels increase. Additionally, the continuation and expansion of this monitoring will document the degree to which measured water quality ranges during start-up, projected to occur in 2017 or later, are consistent with the values measured in 2011-2012 which were used for the characterization of baseline conditions, supported project design elements (such as operational criteria), and will be used in the CEQA/NEPA environmental analysis. This investigation would also ensure any new or existing sources of stormwater that are independent of the project that could cause Lake Merced water quality to substantially deviate from baseline conditions are accounted for as part of operational planning, monitoring and analysis, and adaptive management.

However, in addition to the quarterly monitoring conducted by SFPUC, monthly chlorophyll a and Secchi disk readings could more accurately identify trends of increasing frequency of occurrence and magnitude of algal blooms. Therefore, the monitoring frequency at the SFPUC South Lake Pump Station and Pistol Range locations could be increased to monthly for chlorophyll a, Secchi disk depth, and for a depth profile analysis of DO, pH, and temperature. Monthly depth profiles could more accurately track the onset, breakup, and degree of stratification occurring in the Lake. Previous monitoring of Lake water quality and analysis demonstrates the importance of conducting monthly combined chlorophyll a and Secchi disk monitoring. Modeling was conducted by Dr. Alex Horne to estimate changes to annual average Lake nutrient (total inorganic nitrogen) and algal (chlorophyll a) concentrations at various target WSEs with and without the Canal flow first passing through a basic or advanced design treatment wetlands. As shown in **Table 2** (ESA, 2013), after the Lake reaches the target WSE at the end of the filling period and is at steady state, without the proposed treatment wetland, it is estimated that the Lake would see an increase of about 5.9 µg/L algal chlorophyll (19 percent increase). With a base or advanced treatment wetland, there could be a slight decrease in algae of 1.8 to 3.0 µg/L (6 to 10 percent decrease), respectively, as compared to baseline. Final in-lake concentrations of algal chlorophyll could be approximately 27 to 35.9 µg/L, depending on the wetland design versus the current level of approximately 30 µg/L.

This range of changes in chlorophyll is shown graphically in **Figure 4** (ESA, 2013). Figure 4 also shows that there would be no visibly discernible change in Secchi disk depth over the entire predicted range of changes. Dr. Horne noted that an average 32 percent increase in algae is about that which would be analytically detectable from background over a few years. Smaller increases or declines would be obscured by seasonal and other variations. The low predicted changes in chlorophyll would therefore be difficult to detect through Secchi disk depth monitoring.

TABLE 2
ESTIMATED NET EFFECTS ON WINTER, SUMMER, AND YEAR-ROUND TIN AND ON ALGAL CONCENTRATION AT STEADY STATE

TIN (µg N/L)									Algae (µg Chl/L)	
Winter Inflow	Winter Increase	Winter Depth Reduc tion Effect	Winter Net Increase	Summer Net Increase	Summer Depth Reduc-tion Effect	Summer Usable Over Back-ground	Mean Sum Over Back-ground for 5 Blooms	All Year Increase	All Year Net Increase	All Year Value In Lake
No wetland										
158	68	-40	28	74	0	74	15	43	5.9	35.9
Base wetland										
121	31	-40	-9	20	-40	-20	-4	-13	-1.8	28.2
Advanced wetland										
114	24	-40	-16	9	-40	-31	-6	-22	-3.0	27.0

SOURCE: Horne, 2012c

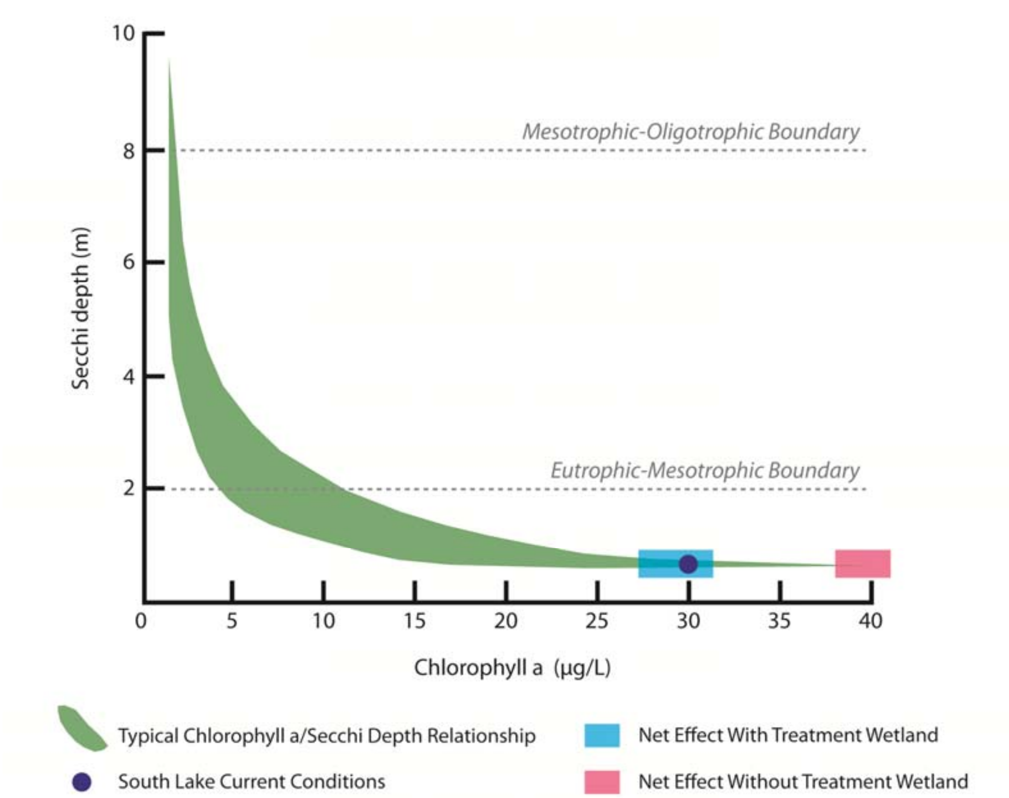

Figure 4
Potential Effects on Chlorophyll A and Secchi Depth

Treatment Wetlands Water Quality Monitoring

To assess the efficacy and performance of the treatment wetlands, samples would be collected to characterize the water quality of flows diverted into the proposed treatment wetlands (influent) as well as flows from the treatment wetlands into Lake Merced (effluent). Monthly samples would be collected for comparison and to assess the efficacy of constituent removal, such as metals, nutrients, and microorganisms, over time as wetland vegetation becomes established, with influent and effluent collected at times offset by the estimated retention time in the wetlands. Representative samples would be collected to assess the treatment wetlands performance when treating 1) Canal wet and dry season baseflows, 2) recirculating Lake water, and 3) stormwater directed to the wetlands. **Table 3** details the preliminary list of water quality constituents targeted for assessment of the treatment wetland performance pending further development of the wetlands design and review and input from the wetlands designers. All samples would be collected using standard accepted field methods and delivered to a commercial lab for analysis of the water quality constituents summarized in Table 3.

TABLE 3
PROPOSED MONITORING PROTOCOL FOR WET WEATHER SEASON
(SAMPLING AND LABORATORY ANALYSIS)

Constituent	South Lake Merced Sampling Frequency	Wetlands Sampling Frequency	Units	Laboratory Test Method	Method Detection Limits	Reporting Limits
Total phosphorus	A target of 3 storm events with 2 samples per event: within 24 hrs of a diversion event and a follow up sample 48-72 hrs following diversions.	Initially monthly influent and effluent for 12 months during differing operational modes; to be reassessed when wetlands design completed	mg/L	EPA 365.1	0.03 mg/L	0.04mg/L
Nitrate as N			mg/L	EPA 300.0	0.019 mg/L	0.1 mg/L
Total Kjeldahl Nitrogen			mg/L	EPA 351.2	0.04 mg/L	0.15 mg/L
Total Ammonia [as N]			mg/L	EPA 350.1	0.05 mg/L	0.05 mg/L
Dissolved Copper			µg/L	E200.8 (filtered)	0.1 µg/L	0.5 µg/L
Total suspended solids			µg/L	SM 2540D	N/A	1 µg/L
E. coli			cfu/ml	SM 9222	1 cfu/ 100 ml	1 cfu/ 100 ml

4.2.3 Short-Term Lake Merced Water Quality Monitoring

During the first year of diversion of Canal flows to Lake Merced, detailed water quality monitoring would be conducted at the background station in South Lake (Lake Merced Pump Station) to assess the change, if any, to conditions in the main Lake water mass potentially attributable to diversion events. Most constituents in Canal flows are associated with particulates (sediments), subject to settling and removal from the water column once entering the Lake. The constructed treatment wetlands system would provide additional particle removal via settling and adsorption onto organic plants and sediments for baseflows and for initial low-level storm flows.

Canal storm flows would be introduced near-shore at the mid-westerly side of Impound Lake typically over a period of a few to several hours. During and following wet season storm events, the Lake is likely to be well mixed, due to the lack of stratification and the presence of storm induced winds. Hydraulically, it is expected that upon entering the Lake, Canal flows would be rapidly dispersed throughout the water column and out into the main water mass of South Lake.

Water quality monitoring in South Lake would be conducted at the Lake Merced Pump Station water quality monitoring location in a manner that generally follows the monitoring plan design described in Daly City's 2011-2012 Wet Season Monitoring Plan (Appendix C), but modified based on the results of the previous monitoring and analysis to target fewer storm events (minimum of three storm events) and key water quality indicator constituents. Sampling would be conducted within 24 hours after the majority of a stormflow diversion event and again 24 to 48 hours after that initial post-diversion sampling. Table 3 details the constituents proposed for wet season water quality characterization of South Lake. All samples would be collected using standard accepted field methods and delivered to a commercial lab for analysis of the constituents listed in Table 3 using NPDES compliant methodologies and detection limits.

4.3 Analysis and Reporting

The monitoring plan would require summarization of monitoring data and submission of annual reports to RWQCB staff. Additionally, as part of adaptive management and long-term trend analysis, a more comprehensive summary and analysis of data would be included in a five-year report. The Daly City, SFPUC, and RWQCB staff would jointly determine how long and/or to what extent routine monitoring and reporting would continue after the initial five-year report. They would also determine compliance assessment procedures to be incorporated into sampling and reporting requirements. Reports would include summary graphs of all quality assured/quality controlled data as well as statistical analyses of the data relative to historic baselines. Reports would assess lake data within the context of the Lake's conceptual and numeric models. The reports would describe any measured trends in beneficial or adverse water quality related changes, such as changes in observed algal blooms/scums, lake aesthetics/odors, and in fisheries habitat quality. The reports would include assessment of the extent to which any such measured changes were attributable to controllable factors, including inputs of Canal flows. Finally, the reports would describe the need for adaptive management measures (discussed under Section 4.4) or BMPs (discussed under Section 5) and would propose a schedule for implementation. The following sections provide details regarding the schedule, content, and framework for detailed analysis and reporting of monitoring data.

4.3.1 Baseline Analysis

Baseline WSE and water quality conditions would be re-established for comparison against the monitoring data and trend analyses compiled for each subsequent annual report following project implementation. Pertinent additional pre-project monitoring data collected since the completion of monitoring and analysis conducted by Daly City (Appendix C) in 2013 would be included to establish re-baseline Lake water quality conditions prior to implementation of diversions.

4.3.2 Annual Reporting

Annual reports summarizing all monitoring data would be prepared and submitted to RWQCB staff for review. Annual data reports would include, at a minimum, the following information:

- Summary of baseline WSE and water quality conditions in Lake Merced against which trends are measured, as established under Baseline Analysis (4.3.1, above);
- Analysis and discussion of WSE and water quality trends as compared to the baseline conditions;
- Hydrologic analysis and discussion to include tables/graphs summarizing monthly dry and wet season flow volumes to Lake Merced directly, to Lake Merced via the constructed treatment wetlands, and to the Pacific Ocean via the Canal and Tunnel and via the Lake Merced overflow structure;
- Water quality analysis and discussion to include tables/graphs summarizing monthly WSE measurements and water quality results for all monitoring locations/depths;
- Summary of project developments potentially affecting WSE or water quality, such as changes to Canal diversion operational protocols;
- Discussion of other watershed factors potentially affecting WSE and water quality, such as groundwater pumping, local development, annual rainfall trends (wet/dry year);
- Preliminary discussion of water quality trends and the potential for available BMPs to address water quality trends attributable to addition of Canal flows or other identified watershed or Lake management factors, as well as additional discussion of other response strategies, such as modifications to operational protocols.

4.3.3 Five-Year Reporting

The fifth annual report would be submitted to the RWQCB staff in the form of a revised LMP. The fifth annual report would focus on analysis, interpretation, and discussion of hydrologic and water quality data collected the five years prior. The objective of the five-year report would be to assess trends in Lake hydrology and water quality within the context of identified beneficial uses and to determine if significant sustained adverse water quality trends attributable to the addition of Canal flows or other Lake management actions are beginning to be observed. This could include trends of increased nuisance conditions (e.g., excessive algal blooms) and/or adverse impacts on fisheries. Declining water quality trends could serve as a potential trigger for additional lake management actions (BMPs) to be implemented, or the need for investigation of any sources of inflow/outflow to the lake that may be affecting water quality.

Along with the components of the annual reports, the five-year report would also include a re-evaluation of Lake Merced WSE and water quality conditions based upon the monitoring data and other applicable information available. The five-year report would be submitted by Daly City and SFPUC to the RWQCB staff for review, and would include, at a minimum, the following information:

- Summary analysis of total contributions to Lake Merced from the Canal along with analysis and discussion of any trends in WSE from the monitoring data within the context of meeting project goals and objectives for lake levels;
- Discussion of any revised estimates of target WSE filling periods as well as maintenance of target WSE as a result of hydrologic monitoring as well as consideration of changes or alterations resulting from operational scenarios, as appropriate;
- Analysis and summary of water quality parameters and constituents monitored during the five year reporting period, including recommendations for any identified changes to the parameters, frequencies, and locations monitored;
- Evaluation of the need to update the modeled predications of the effects of Canal flows on Lake Merced water quality (chlorophyll a, DO, pH, temperature) based on monitoring data collected during the prior five-year reporting period.
- Analysis and discussion of significant trends beginning, such as sustained improvement or declines in Lake Merced water quality over the five-year reporting period as compared against pre-project baseline conditions;
- Recommendations for collection of additional information, such as investigation regarding the quality and quantity of inflow/outflow to the lake to determine if water quality effects are attributable to the Canal, watershed inflow, or other Lake management actions; and,
- If negative trends in water quality attributable to inputs of Canal flows or other Lake management actions are conclusively identified, discussion of operational and watershed management adjustments (such as changes in timing or amount of Canal flow to the lake) or BMPs selected for implementation and description of the associated implementation schedule including a rationale for how BMPs were selected and expected results following implementation.

4.4 Monitoring Plan Adaptive Management

An adaptive management approach to the monitoring plan is incorporated in recognition of the complexity of determining effects to Lake Merced water quality in response to inputs of Canal flows and to management actions undertaken as part of the LMP. Adaptive management provides a practical approach for assessing and responding to uncertainty inherent in complex systems (Eberhard et al., 2009). The cycle of adaptive management refers to the process that typically involves significant review of the experimental design of a monitoring plan and operates over a longer time cycle than annual monitoring and reporting (i.e., 5 to 10 years).

Adaptive management would also allow refinement of and alterations to various operational protocols and would also inform the operation and management of specific project components towards achieving the goals and objectives (Section 2). Adaptive management and evidence based decision making, informed by the results of the monitoring program analysis and reporting, would allow operational protocols to be established and further refined and adjusted over time for the following project components:

- Impound Lake outlet structure: operational protocols for operation of the outlet structure relating to project diversion criteria may be further refined following baseline studies and final design. Further adjustments to diversion criteria may be made as monitoring analyses provide seasonal and annual hydrologic and water quality trend feedback.

- Recirculation of lake water through treatment wetlands: the location of the skimmer/intake as well as the rate and volume of lake water recirculated to maintain treatment wetlands would be adjusted by monitoring and adaptive management to maximize removal of nuisance algae blooms.
- Siphon and overflow weir: The timing of diversions made to the Canal via the siphon and/or weir as well as hydrologic decisions relating to diversion volumes would be informed by monitoring and adaptive management to improve Lake water quality to the maximum extent practicable and provide temporary storage and management of flood flows.
- Treatment wetlands: alterations/adjustments to wetland hydrologic management and/or treatment wetland vegetation communities would be informed by monitoring and adaptive management to maximize treatment efficacy.
- Monitoring and reporting framework: changes to the monitoring and reporting plan may be made in response to contextual changes within the basin or system, such as anticipated or unanticipated alterations to operational parameters, watershed changes (such as development), changes in available technology, efficacy of system operations, or extreme climatic variation (e.g., extended drought conditions).

Further, as part of each five-year monitoring report, the hydrologic and water quality monitoring program design would be re-assessed in response to feedback on progress towards achieving water quality and WSE goals and objectives. Following such an assessment, alterations to the monitoring network may be made, such as revisions to the number, location, and frequency of monitoring parameters (e.g., additional sondes may be added to existing monitoring locations to cover a wider portion of the water column and additional monitoring stations may be added to cover a wider area of the Lake).

5. BMP Implementation

This section of the LMP provides a description of actions that Daly City is implementing as part of the Municipal Regional Stormwater Permit (MRP), those that SFPUC is implementing as part of their Phase II permit, and BMPs in addition to those required by the permits that could be implemented to further help maintain or improve water quality in the Canal and in the Lake. Daly City and SFPUC developed a preliminary list of 33 potential actions (including BMPs) intended to help improve water quality in South Lake. Dr. Alex Horne provided the evaluation of each action's influence on DO and pH levels. The preliminary list was transmitted to RWQCB staff (May 11, 2012) for review and comment. Based on the comments received, the preliminary list of 33 potential actions was reduced to 24.

These potential actions were screened for compliance with the LMP's goals and objectives (see Section 2.0) and then ranked according to a series of criteria that assessed their feasibility for implementation such as: improvements to water quality (DO, pH), improvements to external and internal nutrient inputs, capital costs, operation and maintenance costs, ease of operation, potential for stakeholder support, social benefits, and timeline for implementation. In addition to more conventional stormwater/watershed BMPs, several stormwater treatment measures and in-lake treatment measures were also considered. Daly City and SFPUC convened a workshop to discuss the final screening and ranking of the BMPs and treatment measures and produced a final list of nine management actions to include in this LMP. The complete list of actions that were considered is presented in a matrix in Appendix D. The list of BMPs below comprises potential measures that could be implemented.

5.1 Watershed Best Management Practices

5.1.1 Detention and Filtration

Description

This BMP would involve building infrastructure for stormwater filtration, such as bioretention/rain gardens, vegetated filter strips, sand filters, and vegetated swales throughout the Vista Grande Watershed. Such measures may reduce levels of sediment, nutrients, trash, metals, bacteria, oil and grease, organics, and oxygen-demanding substances in source water. Additional infrastructure, such as infiltration basins and trenches would promote infiltration and reduce the volume and rate of runoff in the watershed, as well as reduce levels of sediment, metals, bacteria, and nutrients in stormwater flows.

These measures would have a minor influence on DO and pH by reducing particulate-bound nutrient levels in storm flows that could potentially stimulate additional algal growth.

Most low-impact design (LID) projects in Daly City and San Francisco would be implemented as opportunities arise with redevelopment and infrastructure projects.

Existing Sites

- (Daly City) Serramonte Library Bioswale Demonstration Garden
- (Daly City) Home Depot Vortfilter system in the parking lot
- (Daly City) Monarch Village/Peninsula Del Rey senior care facility treats stormwater flow onsite using a dual-vortex hydrodynamic separator

Potential Sites for Implementation

- (Daly City) Post-construction stormwater management actions for all development projects that disturb 5,000 or more square feet of land
- (Daly City) Potential funding source through Proposition 84 – Clean Water, Parks, and Coastal Protection Bonds
- (Daly City) John Daly Boulevard segment between Mission and De Long Street
- (SFPUC) Lake Merced Watershed Green Infrastructure - Holloway Avenue Green Street would install bioretention bulbouts and planters

Management Action Assessment

Describe projects that were implemented.

5.1.2 Pet Waste Management

Description

Daly City would implement an education program and provide facilities such as compostable clean-up bag stations and trash receptacles to reduce pet wastes within the Canal watershed. This BMP is intended to reduce levels of nutrients, bacteria, and oxygen-demanding substances in source water.

Reduction in levels of oxygen-demanding substances and nutrients present in pet wastes would reduce the potential for stormwater to stimulate algal growth in the lake and degrade DO levels.

Potential Sites for Implementation

Daly City would install compostable clean-up bag stations and trash receptacles in Westlake Park, Westmoor Park, and Marchbank Park. San Francisco would install them around Lake Merced. Daly City would also work with pet food stores, veterinarians, and other pet-related businesses to provide educational materials to pet owners about the impacts of pet waste and how to reduce them.

Management Action Assessment

Describe the educational efforts implemented and how many clean-up bag stations and trash receptacles were installed and where.

5.1.3 Green Infrastructure Education Programs

Description

"Green infrastructure" describes systems and practices that use or mimic natural processes to promote the infiltration, evapotranspiration (the return of water to the atmosphere either through evaporation or by plants), or reuse of stormwater or runoff on the site where it is generated (USEPA, 2014). These include but are not limited to green roofs, trees and tree boxes, rain gardens, vegetated swales, pocket wetlands, infiltration planters, vegetated median strips, reforestation, and protection and enhancement of riparian buffers and floodplains (USEPA, 2007). Green infrastructure education programs could include public workshops, school programs, and curriculum development such as the existing programs described below. This BMP could be combined with the detention and retention BMP. The proposed Vista Grande Drainage Basin Improvement Project is a significant green infrastructure effort that would capture and divert large volumes of stormwater to Lake Merced that would otherwise be "wasted" by continued conveyance to the ocean.

Opportunities for Implementation

Daly City, in partnership with the Bay Area Water Supply and Conservation Agency (BAWSCA), contracts with EarthCapades to present the "H_2O Show" that uses an interactive approach at school assemblies for kindergarten through 6th grade. The show teaches students about how vital water is to sustain life, and explains how water travels from its source to Daly City homes and schools; how to conserve, protect, and respect water; and how to prevent water pollution. EarthCapades has several teams of performers, ensuring that participating schools receive a different show each year. These educational assemblies engage the students and uses comedy, music, juggling, storytelling, and theatrics to teach children about water resources and conservation while using California State Science Standards content to reinforce learning for standardized testing. In 2012, the program conducted 18 performances before 3,758 students.

SFPUC also conducts education programs such as the "Our Water" curriculum for schools. This program is designed to teach 4th to 6th grade students about San Francisco's water resources and the importance of conservation. It is in interdisciplinary unit that supports California State Standards. The program includes classroom presentations, lesson plans, and activity sheets.

Management Action Assessment

Describe the materials developed and distributed through education programs.

5.1.4 Habitat Enhancement

Description

Enhancing the wetland and riparian habitat around the edges of Lake Merced could provide a moderate beneficial effect on DO and pH by assisting with filtration of and uptake of nutrients from direct stormwater runoff to the lake. While SFPUC's Lake Merced Watershed Report (2011) recommends potentially reducing the width of some sections of Lake Merced Boulevard, John Muir Drive, and Skyline Boulevard to incorporate bioswales and open space, the available road area may be limited due to the need to accommodate bicycle lanes.

This BMP could result in a slight localized DO depletion due to respiration by submerged parts of the enhanced growths of vegetation.

Management Action Assessment

The improved aesthetic, habitat creation, and erosion protection aspects of this alternative would offset any potential likely immeasurable localized DO decreases along the shoreline.

5.1.5 Separating Stormwater

Description

The goal of this BMP would be to separate stormwater from SFPUC's combined stormwater and sewer system and "daylight" streams within the historic Lake Merced watershed, restoring a portion of the lake's historic drainage area. Separating stormwater would have a minor influence on DO and pH by increasing the volume of stormwater runoff to the lake, while having a negligible impact on nutrient concentrations in the lake. Projects may be implemented with major redevelopment and infrastructure projects. The SFPUC's Sewer System Improvement Program (SSIP) is considering some daylighting creek projects, including those that could connect to receiving water such as Lake Merced. However, there are no current plans to implement such plans in the short term.

Potential Sites for Implementation

A non-SSIP potential option for directing stormwater into Lake Merced exists. Parkmerced, a neighborhood of high-rise and garden apartments located east of Lake Merced in San Francisco, currently uses the SFPUC combined stormwater and sewer system. The development's owners plan to create a stormwater conveyance system almost entirely on the surface that would be composed of rain gardens, a stormwater collection pond, swales, and a new stream corridor (Parkmerced, 2011). These facilities would treat stormwater and convey it to the southwest corner of the site, where they would connect to the combined sewer system or use an existing direct connection to Lake Merced. As of April 2012, the developer is studying the possibility of using the connection to the Lake; if this is found to be feasible and constructed, this project would increase runoff volumes into the Lake.

Management Action Assessment

Monitor stormwater flows to Lake Merced for trash, debris, and functional/maintenance issues. Monitor water quality at stormwater outlet(s) to lake to determine nutrient content after traveling through swales and detention ponds.

5.1.6 Reduce Nutrient Sources

Description

This educational effort would target the largest contributors of nutrient sources from regions upland of Lake Merced, which include parks and public agencies that maintain green space where fertilizer and irrigation (which, if not properly managed, can contribute to nutrient-rich runoff) may be used. Some alternative maintenance measures could include the use of woodchips, restriction of lawn fertilizers, and minimization of irrigation runoff through planting (e.g., lawns, shrubs, medians) and inspection and repair of sprinklers contributing to incidental runoff.

This BMP would have a potentially moderate influence on DO and pH by reducing the concentration of nutrients in stormwater runoff that could stimulate algal growth in the lake. This benefit would potentially be more substantial in the summer because warm inflows would float in the photic zone rather than mixing deeper into the lake. However, it is assumed that all of the dry season flows would be conveyed to and treated via the constructed wetlands, thereby significantly reducing the level of nutrients in the Canal baseflow reaching the Lake.

Effective implementation of this BMP would require an inventory of nutrient sources in the watershed to target these sources specifically. It may require coordination of multiple agencies to provide education, implementation, and enforcement, and may require phased implementation. This BMP could be combined with other education-focused BMPs in this report such as the Green Infrastructure Education Programs.

Management Action Assessment

Qualitative description of actions that were implemented by owner/operators of parks and green space to reduce nutrients in runoff.

5.1.7 Catch Basin Screening

Description

A limited pilot program would test the efficacy of installing storm drain catch basin screens at targeted locations in Daly City that would screen out large trash, potentially reducing nutrient levels, which would reduce the potential for stormwater to stimulate additional algal growth in the lake. This program could also reduce the frequency of maintenance and cleaning of the gross solids screening device for particles that are greater than 5 millimeters proposed to be installed at the entrance to the Canal (described in Section 3.2.2).

The Wastewater Collection Division in Daly City has tested a pilot program to keep large pieces of trash out of the ocean by inserting catch basin nets (larger than the 5 mm standard) in an area south of the Basin.

Potential Sites for Implementation

A similar pilot program could be implemented during the dry season around the area of the wastewater plant using the same type of catch basin nets used in the pilot program described above. This would include areas around Westlake Park and the Burger King at the intersection of Daly City Boulevard and Lake Merced Boulevard.

Management Action Assessment

Monitor catch basin screens and record frequency of cleaning and/or volume of debris removed from stormwater upstream of the linear radial screening device to determine benefit to project operation.

5.2 Adaptive Management Actions

5.2.1 Additional Measures

This plan uses a tiered approach for managing stormwater quality and quantity before it enters Lake Merced. As described above, numerous BMPs have been evaluated for their inclusion into this plan. Several actions considered but not described above were dismissed because they were found to be infeasible or to conflict with the project objectives (see Appendix D). Following the installation of the project components and the implementation of the selected BMPs, water quality would be monitored as described in Section 4. Should there be less improvement in in water quality in the lake attributable to lake management actions than expected, the addition of flows from Canal, additional stormwater quality investigations, stormwater treatment, and in-lake treatment measures could be re-considered for implementation. Additional stormwater source and water quality investigations would include monitoring of stormwater inputs to the lake to determine potential sources of pollutants that could be contributing to significant deviations in water quality trends towards planning and implementing corrective actions, such as adjustments to the timing and input of Canal flow to the lake. Investigations may also suggest that implementation of appropriate BMPs and direct lake management actions may otherwise provide for lake quality benefits.

It is also an option that flows from Canal could be reduced or terminated while any water quality changes was investigated. Additionally, as part of adaptive management, stormwater contributions to the Lake could be utilized directly to dilute lake water and re-establish flows to the Pacific Ocean, as historically occurred (Lake Merced once had an outlet to the Pacific Ocean and therefore was not a terminal lake). As discussed in Section 3.2.1, when feasible, overfilling and thereby flushing the lake with low-alkalinity stormwater could reduce the background pH of the lake by diluting salts in the lake and displacing higher alkalinity water. Such a measure would be implemented through adaptive management of the project provision to temporarily extend the duration of elevated WSE conditions above target maximum.

While the additional BMPs described in Appendix D were initially proposed for inclusion in the LMP, upon further evaluation, it was determined that it is highly improbable that they could be easily implemented successfully; or would conflict with project objectives. These measures are included in Appendix D and could be revisited (with the exception of those that do not meet project objectives) depending on the specific condition in the lake if the situation requires. Of those measures, aeration mixing is an action that has been implemented in other, generally more eutrophic and deeper lakes than Lake Merced. It was generally viewed as a method-of-last-resort, if deemed necessary to increase bottom layer dissolved oxygen concentrations during periods of stratification, but with the potential for unintended consequences to the Lake’s functions and aquatic health.

5.2.2 Aeration Mixing

Description

Consistent with SFPUC and Regional Board discussions of December 2011, because aeration mixing is not typically conducted in lakes similar to Lake Merced water quality benefits are not proven and aeration mixing may have unintended consequences, and so aeration mixing is not included as a BMP to be implemented as part of the proposed project. However, SFPUC is separately implementing a demonstration aeration mixing project to evaluate potential benefits to the lake. The demonstration system is further discussed below.

If used, aeration mixing would be achieved by installing a bubbler device near the lake bottom to create a mixing force that causes circulation of lake waters so the lower layer of low-DO water is mixed with upper waters with higher DO concentration to reduce or eliminate anoxic conditions. Oxygen produced by photosynthesis during the day at the surface would be mixed with uprising lower DO water and circulated though most of the lake volume. The system would likely be operated to provide complete top-to-bottom mixing throughout the potentially stratified period. Circulation could potentially also create conditions that allow for enhanced growth of non-blue green phytoplankton, thereby creating a potentially more sustaining food web for fisheries.

It is expected that aeration mixing in and of itself would have a minor direct influence on DO and pH, but a moderate to major indirect effect due to the transport of higher surface DO (due to algal photosynthesis and atmospheric reaeration) to the lower waters. There is also a potential to reduce algae-related pH levels by reducing algae exposure to sunlight (which would reduce algal production). To the extent that mixing allowed for a greater oxidized layer to be maintained at the surface of the sediments, there could be a potential reduction in the amount of internal nutrient loading from the sediments. While it is not likely that aeration mixing in Lake Merced would alter chlorophyll concentrations, it would potentially increase water clarity (Secchi depth) since the algae would be spread over a greater depth rather than being concentrated floating at the Lake surface. However, due to the high alkalinity and thus high background pH of the lake, the effect on pH would be limited.

Because algae are responsible for producing DO, on rare occasions when algae growth is inhibited too much, aeration can lead to anoxic periods that may result in fish kills to some species. Aeration mixing would disrupt lake stratification, resulting in a reduction in the volume of colder hypolimnion habitat that helps supports an existing recreational trout fishery. Conversely, there would be an increase in DO levels in the hypolimnion. As described in the fisheries section of the WQA, the warm water and cold water species have different preferences for and tolerances of mutually occurring DO and temperature conditions in the lake strata.

Aeration mixing would require the installation and long-term maintenance of new infrastructure in the lake (air lines and bubble diffusers), and an air compressor(s) on shore. There are multiple possible aeration mixing system designs. Two possible options for South Lake Merced based on information from Alex Horne are presented below.

> **Option # 1.** Install a diffuser array in deeper water only, with diffusers located approximately 1 foot above the lake bottom and set at about 200-300 feet intervals in water greater than 15 feet deep. This could result in aeration mixing of most of the lake. In shallow edge water, the effect would likely be minimal unless water is within 150 feet of a diffuser head. Installation of diffusers in areas greater than 15 feet deep would likely include a relatively small, but well-used part of Lake Merced. Air could be supplied from a compressor shed with sound baffling located on shoreline via self-sinking hoses connected to each diffuser. No change in total chlorophyll would expected; however, edge scums should be reduced, depending on location of diffusers.

> **Option # 2.** In addition to the deep water array described under Option 1, an additional array of diffusers would be installed in shallow water between approximately 5 feet and 15 feet deep, with diffuser heads set at about 70-130 feet intervals. The shallow array would

likely break up blue-green algae scums and replace them with smaller algae which may or may not be blue-green. No change in total chlorophyll a would be expected, but water clarity would improve with edge scums greatly reduced. Longer runs of aeration pipes with regulators would be required for each diffuser. A larger compressor shed with more compressors would be required.

SFPUC Demonstration Aeration Mixing System

Consistent with the February 2015 meeting with the RWQCB, the SFPUC is in initial planning to implement a demonstration aeration mixing system in the south portion of Lake Merced's South Lake. The purpose of this demonstration would be to evaluate potential benefits as well as any unanticipated negative effects of aeration mixing for Lake Merced.

Following required environmental review and installation of the demonstration project, the SFPUC will evaluate pertinent water quality parameters to determine whether aeration mixing would produce an overall improvement to key water quality parameters without causing unanticipated negative impacts to the Lake.

The results of post-installation monitoring and data review will be shared with the RWQCB staff. Based on these findings the SFPUC will be prepared to implement a full-scale aeration mixing system for Lake Merced's South Lake, if deemed necessary to increase bottom layer dissolved oxygen concentrations during periods of stratification and assuming the results from the demonstration program indicate measurable benefits in key water quality parameters.

5.2.3 Management Action Assessment and Adaptation

As described in Sections 4.3.2 and 4.3.3, lake management actions (BMPs) would be implemented if monitoring and analysis of lake hydrology and water quality identifies significant deviations in expected water quality trends attributable to addition of Canal flows or other lake management actions. Water quality trends could include less water quality improvement than predicted, or trends of increased nuisance conditions (e.g., excessive algal blooms) that can be addressed primarily though adjustment of the operational protocols (e.g., amount and timing of diversions). If the addition of BMPs would provide additional benefits and are implemented, an assessment and adaptation program would be implemented to track their effectiveness. The ambient water quality would be monitored and assessed on an annual basis, the BMPs that were implemented would be tracked alongside the results of the water quality monitoring and analysis. The BMP management action assessment and adaptation program would help identify the effectiveness of a given BMP. Assessment would consist of an adaptive management plan that would track a list of actions taken to improve water quality and document whether water quality was maintained or improved. To the extent practicable, this assessment would be linked to the water quality monitoring and reporting program described in Section 4.

6. References

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APPENDIX A
RWQCB Consultation History

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

San Francisco Bay Regional Water Quality Control Board

May 9, 2013
CIWQS Place ID 766747

Sent via electronic mail: No hard copy to follow

City of Daly City
333 90th Street
Daly City, CA 94015-1895
Attn.: Ms. Patricia Martel
Email: pmartel@dalycity.org

Subject: Concurrence with Proposed Regulatory Process for Vista Grande Drainage Basin Improvement Project, Lake Merced Alternative

Dear Ms. Martel:

We have reviewed the letter dated March 12, 2013, summarizing the proposed regulatory process for the Vista Grande Drainage Basin Improvement Project, Lake Merced Alternative (Regulatory Process Letter). In general, we concur with the regulatory process as proposed by the City of Daly City. However, we are providing clarifications to the Regulatory Process Letter to help improve the City's understanding of the process and our expected outcomes from the process.

Lake Management Plan

On page 2 of the Regulatory Process Letter, the text indicates that the Lake Management Plan (LMP) would specify best management practices (BMPs) to maintain and where feasible, improve the water quality of Lake Merced. We suggest "where feasible," be deleted from the objective in the LMP. Our expected outcome from implementation of the LMP is for the water quality of Lake Merced to improve. Although we agree that technical and logistical feasibility as well as cost considerations will need to be evaluated during the BMP selection process, our expectation is that implementing the LMP would improve the water quality of Lake Merced.

Basin Plan Amendment

On page 4 of the Regulatory Process Letter, the text indicates that we could recommend to the U.S. Environmental Protection Agency (USEPA) that Lake Merced be taken off the 303(d) list of impaired water bodies after (1) the LMP is implemented via an operational agreement between the City and the San Francisco Public Utilities Commission and (2) the Regional Water Board adopts site-specific dissolved oxygen and pH implementation provisions via a Basin Plan amendment. Although we agree with this approach, please note that any Basin Plan amendment would need to be approved by the State Water Board, the State Office of Administrative Law, and USEPA before we could recommend delisting Lake Merced. We would also need adequate evidence that Lake Merced water quality complies with the site-specific dissolved oxygen and pH implementation provisions.

Closing

If you have any questions, please contact Xavier Fernandez of my staff at (510) 622-5685 or by e-mail at xafernandez@waterboards.ca.gov.

Sincerely,

Digitally signed by Bruce H. Wolfe
Date: 2013.05.09 10:58:49 -07'00'

Bruce H. Wolfe
Executive Officer

cc: SFPUC, Steve Ritchie, SRitchie@sfwater.org
ESA, Josh Ferris, JFerris@esassoc.com
ESA, Alisa Moore, AMoore@esassoc.com

City of Daly City

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March 12, 2013

San Francisco Bay Regional Water Quality Control Board
Mr. Bruce H. Wolfe, Executive Officer
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Draft - Proposed Regulatory Process for the Vista Grande Drainage Basin Improvement Project

Dear Mr. Wolfe,

I appreciate the time and attention that you and your staff have committed to the preliminary review of the Vista Grande Drainage Basin Improvement Project. This project is critical to resolving ongoing flooding issues in Daly City and provides an important means to improve the use, enjoyment, and health of Lake Merced. Daly City has worked closely with the San Francisco Public Utilities Commission (SFPUC), other stakeholders, and Regional Water Quality Control Board (RWQCB) staff in developing the Lake Merced Alternative, which if approved, would divert selected storm flows from the Vista Grande Canal to Lake Merced, reconnecting a significant portion of the lake's original recharge area and thereby providing a reliable water supply to raise and maintain lake levels.

Daly City is committed to developing the Lake Merced Alternative and, if approved, operating it in a manner that protects the water quality and beneficial uses of Lake Merced. Daly City and the SFPUC expect that implementation of the project, in conjunction with the proposed Lake Management Plan, would improve the health of Lake Merced over time. To ensure the attainment of dissolved oxygen (DO) and pH standards, the RWQCB, Daly City, and SFPUC have agreed that site-specific implementation provisions should be developed to address the lake's unique conditions. This letter summarizes the regulatory approach that has been developed by the three parties, and requests that the RWQCB staff provide their written concurrence with this approach as part of the overall project review and approval process.

PROJECT DESCRIPTION

The Vista Grande Drainage Basin Improvement Project is being proposed by the City to pro-actively address instances of storm-related flooding in the Vista Grande Watershed Drainage Basin while providing the benefit of restoring the Lake Merced water surface elevation to desired levels. This approach builds upon the City's previous determination to focus on downstream improvements within the Vista Grande Watershed in advance of upstream projects within the basin. Of seventeen alternatives analyzed, the City has identified the

Lake Merced Alternative as its preferred alternative/proposed action, and will complete an environmental impact report (EIR) to evaluate the potential environmental impacts of the project prior to consideration for approval.

The project would consist of the following:

- Partial replacement of the existing Vista Grande Canal to incorporate a gross solid screening device, a treatment wetland, and diversion and discharge structures to route selected stormwater (and authorized non-storm water) flows from the Vista Grande Canal to South Lake Merced;
- Replacement of the existing Vista Grande Tunnel to expand its capacity; and
- Replacement of the existing outfall structure at Fort Funston.

Please refer to the project description provided as **Attachment A** for a detailed description of the project. Daly City released a Notice of Preparation for the EIR in February 2013.

TWO-PART REGULATORY APPROACH OVERVIEW

Daly City, SFPUC, and the RWQCB have developed a two-part approach to address the 303(d) listing of Lake Merced. The first part is the development and implementation of a Lake Management Plan (LMP). The LMP would define the applicable best management practices (BMPs) that would be implemented to maintain and where feasible, improve water quality conditions in Lake Merced. However, with these BMPs alone, the existing water quality objectives may not always be met throughout the water column during seasonally stratified conditions that independently exist. Accordingly, new site-specific implementation provisions for the existing DO and pH water quality objectives (WQO) are proposed to be developed to address the unique conditions of Lake Merced.

Part 1 - Lake Management Plan

The City and SFPUC have agreed to develop and propose for approval a LMP that would maintain and, where feasible, improve the water quality of Lake Merced. The LMP will include goals and objectives, an operational plan for the proposed Vista Grande diversions, a water quality monitoring plan, evaluation of BMPs, and an implementation and adaptive management plan. The LMP will be developed in consultation with the RWQCB. The LMP will include pre- and post-project in-lake and Vista Grande Canal monitoring, and an adaptive management process regarding future monitoring and BMP implementation. Annual monitoring and management reporting to the RWQCB will be provided independently and separately from annual reporting provided in compliance with the Municipal Regional Stormwater NPDES Permit (MRP). The LMP, if approved by Daly City and the SFPUC, would be implemented pursuant to a legally binding operational agreement between Daly City and the SFPUC. The agreement would contain provisions requiring RWQCB notification and approval of specified changes to the LMP. A draft of these provisions will be provided to the RWQCB for review prior to finalizing the operational agreement.

The Draft LMP will be developed in the first half of 2013. Please refer to **Attachment B**, which provides an outline of the LMP.

Part 2 – Basin Plan Amendment

As the second part of the regulatory approach, the Basin Plan will be amended to incorporate site-specific implementation provisions for the DO and pH objectives. This is consistent with Basin Plan guidance (p. 3-2), which states "*Compliance with water quality objectives may be prohibitively expensive or technically impossible in some cases. The Regional Board will consider modification of specific water quality objectives as long the discharger can demonstrate that the alternate objective will protect existing beneficial uses, is scientifically defensible, and is consistent with the state Antidegradation Policy. This exception clause properly indicates that the Regional Board will conservatively compare benefits and costs in these cases because of the difficulty in quantifying beneficial uses.*"

The unique conditions of Lake Merced that necessitate site-specific DO and pH implementation provisions include the following:

Polymictic. It is normal for deeper lakes and reservoirs to stratify in the summer, remain stratified until the fall turnover, and then remain mixed until the next summer stratification. During stratification, DO concentrations decrease in the lower unmixed layer (hypolimnion) due to the absence of aeration from the surface and from the oxygen demand by organic material decay in the sediments. Lake Merced also stratifies between late spring and early fall but is shallow enough for winds to periodically mix the lake (polymictic) from top to bottom for short periods of time before the stratification is re-established. These periodic mixing events are not sufficient to significantly increase the low dissolved oxygen levels (< 5 mg/L) that can be present within the hypolimnion during this seasonal stratification.

Terminal lake. Lake Merced was once a seasonal lagoon, but in the late 1800s, was developed into a reservoir to serve as a public water supply, and drainage from the increasingly urban watershed was diverted from the lake to the Pacific Ocean. The only outlet is an overflow to the Vista Grande Canal at a water surface elevation that has not been exceeded since the 1940s. Because the lake is not flushed with storm flows from the watershed, minerals have built up over time, increasing the alkalinity of the lake and thereby increasing the ambient baseline pH levels above those of typical lakes in the region. Therefore, normal diurnal pH increases due to algal photosynthesis in the upper photic zone can cause pH levels to increase above 8.5 solely due to the elevated alkalinity in this terminal lake.

Marine coastal influence. Lake Merced has relatively low temperatures for a lake of moderate depth at this latitude. This is due to the lake's close proximity to the Pacific Ocean. Prevailing winds bring cool air off the ocean as well as fog that blocks solar radiation, keeping the lake cooler than similar inland lakes.

Artificially maintained coldwater fishery. Lake Merced does not contain suitable spawning habitat nor is it connected to streams that provide suitable spawning habitat; therefore, it does not and cannot support a self-sustaining population of trout. However, the California Department of Fish and Wildlife (CDFW) has stocked the lake with rainbow trout for many decades in support of a popular put-and-take recreational fishery. The current DO and pH conditions in Lake Merced do not appear to be adversely affecting CDFW's ongoing stocking program.

Self-sustaining warmwater recreational fishery. Lake Merced maintains self-sustaining populations of native and non-native warm water fish species, including largemouth bass, carp, and catfish, which are targeted by anglers. The current DO and pH conditions in Lake Merced do not appear to be adversely affecting warm water habitat.

Emergency non potable water supply for San Francisco. The SFPUC has designated Lake Merced as an emergency non-potable water supply for the City of San Francisco to be used for firefighting or sanitation purposes if no other sources of water are available. Given that the Lake is designated as a potential water supply, SFPUC prohibits body contact recreation (e.g., swimming, wading) in the Lake.

The State's Impaired Waters Policy also recognizes that water quality standards may be inappropriately applied, making attainment impossible. In such cases, the Policy identifies that revision of the standards may be the best or only way to address the impairment. Daly City, SFPUC, and RWQCB have come to consensus that although implementation of the Lake Management Plan is expected to improve water quality, it will not independently resolve the impairment. Therefore, site-specific implementation provisions are required to make attainment of DO and pH objectives possible.

The findings made by the U.S. Environmental Protection Agency (USEPA) in its 2003 listing of Lake Merced for DO and pH impairment highlight the need to amend the water quality objectives (WQOs) for DO and pH, and/or establish a manner in which compliance with those WQOs is assessed to reflect site-specific conditions. In its findings, USEPA established "a low priority for this listing based on the considerations that *no specific beneficial use impairments have been associated with DO and pH problems in the Lake*, and that additional monitoring is warranted to verify these listings prior to developing TMDLs." USEPA concluded that "*absent Basin Plan language to the contrary, these standards apply at all water depths*" (*emphasis added*).

The proposed two-part regulatory approach is supported by the State Water Board's TMDL Guidance and the Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options (Resolution No. 2005-0050). This policy established that RWQCBs can formally recognize regulatory or non-regulatory actions of other entities as appropriate implementation programs that will result in the attainment of standards. The LMP, which if approved would be implemented by Daly City and SFPUC via an enforceable operational agreement, would serve as the appropriate implementation program, in combination with the site-specific implementation provisions modification.

An annotated version of the Regulatory Decision Tree (**Attachment C**) from the State's Impaired Waters Policy graphically shows how the two-part regulatory process would proceed. If and when both the LMP becomes effective via the operational agreement and the site-specific DO and pH implementation provisions are adopted via a Basin Plan Amendment, the RWQCB could proceed with recommending to USEPA the delisting of Lake Merced (green arrow labeled Future Goal). Depending on the timing of the listing cycle, it could take several years for a delisting request to be approved. There may also be modifications needed to the SWB 2004 Listing Policy to accommodate the proposed DO and pH implementation provisions. If so, the RWQCB could potentially request that USEPA move Lake Merced to 303(d) Category 4b or 4c, clarifying that a TMDL is not required, while 303(d) list timing and/or Policy language issues are resolved to allow for full delisting.

Daly City, SFPUC, and RWQCB staff have agreed that the scope of the standards action will be to adopt site-specific objective implementation provisions for Lake Merced within the Basin Plan specifying how the existing DO and pH numerical objectives would be implemented and evaluated for 303(d) water quality assessment purposes. The State of Colorado has adopted standards and methodologies specific to lakes and reservoirs that take stratification into account. Colorado's approach to DO and pH assessment (summarized below) provides an example that can be applied as a starting point template and modified as necessary to reflect the site-specific conditions unique to Lake Merced:

> Dissolved Oxygen Assessment. Assessment of dissolved oxygen within a profile of a lake or reservoir is accomplished by comparing the average of the measurements within the upper portion of the lake to the applicable standard. For lakes over 5 meters deep (such as Lake Merced), the upper portion is assessed as the average of all measurements from 0.5 meters to 2.0 meters. The lower portion of a lake is assessed by averaging the measurements from 1-3 meters above the bottom of the lake. In the lower portion of a lake, dissolved oxygen may be less than the applicable standard except where a site-specific standard has been adopted, or where adequate refuge is necessary for assessment of the temperature standard. Colorado's assessment methodology also provides for fall turnover of lakes and reservoirs, when seasonal stratification breaks down and low-DO water from the bottom of the lake rises and for a short period of time mixes with and lowers the DO of surface waters.

> pH Assessment. Assessment of the pH standard for a lake is accomplished by calculating the pH from the upper and lower portions of the lake. The 15th and 85th percentiles of the sample values from each portion are then compared to the minimum and maximum pH standard for the determination of attainment. Discrete samples from the upper and lower portions are evaluated separately because they represent different habitat regions in a stratified lake. When variations in pH are driven largely by biological processes within a lake, the risks of exceedance are generally associated with high pH in the upper portion (due to high rates of algal productivity) and low pH in the lower portion (due to high rates of decomposition).

A similar assessment methodology will be adapted for Lake Merced to address site-specific conditions. We do not propose changing the numeric DO and pH objectives presented in Chapter 3 of the Basin Plan, only how or where these standards are applied to Lake Merced. At the RWQCB's discretion, a footnote or other language may be added to the appropriate section(s) of Chapter 3 pointing to the Lake Merced Site-Specific Implementation Provisions language that would be added to the Chapter 4 Implementation Plan and/or Chapter 7 Water Quality Attainment Strategies Including TMDLs.

A draft scope and schedule for the Basin Plan Amendment process is provided as **Attachment D**. The scope and schedule is intended to assist in estimating the level of effort and duration of the Basin Plan Amendment process. Daly City will provide technical support to the RWQCB throughout the process. Daly City will also work with RWQCB to address its administrative costs to adequately staff this effort.

PROJECT PLANNING COORDINATION

The development of the LMP and Basin Plan Amendment will require consideration of, and coordination with, the following planning activities.

CEQA review
Daly City will begin preparation of an EIR to address the Vista Grande Project in early 2013. This EIR will also address the implementation of the LMP. Daly City understands that RWQCB will need to comply with the California Environmental Quality Act (CEQA) to address the means of compliance and environmental consequences of the Basin Plan Amendment. Daly City will work with RWQCB to ensure that the scope of the environmental analysis addresses the CEQA-equivalent requirements relative to the RWQCB's approval of the proposed Basin Plan Amendment to the extent practicable. As provided by CEQA, no approvals of the LMP, the Basin Plan Amendment, the operational agreement, and other discretionary projects decisions will be made prior to completion of the environmental analysis process.

Coverage under the Municipal Regional Permit
RWQCB staff has indicated that the proposed diversions of stormwater from the Vista Grande Canal to Lake Merced are covered under the existing MRP. Daly City understands that no additional NPDES permits are needed for operation of the proposed project. The City understands that additional discussion will need to be conducted with RWQCB and MRP co-permittees as the project progresses to determine the need, if any, to more specifically address the project via modifications to the MRP during the scheduled 2014 MRP reissuance process. Daly City will apply for and obtain a Clean Water Act Section 404 Permit from the US Army Corps of Engineers and associated Section 401 Water Quality Certification from RWQCB for the construction of the proposed facilities.

Operational Agreement
Upon completion of the CEQA process, Daly City and SFPUC will consider the approval of a legally binding operational agreement to address development of permanent Daly City facilities on CCSF lands, operation of the project, stormwater diversion threshold criteria, wetlands flow management, lake level management, and implementation of the LMP. The agreement would include commitments and conditions describing how the treatment wetlands would be constructed and managed to comply with RWQCB Resolution No. 94-102 *"Policy on the Use of Constructed Wetlands for Urban Runoff Pollution Control."* The agreement would contain provisions requiring RWQCB notification of specified changes to the LMP. Daly City and SFPUC are currently working on an outline of the operational agreement, and will provide it to the RWQCB for review.

Timeline of Permits and Approvals
Daly City anticipates completing the CEQA process for the proposed project in mid-2014, assuming the full cooperation of state and federal agencies. During completion of the CEQA process, Daly City will begin to obtain all necessary permits and approvals for the project, including the Section 401 Water Quality Certification required from the RWQCB. The Section 401 Water Quality Certification is the only permit/approval believed to be necessary from RWQCB to allow construction and operation of the proposed facilities. The Basin Plan Amendment would require approval by the RWQCB followed by approval by the State Water Resources Control Board, Office of Administrative Law, and USEPA. Please refer to the draft scope and schedule provided in Attachment D for additional details on the sequence of major activities.

CONCLUSION
Daly City respectfully requests the RWQCB staff's written concurrence with the regulatory process as outlined above as the initial step in the overall project approval process. The City understands that the

RWQCB will be providing comments and/or conditions on the project as part of the 401 Certification and CEQA processes. Following completion of the 401 Certification and CEQA processes, the City may request a second letter from RWQCB staff indicating approval of the project conditioned on compliance with the terms and conditions contained in the LMP, operational agreement, 401 certification, and CEQA monitoring and mitigations.

Sincerely,

Patricia E. Martel
City Manager

L13-039

cc: Steve Ritchie, SFPUC

PROJECT DESCRIPTION

Daly City Vista Grande Drainage Basin Improvement Project

Introduction

The City of Daly City (City) is proposing the Vista Grande Drainage Basin Improvements project to address storm related flooding in the Vista Grande Watershed Drainage Basin while providing the benefit of restoring the level of Lake Merced. The Vista Grande stormwater system drains the northwestern portion of the City and an unincorporated portion of San Mateo County – areas originally within the watershed of Lake Merced. In the 1890s, the Vista Grande Canal and Tunnel were built to divert stormwater away from the lake to an outfall at the Pacific Ocean, below what is now Fort Funston. The existing canal and tunnel do not have adequate hydraulic capacity to convey peak storm flows, and during storm events, flooding periodically occurs in adjacent low lying residential areas and along John Muir Drive. The proposed project would alleviate flooding and protect the ocean outfall from ongoing coastal erosion while reconnecting a significant portion of the Lake Merced Watershed.

Background

The City evaluated seventeen alternatives for managing stormwater in the Vista Grande Drainage Basin. The alternatives included various combinations of facilities including different tunnel alignments and capacities, storm water detention structures and groundwater recharge facilities. Alternatives were evaluated based on their potential for reducing flooding, operational viability, public impacts, environmental benefits and constructability. The Lake Merced Alternative emerged as the preferred alternative, based on its "green infrastructure" approach of using stormwater to restore the level of Lake Merced, which declined in the late-80s and early-90s and has not fully recovered. The City has worked closely with the San Francisco Public Utilities Commission (SFPUC) and the San Francisco Bay Regional Water Quality Control Board (RWQCB) in the development of this project. The City intends to prepare an Environmental Impact Report (EIR) for the proposed project in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The Lake Merced Alternative, described below, will be considered the proposed project in the EIR. Other alternatives will be evaluated as required by CEQA and NEPA.

Project Location

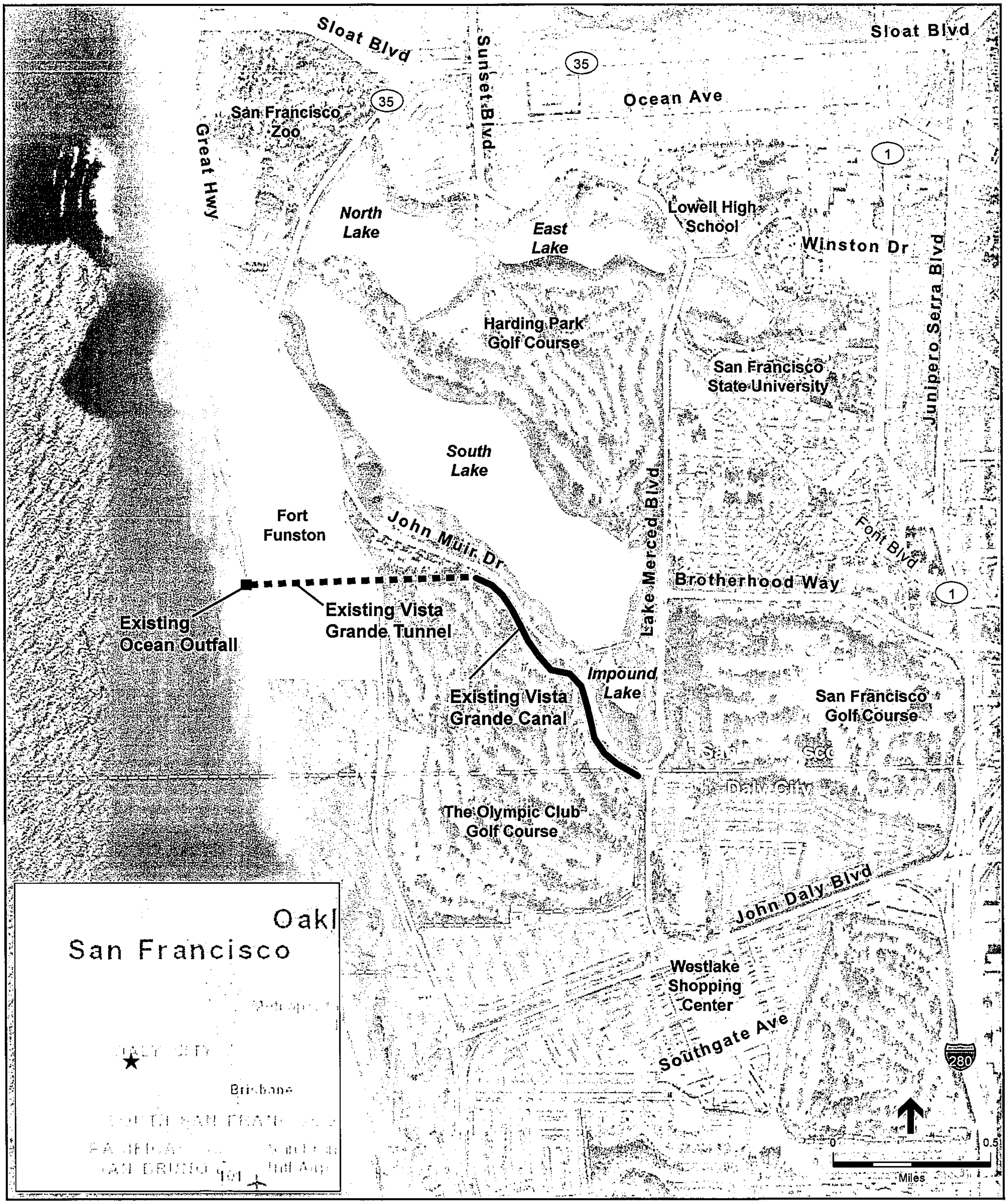
The Vista Grande watershed area is located in the city of Daly City and unincorporated Broadmoor Village, in northwestern San Mateo County. This watershed is approximately 2.5 square miles in area and is bordered by San Francisco County to the north, Colma Creek watershed to the south and east, and the Pacific Ocean on the west. The watershed is drained through the Vista Grande Canal and Tunnel which are located in the City and County of San Francisco, adjacent to John Muir Drive and the southwestern shoreline of Lake Merced. The tunnel outfall is located at the Pacific Ocean at Fort Funston, which is managed by the National Park Service (NPS) as part of the Golden Gate National Recreation Area (GGNRA). The Project location is shown in **Figure 1**.

Project Objectives

The City has identified the following objectives for the proposed project:

Flood Protection	• Improve the lower Vista Grande Drainage Basin to safely route stormwater to reduce public hazard and minimize property damage, business interruption and public inconvenience • Reduce the number of uncontrolled overflows from the Vista Grande canal into Lake Merced
Water Resource Management	• Implement stormwater best management practices to facilitate the beneficial re-use of stormwater • Provide a sustainable source of stormwater to facilitate the management of the Lake Merced water surface elevation • Increase groundwater recharge • Protect and, where feasible, improve South Lake Merced water quality • Manage Lake Merced overflow capacity to minimize environmental and property damage associated with large storms and high lake levels
Environmental	• Improve the recreation access along the beach below Fort Funston • Reduce litter transfer and deposition on the beach below Fort Funston • Reduce the project footprint and minimize construction-related disruptions of surrounding recreational uses and vehicle and pedestrian traffic by maximizing use of existing rights-of-way, easements, and infrastructure • Provide environmental benefits by providing, among other benefits, water quality treatment and wildlife habitat • Accommodate sea level rise and coastal erosion • Improve the aesthetic, educational and recreational benefits of stormwater facilities
Economic	• Protect residential property values by improving flood protection • Reduce construction cost, time, and materials by maximizing use of existing rights-of-way, easements, and infrastructure alignments • Reduce stormwater management life-cycle costs (capital, operating and maintenance) • Reduce waste water effluent management life-cycle costs (capital, operating and maintenance) • Reduce coastal litter cleanup and disposal costs • Minimize property damage and business interruption by improving flood protection

Attachment A



SOURCE:

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 1

Project Location

Proposed Project Components

The project would consist of the following:

- Improvements within the Vista Grande watershed collection system upstream of the Vista Grande Canal;
- Partial replacement of the existing Vista Grande Canal to incorporate a gross solid screening device, a treatment wetland, and diversion and discharge structures to route some stormwater (and authorized non-storm water) flows from the Vista Grande Canal to South Lake Merced;
- Replacement of the existing Vista Grande Tunnel to expand its capacity; and
- Replacement of the existing outfall structure at Fort Funston.

These components are described below, and locations are shown in **Figure 2.**

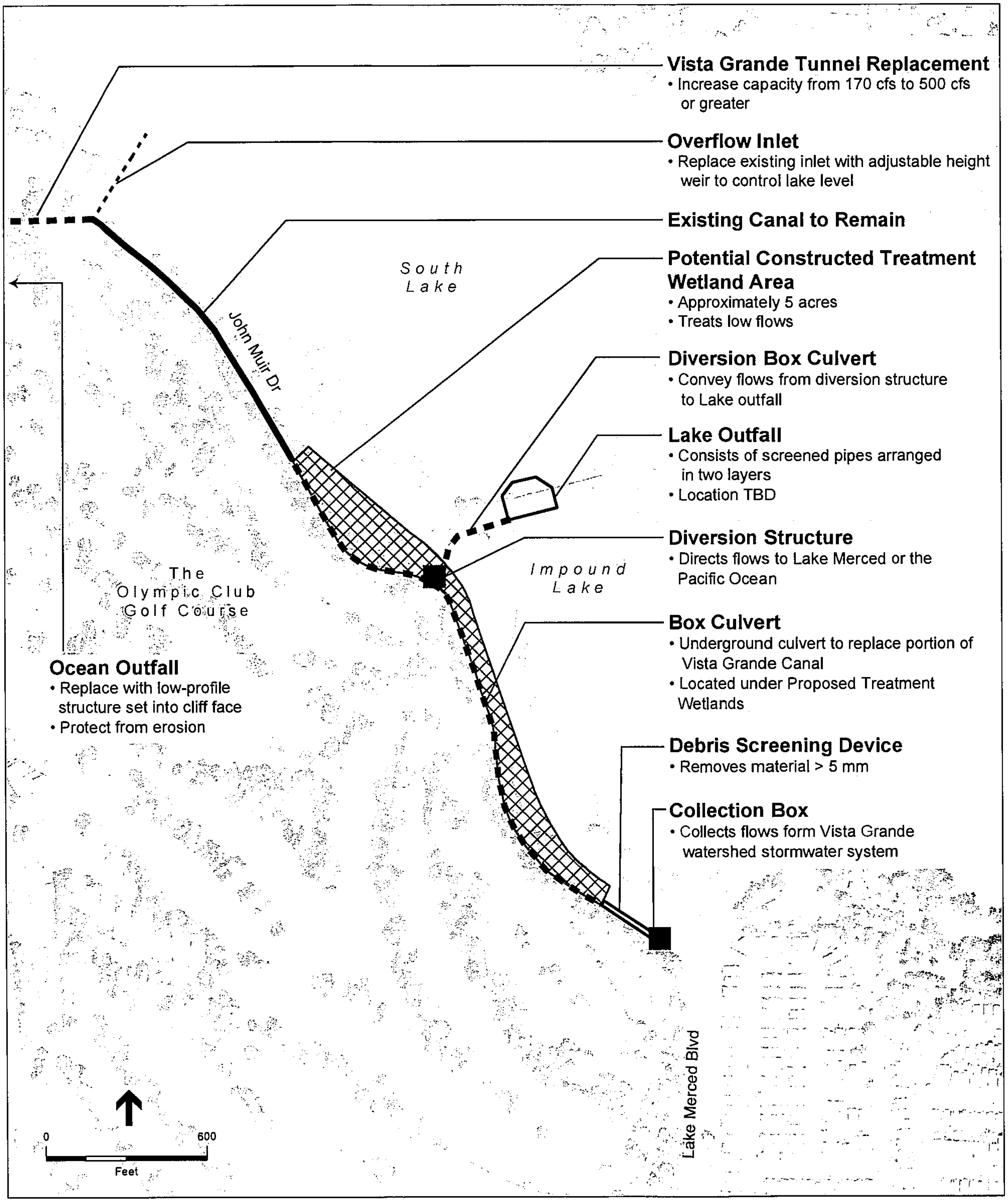
Vista Grande Canal Improvements and Diversion to Lake Merced

The existing Vista Grande Canal is a 3,600-foot-long brick-lined trapezoidal channel with a flow capacity of 500 cubic feet per second (cfs). Under the proposed project, a portion of the canal would be replaced with several new facilities to improve storm water quality and conveyance capacity. A collection box, debris screening device, box culvert, and diversion structure would replace the upstream portion of the canal. A treatment wetland would be developed over the box culvert in an area between John Muir Drive and the southern edge of the canal. From the diversion structure, a box culvert would be developed under John Muir Drive and a screened outfall structure constructed at the edge of South Lake. These components are described below.

Collection Box and Debris Screening Device

A collection box would replace the headworks of the existing Vista Grande Canal to collect flows from the contributing storm drains. An approximately 275-foot long linear radial debris screening device would be installed downstream of the collection box. Stormwater would enter the box culvert structure through several cylindrical casings and exit through louvers perforated in the casings, trapping all debris greater than 5 mm within the casings. Debris would be removed from the well casings with vacuum trucks on a scheduled basis.

Attachment A



SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2
Project Components

Box Culvert

Directly downstream of the debris screening structure, a reinforced concrete box culvert would replace approximately 1,500 feet of the existing canal. The proposed box culvert would run underneath the proposed treatment wetland described below.

Constructed Treatment Wetland

A constructed treatment wetland would be developed along John Muir Drive, a portion of which would overly the box culvert. The wetland would treat low flows from the watershed (also referred to as base flows), which consist of authorized non-stormwater flows (such as irrigation runoff that are present in the canal all year). The water would be pumped from the box culvert to the wetland. Water would flow via gravity through a cascading series of hydraulically connected cells. Portions of each cell would be planted with emergent reeds such as cattails or bulrush, which would provide water quality improvement by intercepting and settling out suspended particulates and providing attachment surfaces for beneficial bacteria. Open-water portions of each cell would allow wind mixing of the water column and would provide habitat for mosquitofish to reduce mosquito breeding in the wetlands. After passing through the wetland, the treated water would flow by gravity through the diversion structure to the outfall at South Lake. During periods of very low or no flow, a recirculating pump would draw water from South Lake and replenish the wetland.

Diversion Structure

A semi-automated hydraulic diversion structure would be constructed directly downstream of the box culvert and treatment wetlands to direct flows to either the Pacific Ocean or South Lake. The diversion structure would be comprised of a box culvert with one set of control gates that would direct flows to the existing Vista Grande Canal and ocean, and one set of control gates that would direct flows to a diversion box culvert and Lake Merced. The diversion of flows would be conducted as described in the System Operation section below.

Diversion Box Culvert and Lake Outfall Structure

Flows that are directed into South Lake would be conveyed into the lake via a box culvert constructed under John Muir Drive to an outfall at the southwestern edge of South Lake or northwestern portion of Impound Lake. The water would flow through the submerged outfall structure into the lake. The specific location of the outfall structure will be determined based on further engineering and environmental review. Depending on the final location, the outfall structure and/or the associated box culvert may be routed beneath the SFPUC's existing transport tunnel that crosses between Impound Lake and South Lake.

Lake Merced Overflow

An existing Lake Merced overflow structure consists of a brick and masonry riser and tunnel that connects South Lake with the Vista Grande Canal. Under the proposed project, a portion of the existing Lake Merced overflow would be replaced with an adjustable-height weir that would be used to control the lake level and allow water to be diverted back into the Vista Grande Canal. As described in the System Operation section below, three operational lake level scenarios will be evaluated with overflow elevations at El. 7.5, 8.5, or 9.5 (San Francisco City Datum). At water surface elevations below approximately 8.5 feet, pumping would be required to lift the water to the elevation of the canal.

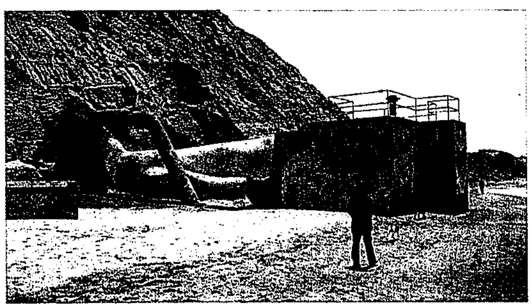
Vista Grande Tunnel Replacement

The existing Vista Grande Tunnel constructed in 1896 has a hydraulic capacity of 170 cfs. The Tunnel would be enlarged to increase its capacity to 500 cfs or greater and to extend its operating life. Alternatively, a new tunnel could be bored adjacent to and parallel with the existing tunnel. Under either option, the new tunnel would have a concrete lining and would incorporate a wholly contained section of a 30-inch diameter pipeline to transport treated effluent from the Daly City Wastewater Treatment Plant to the ocean outfall.

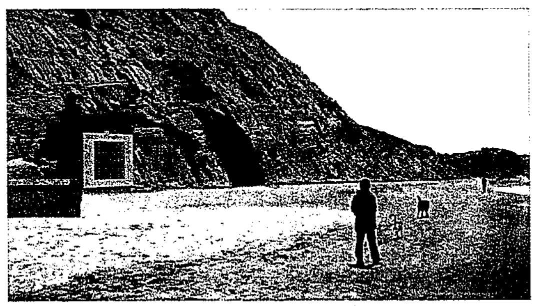
Ocean Outfall

Daly City's existing outfall structure is located on the beach below Fort Funston. The outfall structure discharges the Vista Grande Watershed stormwater and also connects an existing 30-inch effluent force main from the Daly City Wastewater Treatment Plant with a subsurface and sub-marine outfall pipeline. The outfall structure, a segment of the Vista Grande Tunnel, and the force main segment are fully exposed to the surf and waves which have caused significant damage to the structure and contributed to the ongoing erosion of the cliff face.

The proposed project would reconfigure these structures to provide protection from the surf and waves. The existing Daly City outfall structure would be removed and replaced with a low-profile outfall structure set into the existing cliff face to reduce future erosion (**Figure 3**). The existing 30-inch force main would also be removed and replaced with a similar configuration set back into the cliff face. The existing submarine outfall pipeline and diffuser would be renovated to protect it from erosion and extend its operating life.



View of Existing Outfall Structure



Simulation of Proposed Outfall Structure

Figure 3
Existing and Proposed Ocean Outfall Structure

Project Construction

Improvements to the Vista Grande Canal and the facilities associated with the diversion to Lake Merced would be constructed from staging areas located adjacent to the construction areas. Construction of the canal improvements, diversion structure, and treatment wetland would require site clearing and removal of trees in the area bounded by Lake Merced Boulevard, John Muir Drive, and the southern edge of the canal. Some utility relocations will also be needed.

The proposed Vista Grande Tunnel would be constructed using a tunnel shield or a soft ground tunnel boring machine. The machine would be launched from a construction shaft located at Fort Funston, or from a staging area adjacent to the Vista Grande Canal off John Muir Drive. The City has an existing 100-foot right of way across Fort Funston providing perpetual use for sewerage, drainage and lake protection purposes. The construction shaft would be approximately 40 feet in diameter. A crane would be positioned near the shaft edge to hoist personnel, materials, and equipment between the tunnel and the surface. The main construction staging area would be located adjacent to the shaft and most construction activities associated with tunnel construction would take place in this area. The desired construction shaft staging area acreage is about four acres.

Construction access to the new Daly City Ocean Outfall structure on the beach below Fort Funston would be provided either through the construction shaft or from a temporary access road constructed between Fort Funston and the beach.

Operation

Lake Level Management

The proposed project will divert some stormwater and authorized non-stormwater flows to South Lake to aid the SFPUC in operating Lake Merced within desired water levels. The water level of Lake Merced has fluctuated historically from Elevation (El.) 13 feet (San Francisco City Datum) in the 1940s to a low of El. -3.2 feet in 1993. Since then, the water surface elevation (WSE) of Lake Merced has risen due to increases in average rainfall and water additions by the SFPUC (SFPUC, 2011). From 2006 to 2010, the lake level ranged from El. 4.8 feet to El. 6.9 feet with an average of approximately El. 5.8 feet (City Datum). SFPUC has identified a goal of restoring historic water levels in the lake to serve beneficial uses and provide a reliable emergency water supply for firefighting and sanitation purposes.(SFPUC, 2011). The SFPUC has identified a preliminary target range of El. 5.5 to El. 9.5 feet (City Datum). The EIR will evaluate three lake level operational scenarios within this preliminary target range, and based on the analysis presented in the EIR, the SFPUC will identify the preferred operational scenario under which the project will be managed.

The three operational scenarios are identified by the target maximum WSE– 7.5, 8.5, and 9.5 feet (see **Figure 4**). This is the elevation at which the lake overflow weir would be set under each scenario. After winter rains taper off, about 1.5 feet of water is lost each year, primarily due to evaporation. Thus, for each scenario there is a corresponding target normal minimum WSE. The term normal is used to refer to normal and wet year conditions. Under dry year and multiple dry year conditions, it is assumed that WSE of Lake Merced would fall below the target normal range. During a storm event, the lake's WSE may rise above the target maximum WSE, as the flow of stormwater being diverted into the lake exceeds the capacity of the overflow outlet, thus providing short-term water storage for flood events.

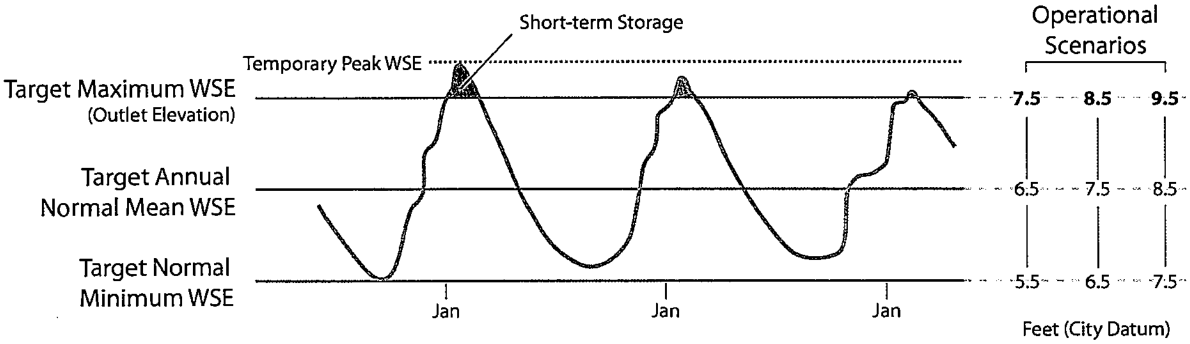


Figure 4
Lake Level Operational Scenarios

Operating Modes

In order to maintain lake levels within target WSEs and to ensure protection of Beneficial Uses within Lake Merced, the proposed operating model includes provisions for several operating modes dependant on flow and storm water quality. Three principal operating modes are described below and shown in **Figure 5**.

1. **Screened low-flows in the Canal can be routed through a wetlands system before being released to Lake Merced.** Screened dry weather flows (authorized non-stormwater) and low stormwater flows can be routed through a wetlands natural treatment system. These flows would help to maintain overall lake level and sustain the proposed treatment wetlands throughout the year.

2. **Screened higher canal flows satisfying a storm water quantity or quality criteria can be routed into Lake Merced.** Winter storm water flows exceeding the capacity of the wetlands natural treatment system can be routed to either Lake Merced or the Pacific Ocean.

3. **Screened higher canal flows can be routed to the Pacific Ocean.** Screened storm water flows exceeding the capacity of the wetlands natural treatment system but not satisfying the storm water quantity or quality criterion can be routed to the Pacific Ocean via the canal, tunnel, and outfall structure.

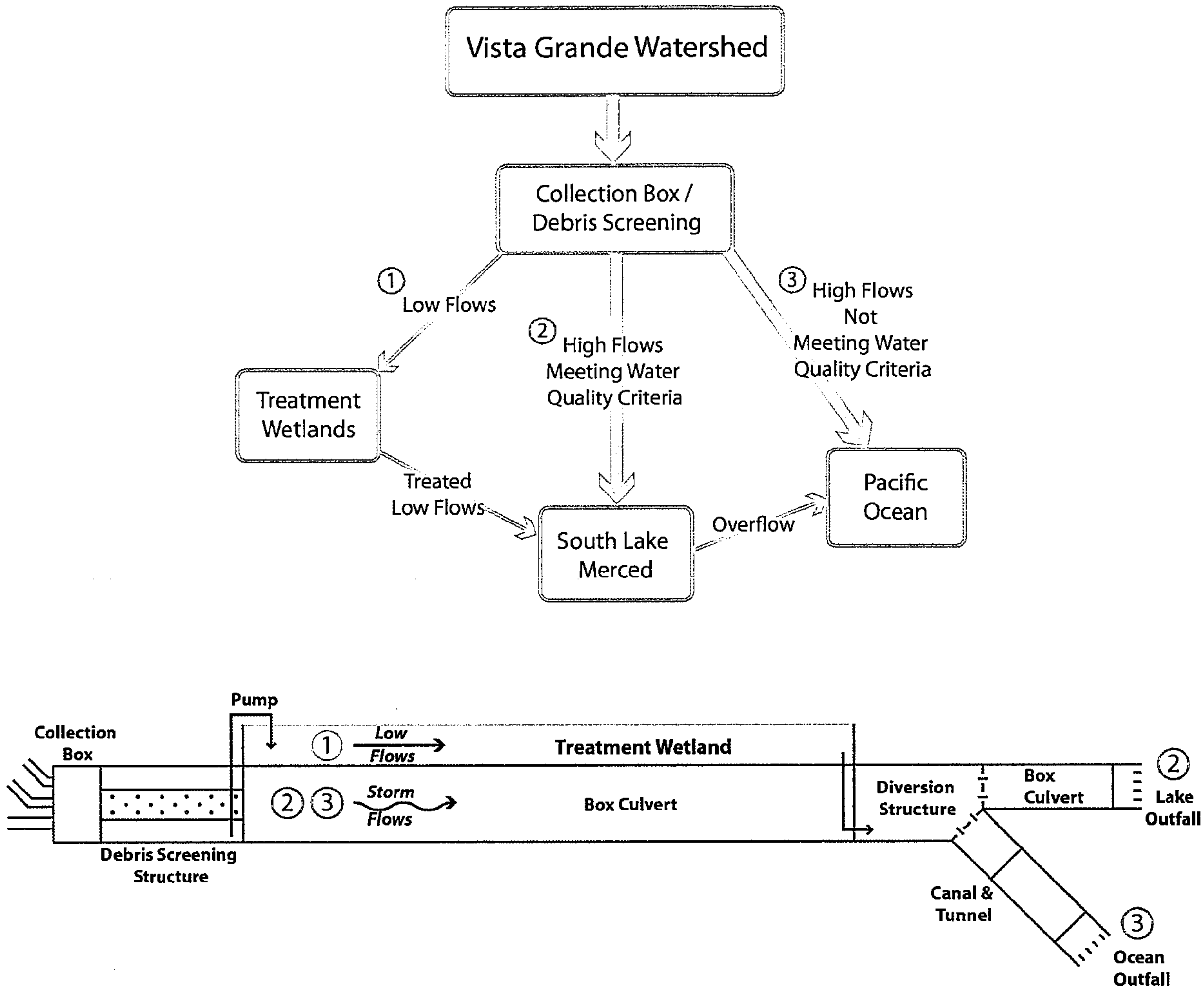


Figure 5
Flow Diagram

Lake Management Plan

The City and SFPUC have agreed to develop a Lake Management Plan (LMP) to maintain and where feasible improve the water quality of Lake Merced. The LMP will include an operational plan for the proposed Vista Grande diversions, a water quality monitoring plan, and best management practices that would be implemented by the City and SFPUC. The LMP will be developed in consultation with the RWQCB with respect to project review under the National Pollution Discharge Elimination System (NPDES).

Regulatory Requirements, Permits and Approvals

Private, local, state, and federal entities own the lands needed to construct, operate, and maintain the proposed project. The City would need to consult with relevant resource agencies and follow prescribed environmental review processes to evaluate project environmental effects and obtain construction permits for proposed components or improvements. The following table summarizes the agencies with regulatory oversight, the governing regulation and the likely permits and approvals that would be necessary.

Agency	Governing Regulation	Potential Requirements
City of Daly City, Lead Agency, (California)	California Environmental Quality Act (CEQA)	CEQA Compliance (EIR)
U.S. National Park Service - Golden Gate National Recreation Area, Lead Agency (Federal)	National Environmental Policy Act (NEPA)	NEPA Compliance, Special Use Permit; Right-of-Way Permit
California Coastal Commission	California Coastal Act; Coastal Zone Management Act	Coastal Development Permit; Local Coastal Plan compliance; Public Works Plan; Federal Consistency Determination
U.S. Army Corps of Engineers	Clean Water Act	Section 404 Authorization
U.S. Fish and Wildlife Service	Endangered Species Act	Section 7 Consultation
National Oceanic and Atmospheric Association	Endangered Species Act and Magnuson-Stevens Essential Fish Habitat	Section 7 Consultation
State Water Resources Control Board	Clean Water Act	General Construction Permit
San Francisco Bay Regional Water Quality Control Board	Clean Water Act	NPDES Stormwater coverage; Section 401 Water Quality Certification; Section 402 Policy on the Use of Constructed Wetlands for Urban Runoff (No. 94-201)
California Department of Fish and Game	Fish and Game Code Section 1602	Lakebed Alteration Agreement
California Office of Historic Preservation	National Historic Preservation Act	Section 106 Consultation

References

San Francisco Public Utilities Commission (SFPUC), *Lake Merced Watershed Report*. January, 2011.

Attachment B

Vista Grande Drainage Basin Improvement Project March 11, 2012
South Lake Merced Alternative
Lake Management Plan Outline

1. Plan Goals and Objectives
    - Restore and maintain water surface elevation of Lake Merced
    - Maintain/improve water quality in Lake Merced
    - Maintain /improve aquatic habitat

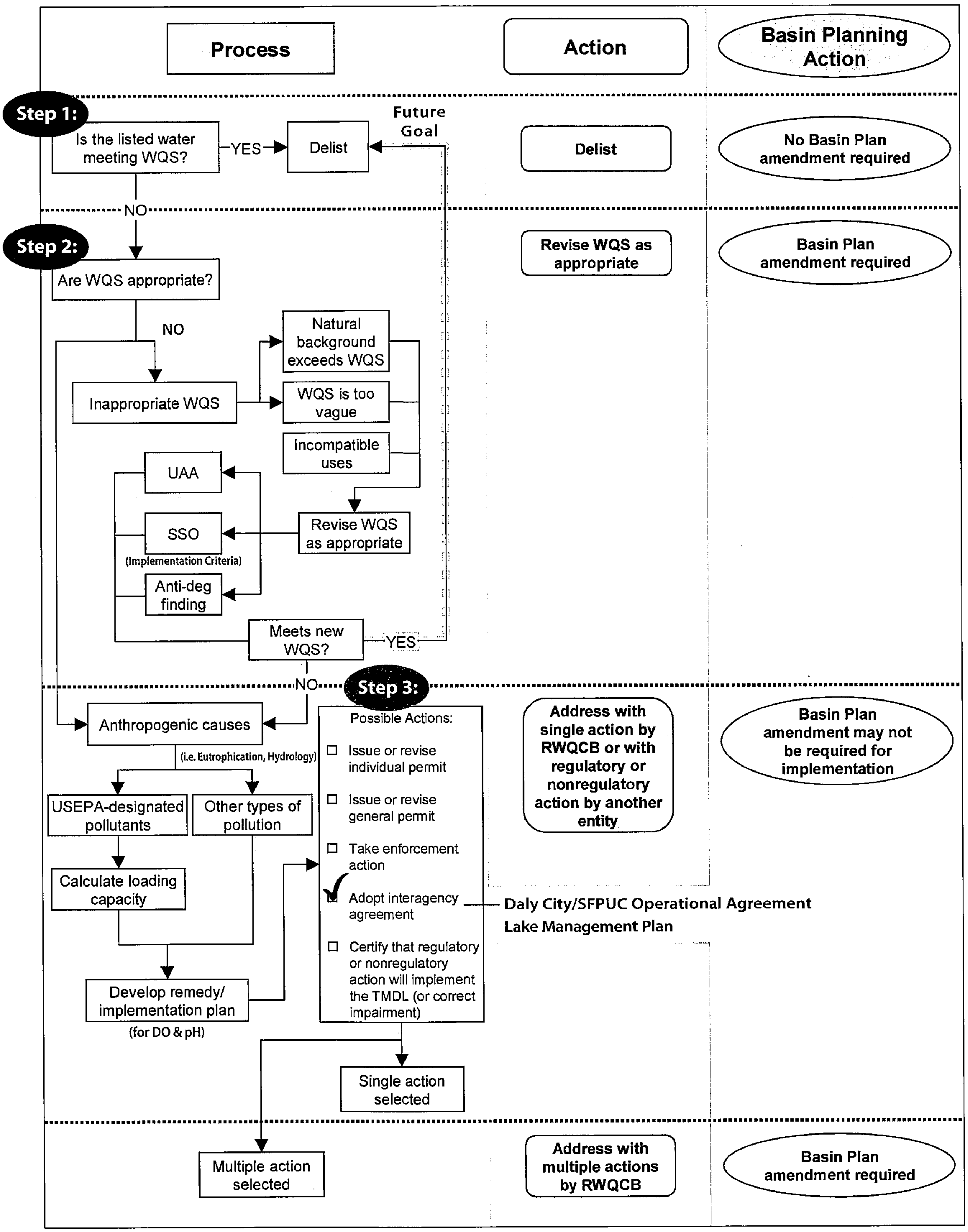
2. Vista Grande Operational Plan
    - Lake level management
        - Normal operational range, overflow elevation
    - Diversion operation
        - Diversion criteria for storm flows (dry weather interlude duration, volume)
        - Treatment criteria for canal base flows
        - Facility operation and maintenance

3. Implementation and Adaptive Management Plan
    - BMPs
        - Schedule/Phasing
        - BMP assessment & adaptive management
    - Lake Management Actions (DO and pH maintenance)
        - Implementation Criteria
        - Management action assessment & adaptation
    - Reporting schedule
    - Implementation plan assessment & adaptation

4. Water Quality Monitoring Plan
    - Summary of existing water quality
    - Water quality objectives and goals
    - List of constituents and parameters to be monitored
    - Temperature, DO and pH monitoring
    - Sampling program
        - Lake Merced
        - Vista Grande Canal
    - Reporting schedule
    - Monitoring plan assessment & adaptation

Appendix A: BMP & Lake Management Actions Evaluation

Attachment C



Source: Adapted from SWRCB, 2005
Version: December 7, 2012

SWB Regulatory Decision Tree: Process for Addressing Impaired Waters - Adapted for Lake Merced

Attachment D

Regulatory Process Scope & Schedule
Vista Grande Drainage Basin Improvement Project

2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Vista Grande Project Environmental Review	Notice of Preparation (NOP) and Notice of Intent (NOI) Issued	Preparation of draft CEQA Project Description Scoping Meetings	Preparation of Administrative Draft EIR/EIS			Preparation of Public Draft EIR/EIS Prepare Permit Applications (USACE 404, RWQCB 401, USFWS Section 7, CDFW Lakebed Alteration Agreement, CCC Coastal Development Permit, etc.)	Public Review and Comment Period
Lake Management Plan	**Develop Draft LMP:** Develop Goals and Objectives - Identify broad project goals tied to specific physical attributes (objectives) that can be measured, monitored, and used in an evaluation of enhancement actions Vista Grande Operational Plan – Define the normal operation range, stormwater diversion criteria, treatment criteria, and facility operation and maintenance Feasibility Review - Assess the feasibility of source control and lake management actions including the review of available technology, engineering and site constraints, planning and phasing considerations, etc. Water Quality Evaluation - Evaluate the selected range of management actions to determine the ability to meet water quality goals, addressing influences on DO and pH levels and general water quality benefits Fisheries Evaluation – Evaluate in-lake management options to address potential effects to fish habitat Implementation and Adaptive Management Plan - Identify: 1) BMPs and lake management actions to maintain/improve water quality, 2) an implementation schedule, and 3) assessment and adaptive management Water Quality Monitoring Plan – identify list of constituents and parameters to be monitored; locations, depths, frequency, and methodology for monitoring; and a reporting and monitoring plan assessment schedule						
Basin Plan Amendment	**Project Analysis** - Complete Phases 1-5 of California Impaired Water Process (see Table 3-3, pg. 3-5 of *A Process for Addressing Impaired Waters in California*, SWRCB, 2005) Phase 1 – Definition of project, pollutant(s)/waterbody, justification Phase 2 – Compile existing information, identify data needs, develop study plans, and engage stakeholders Phase 3 – Data collection and analyses Phase 4 – Project report(s) with data and analysis findings. May include impairment assessment, source and loading analysis, implementation alternatives Phase 5 – Develop recommendations for regulatory action, compile results/findings *NOTE: This information will be provided by the Lake Management Plan and Water Quality Assessment*						
SFPUC	**LMP:** Review and provide comments on goals and objectives	**ENV:** Review and provide comments on draft CEQA Project Description **LMP:** Provide input on feasibility analysis and cost estimates	**LMP:** Provide input on operational plan, evaluation, management and monitoring plan	**LMP:** Review and provide comments on Draft LMP	**ENV:** Review and provide comments on Admin Draft EIR/EIS **LMP:** Review Final LMP	**ENV:** Review and provide comments on Screencheck Draft EIR/EIS	
RWB	**ENV:** Review and provide comments on NOP **LMP:** Review and provide comments on goals and objectives **BPA:** Start Administrative Record		**LMP:** Provide input on operational plan, evaluation, management and monitoring plan		**LMP:** Review and provide comments on Draft LMP **BPA:** CEQA Scoping for Basin Plan Amendment		**ENV:** Review and provide comments on Draft EIR/EIS
NPS	**ENV:** Issue Notice of Intent (NOI) in Federal Register	**ENV:** Review Project Description & Scope of EIS **ENV:** Hold scoping meeting(s)			**ENV:** Review and provide comments on Admin Draft EIR/EIS	**ENV:** Review and provide comments on Screencheck Draft EIR/EIS **ENV:** Consultation with California Office of Historic Preservation - compliance with the National Historic Preservation Act (NHPA).	

Attachment D

Regulatory Process Scope & Schedule
Vista Grande Drainage Basin Improvement Project

2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vista Grande Project Environmental Review	Preparation of Administrative Draft Responses to Comments (RtC) and Final EIS/EIR			Preparation of Public RtC/Final EIR/EIS Develop Mitigation Monitoring and Reporting Plan		**CEQA Findings and EIR/EIS Approval** Preparation of Record of Decision (NPS)	Obtain permits: USACE 404, RWQCB 401, USFWS Section 7, CDFW Lakebed Alteration Agreement, CCC Coastal Development Permit, etc. *Dependent on completion of CEQA/NEPA*		*Final Engineering and Design*			
	Permitting: Consultation with permitting agencies (USACE, RWQCB, USFWS, CDFW, CCC, etc.)											
Lake Management Plan	**Develop Final LMP:** Address comments on Draft LMP						Daly City and SFPUC sign Operational Agreement *Dependent on completion of CEQA*		Commence Pre-Project Monitoring (as determined by LMP)			
Basin Plan Amendment	Preparation of internal Draft Regional Board Agenda Item Package (Staff Report) *NOTE: Endangered species consultation will be undertaken for the Vista Grande project. Coordination will occur with RWB to address BPA*					Regional Board Attorney review of Draft Staff Report	Basin Plan Unit pre-review of Draft Staff Report	Scientific State Peer Review of Draft Staff Report			Response to reviewer comments and internal Draft Agenda Item Package/Staff Report review. *NOTE: Technical Support provided by Daly City*	
SFPUC		**ENV:** Review and provide comments on Draft Responses to Comments (RtC) and Final EIS/EIR					**LMP:** Sign Operational Agreement *Dependent on completion of CEQA*					
RWB	**BPA:** Prepare Draft Staff Report **LMP:** Review RWBQB notification provisions of Draft DC/SFPUC Operational Agreement					**BPA:** Internal RWB review of Draft Agenda Item Package/Staff Report **ENV:** Issue 401 Water Quality Certification					**BPA:** Response to reviewer comments and internal package review	
NPS		**ENV:** Review and provide comments on Draft Responses to Comments (RtC) and Final EIS/EIR				**ENV:** Complete consultation with California Office of Historic Preservation. **ENV:** Prepare and sign Record of Decision (NPS)	**ENV:** Approve special use permit and/or ROW *Dependent on completion of NEPA*					

March 11, 2013

Attachment D

Regulatory Process Scope & Schedule

Vista Grande Drainage Basin Improvement Project

2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vista Grande Project Environmental Review	*Pre-Construction Activities*					*Construction (through 2017)* ⇨						
Lake Management Plan	Pre-Project Monitoring (as determined by LMP)											
Basin Plan Amendment	Preparation and distribution of Public Draft Agenda Item Package/Staff Report.	Public review and comment period Draft Agenda Item Package/Staff Report.		Revision of Agenda Item Package/Staff Report based on comments received. Preparation and distribution of Final Agenda Item Package/Staff Report to public.		Presentation of proposed Amendment to Board; Regional Board Adopts Amendment	State Board review of Administrative Record and Hearing for regionally adopted Basin Plan Amendment				OAL Process	EPA Approval ⇨
SFPUC												
RWB	**BPA:** Revise and distribute Staff Report. *Dependent on completion of CEQA*					**BPA:** Present BPA to board for adoption, submit press release to EO and obtain signature, finalize Administrative Record.	**BPA:** Submit Admin Record to SB and OAL **303(d):** Prepare 303(d) Demonstration Package					**BPA:** Pay CDFW fees, file NOD, revise Basin Plan ⇨
NPS												

APPENDIX B

SFPUC South Lake Merced Limnology Monitoring Report

San Francisco Public Utilities Commission

Land and Natural Resources - Limnology

Reservoir: Lake Merced - **Pistol Range**
Date: August 9, 2012 **Limnologist:** ST EF

Limnological Profile

Depth ft.	Temp °C	pH pH units	Cond µS/cm	TDS mg/L	DO mg/L	ORP mV	TKN mg/L	Hard mg/L	NO_3-N mg/L	NH_3-N mg/L	PO_4-P mg/L	Tot P mg/L	Mn mg/L	Fe mg/L	Pb mg/L	TOC mg/L	Turb NTU
0	20.2	8.65	723	463	12.7	236	8.60	228	<0.01	0.03	0.15	0.35	0.062	0.005	<0.001	7.25	19.6
5	19.4	8.49	726	465	9.7	230	12.21	230	<0.01	0.04	0.14	0.39					19.2
10	19.0	8.28	728	466	7.3	223	2.13	224	<0.01	0.05	0.16	0.29					18.0
15	18.6	7.94	732	468	3.3	202	20.83	226	<0.01	0.04	0.18	0.33					15.4
20	18.3	7.85	732	468	2.0	180											
Btm	18.3	7.80	732	469	0.4	140	14.20	228	<0.01	0.05	0.22	0.39	0.112	0.037	<0.001		13.1

Depth ft.	Chlorophyll-*a* µg/L	Algal Biomass µg/L
0	[redacted]	
5		

Bacteriological Data (MPN)	
Total Coliform	>2420
E. Coli	20

Secchi Disc (ft): 1.25
Air Temp (°C): 18.1
Weather: Fog burning o
Wind: W-SW 2-5 mp

Phytoplankton Count (>98% of total population)

Phytoplankter	1	2	3	4	Total	Natural Unit/m^3	Natural Unit/mL

Summary

Reservoir: Lake Merced - **Pump Station**
Date: August 9, 2012 **Limnologist:** stef

Limnological Profile

Depth ft.	Temp °C	pH pH units	Cond µS/cm	TDS mg/L	DO mg/L	ORP mV	TKN mg/L	Hard mg/L	NO_3-N mg/L	NH_3-N mg/L	PO_4-P mg/L	Tot P mg/L	Mn mg/L	Fe mg/L	Pb mg/L	TOC mg/L	Turb NTU
0	20.3	8.61	724	463	12.7	267	15.01	228	<0.01	0.03	0.18	0.28	0.059	0.005	<0.001	7.14	20.7
5	19.8	8.58	724	463	11.2	263	9.72	230	<0.01	0.04	0.21	0.27					20.3
10	19.0	8.19	730	467	6.8	266	28.73	232	<0.01	0.05	0.19	0.33					17.9
15	18.8	7.98	731	468	4.3	263	26.43	230	<0.01	0.02	0.23	0.29					15.2
20	18.4	7.83	732	469	2.3	262											
Btm	18.4	7.80	733	469	1.7	261	1.82	232	<0.01	0.08	0.24	0.32	0.129	0.010	<0.001		13.7

Depth ft.	Chlorophyll-*a* µg/L	Algal Biomass µg/L
0	[redacted]	
5		

Bacteriological Data (MPN)	
Total Coliform	>2420
E. Coli	7

Secchi Disc (ft): 1.25
Air Temp (°C): 18
Weather: Fog burning o
Wind: W-SW 2-5 mp

Phytoplankton Count (>98% of total population)

Phytoplankter	1	2	3	4	Total	Natural Unit/m^3	Natural Unit/mL
Oscillatoria	6994	6994	6786	6630	27404	697,000,000	697
Blue-green, Diatom, Other					Total	697,000,000	697

Summary

APPENDIX C

Wet and Dry Season Water Quality Monitoring Plans for the Vista Grande Drainage Basin Improvement Project

Final 2011 Dry Season Water Quality Monitoring Plan – Vista Grande Drainage Basin Improvement Project

September 16, 2011

1.0 INTRODUCTION

The City of Daly City has prepared this water quality monitoring plan in support of the Lake Merced Alternative of the Vista Grande Drainage Basin Improvement Project (Project). Lake Merced is the largest freshwater lake located within the City and County of San Francisco (CCSF) and it is operated and maintained by the San Francisco Public Utilities Commission (SFPUC). The northwestern area of Daly City and unincorporated portions of San Mateo County drain into the Vista Grande portion of the City's stormwater collection system. The underground collection system conveys the storm flows to the Vista Grande Canal and then into the Vista Grande Tunnel, which discharges through the Daly City outfall structure into the Pacific Ocean at the beach below Fort Funston. Historically wet weather flows in excess of the capacity of the Canal and the Tunnel have occasionally resulted in local flooding and overflows across John Muir Drive into Lake Merced, causing property damage, bank erosion, traffic nuisances, and public safety issues (RMC, 2006).

The Lake Merced Alternative (the Project) would route a portion of wet season storm flows from the Vista Grande Canal directly to South Lake Merced (South Lake) and a smaller portion of wet season storm flows from the Canal through a proposed treatment wetland to South Lake. In addition, dry season base flow (or runoff) would be routed through the proposed treatment wetland to South Lake.

This monitoring plan has been developed based on a review of water quality monitoring data previously collected by the SFPUC, the City of Daly City and the City and County of San Francisco (Kennedy Jenks, 2010). The intent of the proposed monitoring plan is to provide specific water quality information needed to inform project design and environmental analysis for CEQA and NEPA[1] documentation; and to facilitate project review by the San Francisco Bay Regional Water Quality Control Board (RWQCB). To that effect, the monitoring data will help quantify dry season flow and establish baseline water quality within the Canal and expand on the existing water quality data set for South Lake. The data will be collected from the Canal and South Lake at the same time to develop a comparable data set for the Project.

2.0 PROPOSED MONITORING PLAN

Dry season monitoring of flow and water quality will be conducted in the Canal from approximately August 15 to October 31, 2011. Water quality in South Lake will be monitored during the same period to assess the baseline conditions of the receiving waters for the project and to inform conceptual design of

[1] California Environmental Quality Act, National Environmental Policy Act

the treatment wetlands. For the purpose of this plan, low flows are defined as flows that occur in the Vista Grande Canal during the summer and fall (June 1-October 31) and are primarily associated with exempted and conditionally exempted non-stormwater discharges (e.g., car washing, lawn watering, and landscape irrigation) as described in Provision C.15 of the Municipal Regional Stormwater NPDES permit. Typical dry season base flow within the Vista Grande Canal is estimated to average between 0.1 and 0.4 million gallons per day (mgd) or approximately 0.2 to 0.6 cubic feet per second (cfs). Constructed wetlands must have a source of water throughout the year so that the wetland plants and other organisms within the wetland ecosystem can be maintained. However, dry season flow data is limited and has not yet been accurately quantified and assessed for water quality.

The objectives of the dry season monitoring are to:

- Provide flow and water quality data to characterize baseline conditions in the Vista Grande Canal during summer months for the Project;
- Further establish the water quality of the receiving waters (South Lake) to adequately characterize baseline receiving water quality and provide for the assessment of the Project's potential for impacts (in particular, from future low flow discharges from the Canal through the treated wetlands); and
- Inform conceptual design of the proposed treatment wetlands based on the water quality in the Canal and in South Lake and the summer base flow in the Canal.

2.1 Monitoring Locations

The dry season monitoring would involve collecting flow and water quality data from the Canal and water quality data from South Lake. **Figure 1** shows the proposed monitoring locations (Vista Grande Canal Station or VGC-1 in the Canal; and LM-1, LM-2, LM-3, and LM-4 in South Lake; discussed below).

Canal: Based on field reconnaissance, VGC-1 has been selected to avoid areas of backwatering or velocity changes that may occur at some constricted points along the Canal. Due to very low base flow (≤0.6 cfs) observed in the Canal during the summer, flow will be monitored through combined use of a V-Notch weir of known dimensions with associated pressure transducer (see **Figure 2** at the end) to monitor extreme low flows up to 0.6 cfs, as well as an ISCO Area-Velocity continuously recording data logger, to monitor higher flows exceeding the design capacity of the V-Notch weir (such as from rainfall events). A hand-held water quality meter will be used to measure pH, DO, and temperature and samples will be collected for laboratory analysis of specific constituents, as described in Section 2.2 below.

South Lake: The proposed four monitoring locations for South Lake have been identified based on review of historic data (Kennedy/Jenks, 2010) and the proposed discharge location of the stormwater from the treatment wetlands. Continuously recording (hourly) water quality loggers will be installed at these locations to record pH, DO, specific conductance, and temperature. Depending on the location, the loggers will record water quality at multiple depths (see **Table 1** in Section 2.2).

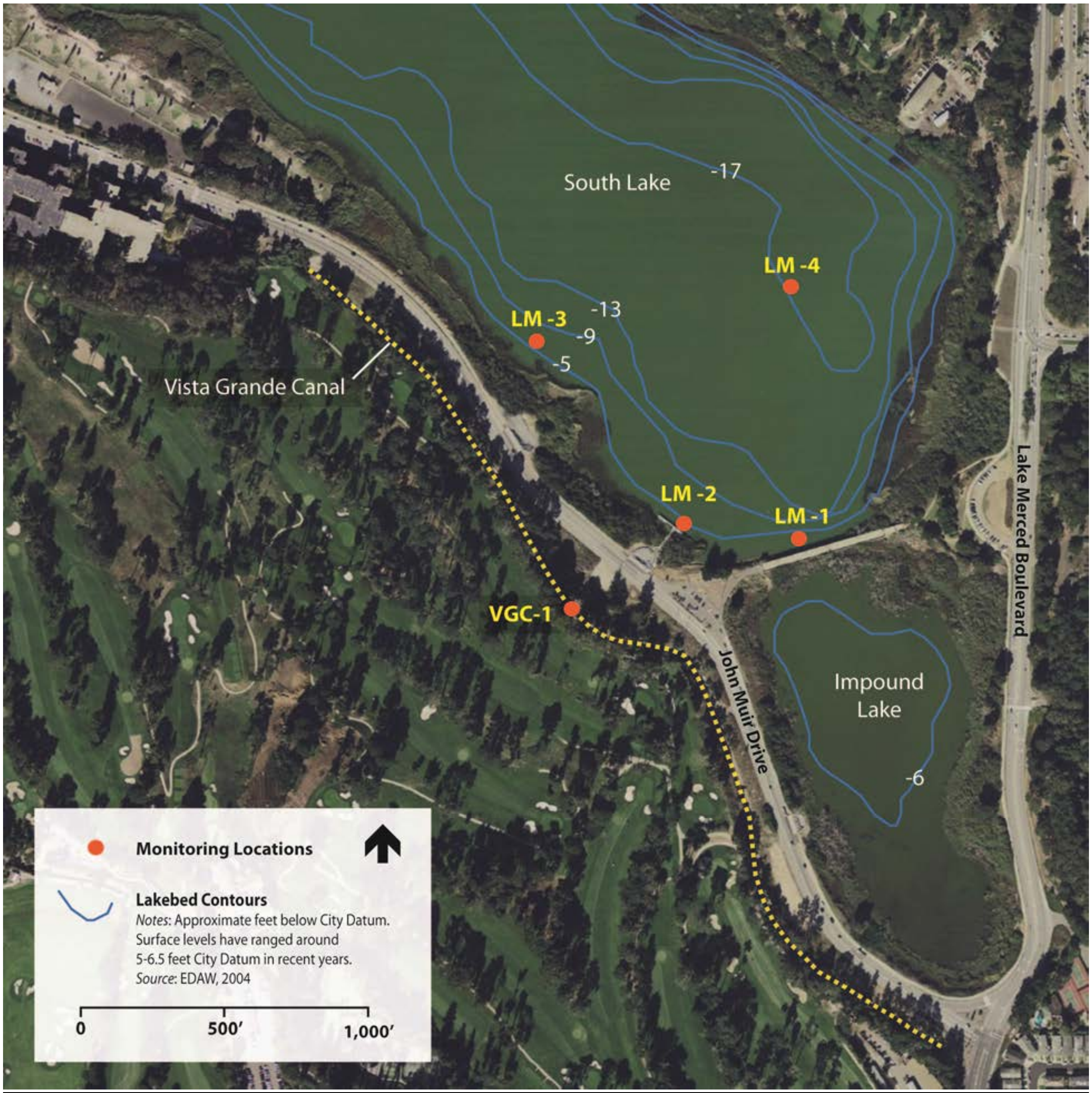


Figure 1
Proposed Vista Grande Canal and South Lake Monitoring Locations

- **Station LM-1** is located close to the proposed discharge point midway across the SFPUC's sewer transport structure separating South Lake Merced and Impound Lake.
- **Station LM-2** is located at a public access floating dock between LM-1 and LM-3 to provide an estimate of the receiving water quality in the close vicinity of the proposed stormwater discharge.

- **Station LM-3** is located approximately 1,000 feet northwest of the SFPUC's sewer transport structure separating South Lake and Impound Lake and adjacent to the existing riprap Canal overflow discharge structure. The loggers here will be installed, with permission, on a temporary marker buoy for the duration of the Project. The water quality data here can serve as backup data in case of equipment malfunction, theft, or vandalism at Station LM-1.

- **Station LM-4** is located at a point that has been used by the SFPUC for monitoring water quality in the South Lake since 1997 and has been determined to be representative of the overall water quality of South Lake (Kennedy/Jenks, 2010). LM-4 has been selected for collecting samples for a more detailed water quality analysis (see **Table 2** in Section 2.2), to be consistent with the location (e.g., South Lake Merced Pump Station) used for long-term quarterly water quality monitoring conducted by the SFPUC. This will allow comparison of the 2011 dry season monitoring data to the larger historic record. Field data and analysis of existing conditions suggest that Lake Merced does not experience persistent, seasonal stratification, but rather stratifies weakly and intermittently in the summer to late fall of some years (EDAW, 2004) (Kennedy/Jenks, 2010), but is otherwise fairly well mixed given its shallow depth and the prevailing winds. . Surface water monitoring (i.e., from 0 to 5-foot depth) is also intended to be representative of the receiving water quality in that portion of the water column most likely to be influenced by the proposed low flow summer discharges from the proposed treatment wetlands.

2.2 Monitoring Methodology

The proposed water quality monitoring will be conducted by:

- Monitoring dry season base flow at VGC-1, and

- Both directly measuring water quality constituents and collecting samples for laboratory analysis at all the locations in the Canal and South Lake as identified in Figure 1.

Direct measurements will involve measuring pH, DO, conductivity, and temperature, using a standard hand-held water quality meter. The samples will be collected using standard accepted field methods and delivered to a commercial lab for analysis of water quality constituents summarized in **Table 2**.

Tables 1 and 2 shows the monitoring protocol proposed for the dry weather season at all locations. **Table 2** lists the proposed water quality constituents that will be monitored in at VGG-1 and LM-4. The constituents listed are based on a review of prior SFPUC reports and data and the RWQCB comment letter dated May 19, 2011. The list includes key constituents that were sampled previously by the SFPUC, to ensure consistency with long-term historic records, and/or constituents identified by regulatory agencies for environmental and human health protection (e.g., constituents appearing on the Section 303(d) list). **Table 3** provides the tests and detection limits along with the rationale for each constituent that would be tested under this plan.

TABLE 1. PROPOSED MONITORING PROTOCOL FOR DRY WEATHER SEASON (DIRECT MEASUREMENT)

Constituent	Location	Depth (feet)	Frequency of Measurements
Vista Grande Canal*			
Flow	VGC-1	-	Continuous, hourly
pH**	VGC-1	-	Twice a month
DO**	VGC-1	-	Twice a month
Temperature**	VGC-1	-	Twice a month
Conductivity**	VGC-1	-	Twice a month
South Lake Merced			
pH, DO, temperature, conductivity	LM-1	Surface (<5)	Continuous, Hourly
pH, DO, temperature, conductivity	LM-2	Surface (<5), near bottom	Continuous, Hourly
pH, DO, temperature, conductivity	LM-3	Surface (<5), near bottom	Continuous, Hourly
pH, DO, temperature, conductivity	LM-4	Surface (<5), 10, 15, near bottom	Continuous, Hourly
pH, DO, temperature, conductivity	LM-1,2,3,4	Manual depth profiles at one-foot intervals	Twice a month

* Monitoring is proposed to occur at a frequency of twice every month, as conditions allow. However, during summer months, flow may be absent in Vista Grande Canal. If sampling cannot be completed due to lack of flow during summer months, the sample schedule and methodology will be revised as appropriate.

** pH, DO, conductivity and temperature will be measured manually twice or thrice during each individual field monitoring event (twice per month).

TABLE 2. PROPOSED MONITORING PROTOCOL FOR DRY WEATHER SEASON (SAMPLING AND LABORATORY ANALYSIS)

Constituent	Location		Sampling Frequency
	Canal	**South Lake Merced**	
Nutrients: Total phosphorous [P], orthophosphate, Total Kjeldahl Nitrogen (TKN), ammonia, nitrate	VGC-1	LM-4 Surface (<5 feet)	Twice a month
Chemical Oxygen Demand	VGC-1		Twice a month
Biochemical Oxygen Demand	VGC-1		Twice a month
Metals: Lead, Copper, Mercury, Nickel, Zinc	VGC-1		Twice a month
Total suspended solids	VGC-1		Twice a month
Volatile suspended solids	VGC-1		Twice a month
Total dissolved solids	VGC-1		Twice a month
Hardness	VGC-1		Twice a month
Conductivity	VGC-1		Twice a month
TC, FC, EC, Ent., MS-2*	VGC-1		Twice a month
Giardia and Cryptosporidium spp**	VGC-1		Once a month
Human Bacteroidales**	VGC-1		Once a month
Chlorophyll a	-		Twice a month
Secchi Depth	-		Twice a month

* TC=Total Coliform, FC=Fecal Coliform, EC=E.Coli, Ent=Enterococcus, MS-2=Male Specific Phage

*******Giardia, Cryptosporidium spp., and* Human *Bacteroidales will be tested once a month.*

TABLE 3. LABORATORY METHODS AND RATIONALE FOR PROPOSED CONSTITUENTS FOR MONITORING

Constituent	Laboratory Test Method	Detection Limits	Type /Indicator / Purpose of Constituent
Dissolved oxygen, pH	-	-	303(d) Impairment evaluation
Temperature	-	-	Dissolved oxygen percent saturation calculation
Total phosphorous [P]	EPA 365.1	0.04 mg/L	Nutrients (factor in eutrophication)
Orthophosphate and Nitrate	EPA 300.1	0.1 mg/L	
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	0.2 mg/L	
Ammonia	EPA 350.1	0.05 mg/L	
Chemical Oxygen Demand	SM 5220D	10 mg/L	Oxygen demand (factor in ambient dissolved oxygen concentration)
Biochemical Oxygen Demand	SM 5210B	4 mg/L	
Total Metals	EPA 200.8	Pb, Cu, Ni (0.1 µg/L) Zn (1 µg/L)	Metals (potential aquatic life impacts)
Mercury	EPA 1631	0.005 µg/L	Bioaccumulation potential (in fish tissue)
Dissolved Metals	E200.8 (filtered)	Pb, Cu, Ni (0.5 µg/L) Zn (5 µg/L)	CTR water quality objectives are expressed as the dissolved metals fraction
Total suspended solids (TSS)	SM 2540D	1 mg/L	Solids loading indicator
Volatile suspended solids (VSS)	SM 2540D	4 mg/L	Organic matter content in TSS
Total dissolved solids (TDS)	SM 2540C	10 mg/L	Mineral content
Hardness	SM 2340B & 200.7	1 mg CaCO3/L	Calculation of fresh water quality objectives
Total Coliform, Fecal Colifom, E. coli*	SM 9222	1 cfu/100 ml	Pathogen Indicators

TABLE 3 (cont.). LABORATORY METHODS AND RATIONALE FOR PROPOSED CONSTITUENTS FOR MONITORING

Constituent	**Laboratory Test Method**	**Detection Limits**	**Type /Indicator / Purpose of Constituent**
Enterococcus*	EPA 1600	1 cfu/100 ml	Pathogen Indicators
MS-2	EPA 1602	1/100 ml	
Human Bacteroidales*	Multiple Markers	1 pfu/vol analyzed	
Giardia and Cryptosporidium spp*	EPA 1623	0.1 cyst of oocyst/L	Human pathogens
Chlorophyll a	SM 10200 Part 4	50 µg/L	Phytoplankton/ algal growth indicator
Secchi Depth	-	-	Lake clarity

Note: * Detection limits shown are target values. Actual detection limits will depend on amount of sample able to be filtered.

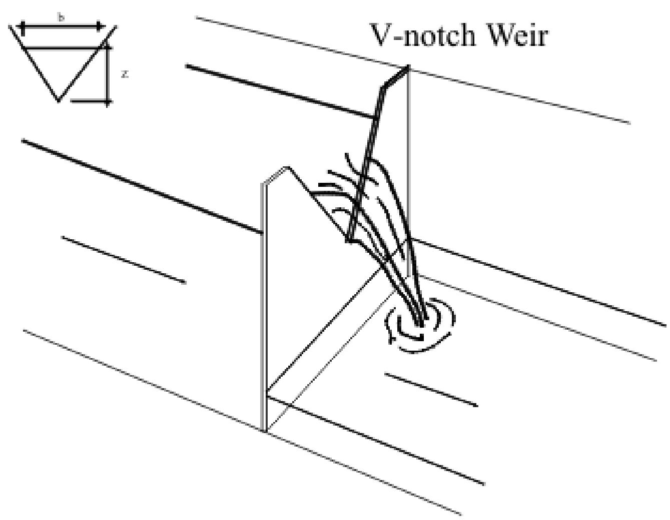


Figure 2
Example of V-Notch Weir for Flow Monitoring

REFERENCES

EDAW and Talavera and Richardson, *Task 4 Technical Memorandum: Impacts to Water Quality, Vegetation, Wildlife and Beneficial Uses, Lake Merced Initiative to Raise and Maintain Lake Level and Improve Water Quality*, Prepared for the San Francisco Public Utilities Commission, September, 2004.

Kennedy/Jenks Consultants, *Lake Merced Water Quality Data Organization, Review, and Analysis, Prepared for the San Francisco Public Utilities Commission*, 2010.

RMC, *Vista Grande Watershed Study*, Prepared for the City of Daly City and City and County of San Francisco. 2006.

Final 2011-2012 Wet Season Water Quality Monitoring Plan

Vista Grande Drainage Basin Improvement Project

November 17, 2011

1.0 INTRODUCTION

The City of Daly City (Daly City) has prepared this water quality monitoring plan in support of the South Lake Merced Alternative of the Vista Grande Drainage Basin Improvement Project (Project). Lake Merced is the largest freshwater lake located within the City and County of San Francisco (CCSF) and it is operated and maintained by the San Francisco Public Utilities Commission (SFPUC). The northwestern area of Daly City and unincorporated portions of San Mateo County drain into the Vista Grande portion of Daly City's stormwater collection system. The underground collection system conveys the storm flows to the Vista Grande Canal (Canal) and then into the Vista Grande Tunnel (Tunnel), which discharges through the Daly City outfall structure into the Pacific Ocean at the beach below Fort Funston. Historically wet weather flows in excess of the capacity of the Canal and the Tunnel have occasionally resulted in local flooding and overflows across John Muir Drive into South Lake Merced, causing property damage, bank erosion, traffic nuisances, and public safety issues (RMC, 2006).

The Lake Merced Alternative (the Project) would route a portion of wet season storm flows from the Vista Grande Canal directly to South Lake Merced (South Lake) and a smaller portion of dry and wet season flows from the Canal through a proposed treatment wetland to South Lake.

2.0 MONITORING PLAN OBJECTIVES

The intent of the monitoring plan is to provide specific water quality data needed to support project design and environmental analysis for California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documentation and to facilitate project review by the San Francisco Bay Regional Water Quality Control Board (RWQCB). To that effect, the monitoring data will help quantify wet season flow and establish baseline water quality within the Canal and expand on the existing water quality data set for South Lake. This monitoring plan has been developed based on a review of water quality monitoring data previously collected by Daly City and the SFPUC (Kennedy/Jenks, 2010).

The scope of this monitoring plan has been developed based on the System Understanding and Assessment Strategy (**Attachment A**) that has been developed to provide an understanding of current water quality conditions in South Lake Merced, the processes and factors governing water quality in South Lake Merced, how the contribution of Vista Grande flows to South Lake Merced might alter existing water quality conditions in South Lake Merced, and a strategy for assessing impacts to existing water quality conditions. Based on the assessment needs identified in the System Understanding and Assessment Strategy, specific information needs, analytical approaches, and data criteria have been identified within the Water Quality Data Objectives Matrix (**Attachment B**). This monitoring plan incorporates the analytic strategy and data objectives developed in these attached documents.

3.0 PROPOSED MONITORING PLAN

Wet season monitoring of flow and water quality will be conducted in the Canal from approximately November 20, 2011 to May 31, 2012. Water quality in South Lake will be monitored during the same period to assess the baseline conditions of the receiving waters for the project.

The objectives of the wet season monitoring are to:

- Provide flow and water quality data to characterize baseline conditions in the Vista Grande Canal during winter months, including storm event flows and base flow (which is typically lower than summer base flow due to reduced irrigation return flow);

- Characterize the baseline water quality of the receiving waters (South Lake) during the proposed stormwater diversion period to provide for the assessment of the Project's potential impacts; and

- Provide data that will support development of the conceptual design of the proposed treatment wetlands based on the water quality and the winter base flow in the Canal.

Additional specific data objectives are identified in the Water Quality Data Objectives Matrix (Attachment B).

3.1 Monitoring Locations

The wet season monitoring would involve collecting flow and water quality data from the Canal and water quality data from South Lake. **Figure 1** shows the proposed monitoring locations (Vista Grande Canal Station, VGC-1; and South Lake stations, LM-1, LM-2, LM-3, and LM-4; discussed below).

Canal

VGC-1 has been selected for hydrologic monitoring and water quality sampling to avoid areas of backwatering or velocity changes that may occur at some constricted points along the Canal.

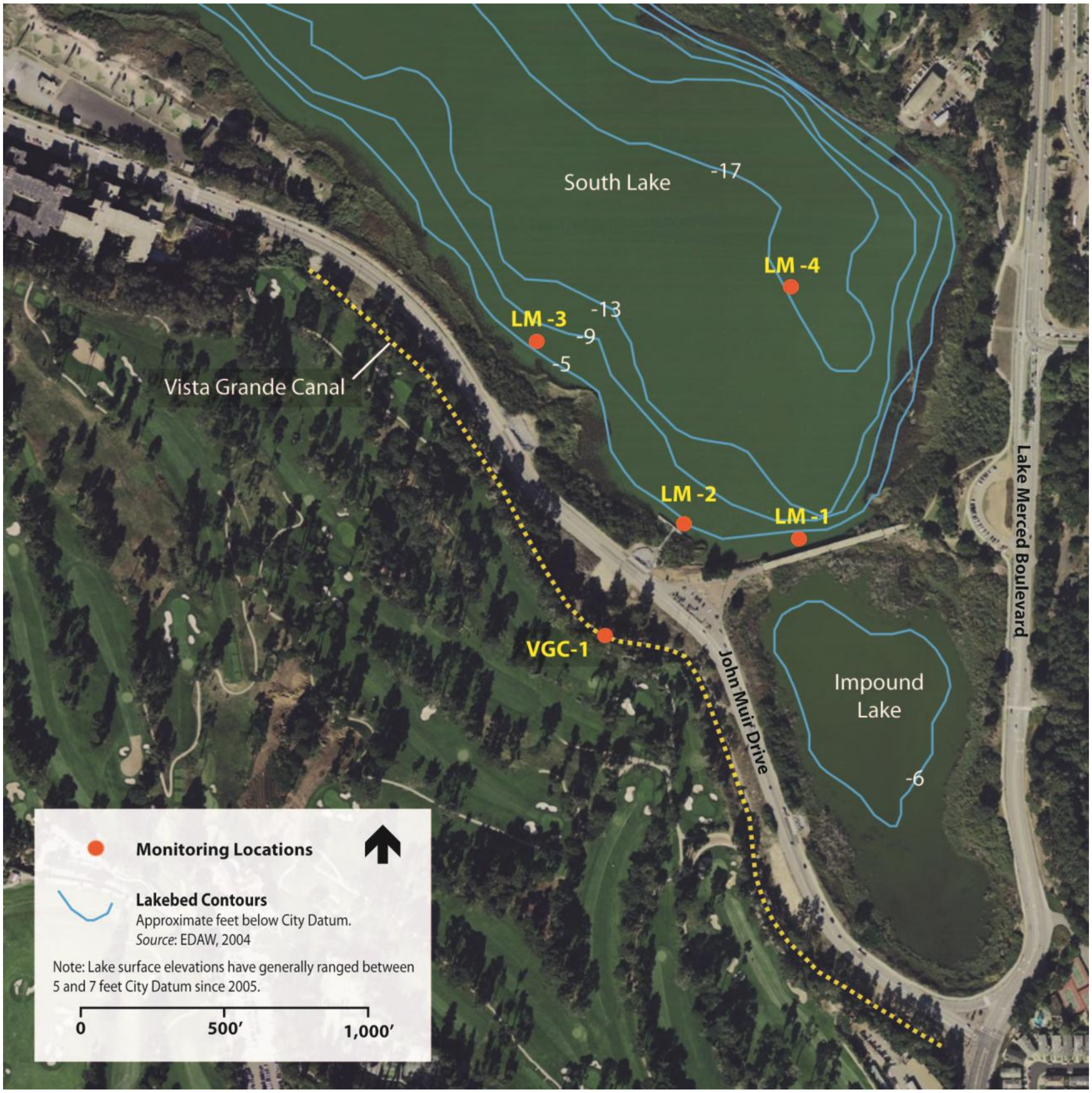


Figure 1
Proposed Vista Grande Canal and South Lake Monitoring Locations

South Lake

The proposed four monitoring locations for South Lake have been identified based on review of historic data (Kennedy/Jenks, 2010) and the proposed discharge location of the stormwater. Locations within South Lake were selected to provide representative data as follows:

- **Station LM-1** is located close to the proposed discharge point midway across the SFPUC's sewer transport structure separating South Lake Merced and Impound Lake. One multiprobe, continuously logging, water quality sonde (pH, DO, temperature, and conductivity) has been installed here at a depth of approximately 1.5-feet depth[1].

- **Station LM-2** is located at a public access floating dock. Between LM-1 and LM-3, the pH, DO, temperature, and conductivity values at LM-2 will provide an estimate on the receiving water quality in the close vicinity of the proposed stormwater discharge. Two loggers have been installed here at the surface and approximately 8-feet of depth.

- **Station LM-3** is located approximately 1,000 feet northwest of the SFPUC's sewer transport structure separating South Lake and Impound Lake and adjacent to the existing riprap Canal overflow discharge structure. Two loggers have been installed here at the surface and approximately 15-feet of depth on a temporary marker buoy for the duration of the Project. The water quality data (pH, DO, temperature, and conductivity) here can serve as backup data in case of equipment malfunction, theft, or vandalism at Station LM-4 and will also capture water quality changes that may result if Canal water flows into South Lake as a result of a Canal overflow or intentional diversion during a major storm.

- **Station LM-4** is located at a point that has been used by the SFPUC for monitoring water quality in South Lake since 1999 and is representative of the overall health and water quality of South Lake (Kennedy/Jenks, 2010). As part of this proposed monitoring plan, LM-4 has been selected for collecting samples for a more detailed water quality analysis (see **Table 1** in Section 2.2), to be consistent with the location (e.g., South Lake Merced Pump Station) used for long-term quarterly water quality monitoring conducted by the SFPUC, allowing comparison of the 2011-2012 wet season monitoring data to the larger historic record. Surface water sampling (i.e., from 0 to 5-foot depth) would be representative of the receiving water quality in that portion of the water column most likely to be influenced by the proposed stormwater discharges from the Canal. In addition, it is noted that the historical data suggests the lake is well mixed during winter months due to low air temperatures and wind action[2].

[1] Note: max depth at location LM-1 is 2-feet.

[2] Due to health and safety concerns for open water sampling during storm event, LM-2 (public dock) will be used as a back-up location for surface water quality sampling during winter months. As noted in the text, data from 12 years of monitoring by the SFPUC indicate that Lake Merced is well mixed during winter months and surface water

3.2 Monitoring Methodology

The proposed wet season water quality monitoring will be conducted using the following techniques:

- Basic water quality constituents (dissolved oxygen, pH, temperature, and conductivity) will be recorded continuously throughout the wet season using multi-probe water quality sondes with logging capability at all the locations in the Canal and South Lake as identified in Figure 1. The sondes are located at depths identified in **Table 2**.
- Hydrologic characterization of stormflow within the Canal will utilize a continuously recording Area-Velocity meter to capture water depth, velocity, and flow within the Canal in real time.
- Detailed water quality characterization of stormflow and South Lake receiving waters will be conducted through collection of water quality samples for laboratory analysis at VGC-1 and LM-4 (or LM-2) as identified in Figure 1. Detailed water quality characterization both in the Canal and in South Lake would be conducted during and following, precipitation events that result in stormflow within the Canal above base flow conditions.
- Detailed water quality characterization of base flow in the Canal will be conducted through collection of water quality samples for laboratory analysis.

The following sections describe the detailed methodologies being employed for water quality and hydrologic characterization of the Canal and South Lake.

Canal

Rainfall: In order to correlate Canal flow to precipitation events, rainfall will be monitored at a local rain gage (Station AS891) located approximately 2.5 miles northwest of Vista Grande Canal at Ocean Beach at an elevation of 33 feet via the MesoWest weather portal online (MesoWest, 2011), administered by the University of Utah, Department of Atmospheric Sciences. Raw tipping bucket rainfall data will be downloaded for Station AS891 monthly, standardized to Pacific Standard Time, and processed to calculate total cumulative rainfall (inches) for the monitoring period; total daily rainfall (inches) for the monitoring period; and cumulative hourly rainfall (inches per hour) for each storm event for which water quality was characterized by sample collection and laboratory analysis (approximately 6 events).

Flow: To monitor flow within the Canal, an ISCO 2150 Area-Velocity meter will be installed at the VGC-1 monitoring station (Figure 1). The ISCO 2150 records continuous measurements of water depth (foot) and water velocity (foot/second). Channel dimensions (from survey data) and channel form (trapezoidal) allow the Area-Velocity meter to report real time flow (cfs). The velocity sensor will be mounted onto a pre-fabricated stainless steel plate which will be fixed in place on the Canal bottom. Flow data will be

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samples at LM-2 would be representative of surface water quality within Lake Merced within the vicinity of the proposed discharge.

used to generate hydrographs of Canal flows. In addition, hydrographs will be generated to correlate water quality data to the timing and volume of storm events sampled.

<u>Water Quality Monitoring by Direct Measurement</u>: For continuous direct measurement of basic water quality constituents of stormflow within the Canal, a multi-probe water quality sonde with logging capability will be installed in the Canal within a PVC stilling well, mounted onto the Canal bank (Olympic Club side). The sonde will continuously record dissolved oxygen levels, pH, and temperature (15 minute interval, synced to Area-Velocity recorder measurements).

<u>Detailed Stormwater Quality Characterization</u>: The intent of the detailed water quality monitoring methodology is to characterize water quality in the Canal (storm flows and base flows proposed for diversion). Table 1 details the water quality constituents proposed for wet season water quality characterization of Canal storm and base flows.

Sampling of the Canal storm flows has two basic objectives. The primary objective is to estimate the constituent loading of storm events. A secondary objective is to measure the variation of pollutant concentrations within each storm event. To meet the primary objective, an Event Mean Concentration (EMC) will be calculated for each storm event and multiplied by the total event flow volume. Due to the flashy nature of urban watersheds, the Vista Grande Canal experiences short durations of storm event runoff and stormflow receds to baseflow levels rapidly following cessation of precipitation.It is therefore problematic to successfully collect grab samples manually. As a result, samples from the Canal will be collected using an ISCO automatic water sampler. To enable calculation of the EMC, flow-interval (volumetric paced) sampling will be used. A pre-determined volume of water (approximately 100mL to 900mL) will be sampled at pre-determined flow rate (e.g. for every 100,000 gallons) that is tracked by the area-velocity meter. Each targeted storm event will be evaluated for intensity and duration using weather forecasts, and the autosampler will be programmed via a telemetry device. In addition to being informed by weather forecasts, programming will be informed by the analysis of previous storm hydrographs and the results of prior sampling events. The following sampling parameters will be determined prior to each sampling event.

- Flow threshold trigger: establishes the point at which the auto sampler will begin sampling a storm event. The flow threshold may range from 2 to 20 cfs, depending on the expected intensity and duration of a flow event. The goal will be to use the lowest flow threshold in order to capture the greatest extent of the hydrograph (and therefore reduces error in calculating the EMC), without triggering a number of smaller pre-storm runoff events that could result in exceeding the bottle capacity before the storm event is finished.

- Sample size: a smaller sample size allows for more samples to be taken (which reduces error in calculating the EMC), however a smaller sample size requires more frequent back flushing of the sampling line, which can limit the ability to sample quickly enough at the peak of the hydrograph (and introduce error in the EMC calculation). As noted, sample sizes are expected to range from 100mL to 900mL.

- Flow interval: determines the rate (volumetric or time paced) at which samples will be taken. The rate will be adjusted according to the expected intensity and duration, and selected sample size. The autosampler will be connected to an ISCO Area-Velocity meter and set to collect water quality samples from the Canal at pre-determined flow thresholds to allow collection of water quality samples during precipitation events that generate Canal storm flow.

The autosampler will sequentially collect samples in 24 (900mL) bottles, filling one bottle before starting the next. At the completion of the sampling, field staff will create a composite event sample by consolidating all or a portion of the individual bottles into one large container. This large container will then be used to fill constituent sample bottles. Because the sampling will be flow weighted, if the storm event is adequately captured by the autosampler this composite sample will provide the EMC for individual constituents. Adequate precautions will be required to ensure the contributing volume from the 24 individual sample bottles is accurately measured, and that settling of the samples is controlled. Water quality samples will be collected from the autosampler for delivery to a commercial lab for analysis within 24 hours of a precipitation event.[3]

To sample the entire suite of constituents indentified in Table 1, a minimum event composite sample of 16.65 liters will be required. In the event that an inadequate volume of water is collected by the autosampler, the sample for giardia and cryptosporidium will be not be included, reducing the minimum event composite sample to 9.08 liters. If less than 9.08 liters is representatively sampled, constituents will be prioritized, or the sampling event will be concluded without sending the samples for laboratory analysis.

Using separate sample bottles in the autosampler instead of one large composite sample container will facilitate the secondary objective – to measure the variation of pollutant concentrations across the storm hydrograph (e.g. pollutant concentrations characterizing the rising versus falling limb of the hydrograph) – to be achieved. If an adequate volume of water is remaining in the 24 individual sample bottles, then this remaining sample volume will be used to develop 1-3 composite samples of the hydrograph. Three potential groupings will be used. The first grouping will consist of two groups, one composite group below a flow threshold, and another group above the flow threshold. This will provide concentration data based on the flow in the canal and may assist in developing operational diversion criteria. The second potential grouping will be to develop 1-3 composite samples relating to the rising limb, peak flow, and falling limb of the hydrograph. This will provide concentration data based on the sequence of flows. If only 1 sample is taken (for instance of the rising limb), this sample would provide some characterization of that segment of the hydrograph as compared to the EMC. The following

[3] Due to the flashy nature of the Vista Grande Basin and Canal, and depending on the timing of precipitation event, sample collection and delivery to a commercial lab will need to occur during business hours Monday to Friday. This is a constraint for water quality analysis that reflects commercial lab operation hours, sample hold times, and staff health and safety considerations. Microbiological constituents will be collected and shipped to the lab as expeditiously as possible.

constituents (listed in order of priority) would be sampled to characterize variation within the hydrograph:

Constituent	**Sample Size (L)**
Total Suspended Solids	1
Orthophosphate & Nitrate as N	0.25
Total Metals (Pb, Cu, Ni)	0.25
Total Metals (Zn)	0.25
Mercury	0.5
Bacteria	0.5

Base flow samples would be collected to characterize the quality of water that would be diverted to South Lake through the proposed treatment wetlands. Six samples would be taken periodically through the wet season (approximately 1 per month), subject to adequate base flow volume. Table 1 lists the laboratory methods for the proposed water quality constituents that will be monitored at VGC-1 (and at LM-4, as detailed below).

South Lake

Water Quality Monitoring by Direct Measurement: For continuous direct measurement of basic water quality constituents for receiving waters, multi-probe water quality sondes with logging capability will be installed at various locations (LM-1 through LM-4 as shown on Figure 1) and at a range of depths (Table 2) to characterize basic receiving water quality both spatially and throughout the water column (where appropriate). The sondes will record dissolved oxygen levels, pH, conductivity, and temperature on an hourly interval, allowing comparative analysis of event based and seasonal water quality trends between the Canal stormwater and South Lake receiving water.

Detailed Receiving Water Quality Characterization: To facilitate comparative analysis and impact assessment, water quality sample collection from South Lake will be synchronized with collection of water quality samples from the Canal. To the extent possible, samples will be collected within 24 hours of a precipitation event (for 6 events) that generates stormflow and autosampler collection within the Canal. Water quality samples collected for laboratory analysis will be collected from station LM-4[4] (Figure 1) surface waters (< 5 foot depth; rationale for location and depth provided in Section 2.1, above). Table 1 details the water quality constituents proposed for wet season water quality characterization of South Lake receiving waters. All samples will be collected using standard accepted field methods and delivered to a commercial lab for analysis of the water quality constituents summarized in Table 1. Additionally, subsequent water quality samples will be collected from LM-4 approximately 24 hours after the cessation of a precipitation/runoff event for analysis of microbiological

[4] Or alternately LM-2 as discussed in Section 3.1, above.

constituents (indicator bacteria as detailed in Table 1) to characterize and assess the rate of bacterial die-off in Lake Merced following contribution of stormflows as part of a Microbial Risk Assessment (see Attachment B for a description of specific data objectives). Table 1 lists the laboratory methods for the proposed water quality constituents that will be monitored at LM-4.

Stormwater Diversion: To facilitate the analysis of indicator bacteria levels, stormwater diversions previously conducted by Daly City and the SFPUC (as described in EOA, 2011) may be conducted during the 2011-2012 wet season to expand on the analysis of potential project-related impacts on bacteria levels in South Lake. The intent of stormwater diversions is to convey a volume of water that more closely approximates volumes that would be diverted by the project. The maximum diversion in the pilot project was 5.4 million gallons, however most diversion volumes were much smaller (ranging from 0.09 to 3.3 million gallons). If feasible during storm events of large magnitude and extent, stormwater would be diverted through the Continuous Deflection System (CDS) established for the pilot project to screen trash and disperse flows into the riparian buffer of South Lake. Indicator bacteria levels at near shore and offshore would be monitored to characterize dilution. A series of 2 samplings would occur at a minimum of 3 locations in South Lake. Sampling would occur at the end of the event and a second sampling would be taken 24 hours following the first sample event to characterize indicator bacteria die-off. Sampling of Vista Grande stormwater would occur during the diversion to characterize indicator bacteria/pathogen levels of the water diverted to South Lake.

TABLE 1. PROPOSED MONITORING PROTOCOL FOR WET WEATHER SEASON (SAMPLING AND LABORATORY ANALYSIS)

Constituent	Canal Sampling Frequency (VGC-1)	South Lake Merced Sampling Frequency LM-4 Surface (<5 feet)	Units	Laboratory Test Method	Method Detection Limits	Reporting Limits	Sample Size
Dissolved oxygen (manual)	A target of 6 storm events and 6 base flow samples	A target of 6 storm events with 2 samples per event	mg/L	N/A (field measurement)			
pH (manual)			pH scale				
Temperature (manual)			Degrees Celsius				
Total phosphorous			mg/L	EPA 365.1	0.03 mg/L	0.04mg/L	(1) 1 Liter
Orthophosphate			mg/L	EPA 300.0	0.021 mg/L	0.1 mg/L	(1) 250 ml
Nitrate as N			mg/L	EPA 300.0	0.019 mg/L	0.1 mg/L	Same Container w/ Ortho.
Total Kjeldahl Nitrogen			mg/L	EPA 351.2	0.04 mg/L	0.15 mg/L	(1) 1 Liter
Total Ammonia [as N]			mg/L	EPA 350.1	0.05 mg/L	0.05 mg/L	(1) Liter
Chemical Oxygen Demand			mg/L	SM 5220D	10 mg/L	10 mg/L	(2) 40 ml
Biochemical Oxygen Demand			mg/L	SM 5210B	4 mg/L	4 mg/L	(1) 1 Liter
Total Metals (Pb, Cu, Ni)			µg/L	EPA 200.8	0.1 µg/L	0.5 µg/L	(1) 250 ml
Total Metals (Zn)			µg/L	EPA 200.8	1 µg/L	5 µg/L	(1) 250 ml
Total Mercury			µg/L	EPA 1631	0.0005 µg/L	0.0005 µg/L	(1) 500 ml
Dissolved Metals (Pb, Cu, Ni)			µg/L	E200.8 (filtered)	0.1 µg/L	0.5 µg/L	(1) 250 ml

TABLE 1 (cont.). PROPOSED MONITORING PROTOCOL FOR WET WEATHER SEASON (SAMPLING AND LABORATORY ANALYSIS)

Constituent	Canal Sampling Frequency (VGC-1)	South Lake Merced Sampling Frequency LM-4 Surface (<5 feet)	Units	Laboratory Test Method	Method Detection Limits	Reporting Limits	Sample Size
Dissolved Metals (Zn)	A target of 6 storm events and 6 base flow samples	A target of 6 storm events with 2 samples per event	µg/L	E200.8 (filtered)	1 µg/L	5 µg/L	(1) 250 ml
Total suspended solids			µg/L	SM 2540D	N/A	1 µg/L	(1) 1 Liter
Volatile suspended solids			µg/L	SM 2540D	N/A	4 µg/L	(1) 1 Liter
Total dissolved solids			µg/L	SM 2540C	N/A	10 µg/L	(1) 500 ml
Hardness			mg/L CaCO3/L	SM 2340B & 200.7	1 mg/L CaCO3/L	1 mg/L CaCO3/L	(1) 250 ml
Chlorophyll a			µg/L	SM 10200 Part 4	5 µg/L	5 µg/L	(1) 1 Liter
Total Coliform, Fecal Colifom, E. coli*			cfu/ml	SM 9222	1 cfu/100 ml	1 cfu/100 ml	(1) 200 ml
Enterococcus*			cfu/ml	EPA 1600	1 cfu/100 ml	1 cfu/100 ml	(1) 100 ml
Male Specific Bacteriophage (MS-2)			PFU/100 ml	EPA 1602	1/100 ml	1/100 ml	(1) 100 ml
Human Bacteroidales*			Number of Markers	Multiple Markers	N/A	N/A	(1) 100 ml
Giardia spp*	A target of 6 storm events**		cyst/L	EPA 1623	0.1 cyst of cyst/L	0.1 cyst of cyst/L	(2) 1 Gallon
Cryptosporidium*			oocyst/L	EPA 1623	0.1 cyst of oocyst/L	0.1 cyst of oocyst/L	
Secchi Depth	n/a		Feet	N/A (field measurement)	N/A	N/A	N/A

Notes: * Detection limits shown are target values. Actual detection limits will depend on amount of sample able to be filtered.

** Due to large sample volume requirements for Giardia and Cryptosporidium (2 gallons) and limitations on volumes collected by the autosampler, sampling of these constituents may be forfeited in favor of providing a representative composite sample of the remaining constituents (to estimate event loading) and characterizing the variation of pollutant concentrations across the storm hydrograph.

TABLE 2. PROPOSED MONITORING FOR WET WEATHER SEASON (DIRECT MEASUREMENT)

Constituent	Location	Monitoring Depth (feet)	Frequency of Measurements
pH, DO, temperature, conductivity	VGC-1	Surface*	Continuous (Hourly)
pH, DO, temperature, conductivity	LM-1	Surface** (<5 ft)	Continuous (Hourly)
pH, DO, temperature, conductivity	LM-2	Surface** (<5 ft), near bottom (8 ft)	Continuous (Hourly)
pH, DO, temperature, conductivity	LM-3	Surface** (<5 ft), near bottom (15 ft)	Continuous (Hourly)
pH, DO, temperature, conductivity	LM-4	Surface** (<5 ft), 10 ft, 15 ft, and near bottom (20 ft)	Continuous (Hourly)

* Continuous water quality monitoring within the Canal is only feasible above a depth of 0.5-feet (stormflow), and as such continuous water quality data will be collected for stormflow but not for baseflow.
**Continuous water quality monitoring between zero and up to 5 feet of depth in the Lake are assumed to be representative of surface sampling.

REFERENCES

EDAW, *Lake Merced: Initiative to Raise and Maintain Lake Level and Improve Water Quality, Task 4 Technical Memorandum*, Prepared for the San Francisco Public Utilities Commission, September 2004.

EOA, *Preliminary Water Quality Screening Results, 2003/04 – 2008/09 Wet Weather Seasons, Lake Merced Pilot Stormwater Enhancement Project*, Prepared for the North San Mateo County Sanitation District, June 2011

Kennedy/Jenks Consultants (KJ)*, Lake Merced Water Quality Data Organization, Review and Analysis*, Prepared for the San Francisco Public Utilities Commission, 25 January 2010.

RMC, *Vista Grande Watershed Study*, Prepared for the City of Daly City and City and County of San Francisco, 2006.

APPENDIX D

BMP Screening and Ranking Matrix and Additional Treatment Measures

Lake Management Actions Eliminated from Further Consideration

Daly City and SFPUC convened a workshop on July 16, 2013 to discuss the final screening and ranking of the BMPs and treatment measures and produced a final list of management actions to include in this LMP. During the discussion, the following BMPs, stormwater treatment measures and in-lake treatment measures were considered and eliminated from further consideration and potential implementation.

Watershed BMPs

Expanded Street Sweeping and Maintenance

Daly City and San Francisco would examine existing street sweeping schedules within the Lake Merced and Vista Grande watersheds and expand efforts and frequency where possible.

Reason for Elimination

Originally this measure was assessed and carried forward for inclusion in the LMP (as reflected in the matrix, below). However, after further assessment this BMP was eliminated from further consideration. Daly City is already implementing a weekly cleaning schedule, which goes beyond the MRP-required once per month schedule. Daly City streets are swept once each week in both residential and commercial areas. There is no formalized coordination between the garbage collection and street sweeping, and coordination would be infeasible because garbage collection requires residents to place bins on the street, where they would interfere with street sweeping. Daly City also sweeps Mission Street/El Camino Real five times per week along the section of Mission Street that drains into the Vista Grande Drainage Basin. In addition to mechanical sweeping, the Public Works Street Division crews hand-sweep the curb returns along streets that are being swept. Additionally, there is no foreseeable benefit in expanding San Francisco's street sweeping activities because of the deep (between 3-8ft) settling basins (cleaned annually) in the catch basins San Francisco has installed in the Lake Merced area.

Infiltration

Retention based green infrastructure BMPs include raingardens/bioretention, infiltration trenches/basins and permeable pavement. This measure would reduce available stormwater for reuse in Lake Merced.

Reason for Elimination

This BMP was eliminated because it conflicts with Objectives 1a (Increase surface water input to the Lake) and 1b (Capture and manage stormwater as a resource) from the LMP Goals and Objectives.

Rainwater Harvesting

The installation of rain barrels and cisterns in the Vista Grande Drainage Basin and/or Lake Merced watershed could reduce peak stormwater flows, increase infiltration, and conserve water for later non-potable use. In the Vista Grande Drainage Basin, rainwater harvesting could reduce the volume of water available for diversion into South Lake.

Reason for Elimination

This BMP was eliminated because it conflicts with Objectives 1a (Increase surface water input to the Lake) and 1b (Capture and manage stormwater as a resource) from the LMP Goals and Objectives.

Downspout Disconnection

Disconnection of downspouts would redirect rainwater to lawns and reduce the volume of peak stormwater flows and increase infiltration. As a voluntary program, its effectiveness would be dependent on the degree of homeowner participation. In the Vista Grande Drainage Basin, downspout disconnection would reduce the volume of water available for diversion into South Lake.

Reason for Elimination

This BMP was eliminated because it conflicts with Objectives 1a (Increase surface water input to the Lake) and 1b (Capture and manage stormwater as a resource) from the LMP Goals and Objectives.

Stormwater Treatment Measures

Stormwater filtration

The use of filtration systems in catch basins or vaults would reduce levels of suspended solids, nutrients and metals from stormwater. Filtration systems would require regular maintenance of vault filters.

Reason for Elimination

This measure could be used as a last resort if water quality is not improving with the implementation of BMPs and end of pipe treatment. San Francisco and Daly City are currently approaching stormwater management at a City-wide level.

Alum or Phoslock treatment of stormwater

This treatment binds with phosphates and removes them from the water column. It is used to reduce or limit the growth of algae. The public perception of chemical use (concerns on the toxicity of aluminum) would not make this a very popular option.

Reason for Elimination

This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

Ferrate treatment of stormwater

The use of Ferrate (Iron VI) serves as an oxidant, coagulant, and disinfectant and requires contact time. It could reduce levels of bacteria, metals, phosphorus in stormwater and have a minor influence on DO & pH. The reduction in nutrient levels could reduce potential for stormwater to stimulate additional algal growth.

Reason for Elimination

This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

In-Lake Management Measures

Alum treatment

Aluminum sulfate (alum) or Phoslock is applied directly to the Lake, which binds with phosphorus in the water and settles to the bottom creating a barrier to phosphorus uptake. This removes and controls internal cycling of phosphorus, reduces algae, and improves clarity. It would have a minor influence on DO & pH and a short-term effect of improving DO by reducing oxygen demand and improving pH by reducing algae.

Reason for Elimination

Lake-wide treatment could be costly, and would only be effective for a limited duration (1-10 years). The effectiveness is limited by ongoing phosphorus inputs to the Lake. This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

Algaecide treatment

This action would apply peroxides (e.g., PAC27) directly to the Lake to reduce algal growth and increase water clarity. Algaecide treatment is expected to have a moderate influence on DO and pH. It may improve DO by reducing oxygen demand, and improve pH by reducing algae, which contribute to high pH.

Reason for Elimination

This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

Biomanipulation

This action is intended to reduce algae in a sustainable manner by manipulating the existing ecology in the Lake. Biomanipulation would require increasing zooplankton and removing small fish, as well as creating a submerged aquatic vegetation zone. It may have a moderate influence on DO and pH by reducing algae, thereby reducing biochemical oxygen demand (BOD) from sediments and production of high pH during the day.

Reason for Elimination

This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

Macrophyte Harvesting

This action would directly remove a small amount of nutrients from Lake water and could improve DO by reducing oxygen demand. It may be combined with biomanipulation.

Reason for Elimination

This measure was eliminated due to lack of public support, feasibility of implementation, and a concern that it may not be beneficial to the water quality.

ID#	Action	Action Type	Estimated benefit to water quality (including cumulative benefits)	Estimated benefit to lake levels	Capital costs	Operation and maintenance costs	Ease of operation	Potential for stakeholder support	Social benefits	Timeline for implementation
			Ranking Criteria							
Proposed Vista Grande Project Components										
1	Return storm water to Lake (proposed for Vista Grand Project)	Watershed/ Source Control	?	2	SFPUC 1 DC 0	SFPUC 2 DC 1	1	2	1	SFPUC 2 DC 1
2	Solids Screening >5mm (proposed for Vista Grande Project)	Treatment	2	0	SFPUC 2 DC 0	SFPUC 2 DC 1	SFPUC 2 DC 1	2	SFPUC 0 DC 1	SFPUC 2 DC 1
3	Treatment wetland for stormwater and year-round flows (low flow wetland proposed for Vista Grande Project)	Treatment	2	1	SFPUC 1 DC 0	SFPUC 2 DC 1	1	SFPUC 2 DC 1	SFPUC 0 DC 1	SFPUC 2 DC 1
4	Flushing of lake water to ocean outfall	In-lake management	2	2	1	2	2	SFPUC 2 DC 1	SFPUC 0 DC 1	SFPUC 2 DC 1
5	Recirculation of lake water to treatment wetland	Treatment	?	?	1	DC 1	SFPUC 1 DC 0	SFPUC 2 DC 1	SFPUC 0 DC 1	SFPUC 2 DC 1
Watershed BMPs										
6	Detention Based Green Infrastructure BMPs (Detention and Filtration): vegetated swales, vegetated filter strips, flow-through planters, sand filters, constructed wetlands, detention ponds	Watershed/ Source Control	1	1		DC 0	DC 1	SFPUC 2 DC 1	1	DC 2
7	Retention Based Green Infrastructure BMPs (Infiltration): raingardens/bioretention, infiltration trenches/basins, permeable pavement	Watershed/ Source Control	0	0	DC -2		DC 1	SFPUC 2 DC -1	SFPUC 1 DC 0	DC 0
8	Separating stormwater from combined system (San Francisco) and daylighting streams	Watershed/ Source Control	0	1				SFPUC 2	SFPUC 1	
9	Pet Waste Management Education program and facilities (clean-up bag stations, trash receptacles)	Watershed/ Source Control	1	0	2	SFPUC 1	SFPUC 2 DC 1	2	1	2
10	Reduce nutrient sources from upland areas surrounding Lake (woodchips, restrict use of lawn fertilizers, minimize irrigation runoff etc.)	Watershed/ Source Control	1	0	SFPUC 1	SFPUC 1	SFPUC 1 DC 0	SFPUC 1 DC 0	SFPUC 1 DC 0	SFPUC 1
11	Expanded Street Sweeping and Maintenance	Watershed/ Source Control	1	0	DC 1		DC 1	SFPUC 2 DC -1	DC 1	2
12	Catch Basin Screening	Watershed/ Source Control	2	0	DC 0	DC 0	DC 1	SFPUC 2 DC -1	DC 0	DC 1
13	Incentive Programs for Downspout Disconnection and Companion Raingardens	Watershed/ Source Control	0	0		DC 2	DC 2	DC -1	SFPUC 1 DC 0	DC 0
14	Incentive Programs for Rainwater Harvesting/Cisterns	Watershed/ Source Control	0	0		DC 2	DC 2	SFPUC 2 DC -1	SFPUC 1 DC 0	DC 0
15	Green Infrastructure Education Programs (public workshops, school programs and curriculum development,	Watershed/ Source Control	0	0	DC 2	DC 2	DC 2	2	DC 1	DC 2
16	Enhance wetland and riparian habitat around Lake	Treatment	1	0	DC 0	SFPUC 1 DC 2	2	SFPUC 0 DC 2	1	1
Potential Stormwater Treatment Measures (if Required)										
17	Stormwater Filtration (Use of filtration systems in catch basins or vaults)	Treatment	1	0	DC 0	DC 0	DC 0	SFPUC 2 DC -1	SFPUC 1 DC 0	DC 1
18	Alum or Phoslock treatment of stormwater	Treatment	2	0		SFPUC 1 DC 0	SFPUC 2 DC 0	SFPUC 2 DC -1	0	SFPUC 2 DC 0
19	Ferrate treatment of stormwater (Use of Ferrate (Iron VI) as an oxidant, coagulant, and disinfectant; requires contact time)	Treatment	?	0		SFPUC 1 DC 0	SFPUC 2 DC 0	SFPUC -2 DC -1	SFPUC -1 DC 0	SFPUC 2 DC 1
Potential In-Lake Management Measures (if Required)										

			Ranking Criteria							
ID#	Action	Action Type	Estimated benefit to water quality (including cumulative benefits)	Estimated benefit to lake levels	Capital costs	Operation and maintenance costs	Ease of operation	Potential for stakeholder support	Social benefits	Timeline for implementation
20	Aeration Mixing (Bubbler devices in Lake bottom create a mixing force that causes circulation of Lake waters)	In-lake Management	2	0	SFPUC 0 DC 1	0	1	SFPUC 1 DC -1	0	SFPUC 2
21	Alum Treatment (Aluminum sulfate (alum) or Phoslock (see earlier) is applied directly to the Lake, which binds with phosphorus in the water and settles to the bottom creating a barrier to phosphorus uptake)	In-lake Management	2	0		1	SFPUC 2 DC 0	-2	0	SFPUC 2
22	Algaecide Treatment (Application of peroxides (e. g. PAC 27) directly to the Lake to reduce algae growth). Copper-based algaecides will not be considered.	In-lake Management	2	0		SFPUC 2 DC 0	SFPUC 2	SFPUC -1 DC -2	SFPUC 0	SFPUC 2
23	Biomanipulation	In-lake Management	1	0		SFPUC 2	SFPUC 2	SFPUC -2	SFPUC 0	SFPUC 2
24	Macrophyte harvesting	In-lake Management	1	0		SFPUC 2	SFPUC 2	SFPUC 0	SFPUC 0	SFPUC 2

Different
Exactly the same
No input provided

Ranking Criteria	Category weighting	Score	Description
Estimated benefit to water quality (including cummulative benefits)	**1**	2	Would improve water quality in a detectable manner
		1	Would improve water quality in a non-detectable manner
		0	Would have no effect on water quality
		-1	Would degrade water quality in a non-detectable manner
		-2	Would degrade water quality in a detectable manner
Estimated benefit to lake levels (including cumulative benefits)	**1**	2	Would improve lake levels in a detectable manner
		1	Would improve lake levels in a non-detectable manner
		0	Would have no effect on lake levels
		-1	Would degrade lake levels in a non-detectable manner
		-2	Would degrade lake levels in a detectable manner
Capital costs	**1**	2	< $100,000
		1	$100,000 - $1 million
		0	> $1 million
Operations and maintenance costs	**1**	2	Would require no additional operations and maintenance staff and equipment
		1	Would require intermittent operational and maintenance staff and equipment
		0	Would require dedicated operations and maintenance staff and equipment
Ease of operation	**1**	2	Self maintaining system
		1	Performance would be slightly affected by operational decisions
		0	Performance would be dependent on operational decisions
Potential for stakeholder support	**1**	2	Majority stakeholder support - minority neutral
		1	Majority stakeholder support - minority oppose
		0	All stakeholders neutral
		-1	Majority stakeholder oppose - minority support
		-2	Majority stakeholder oppose - minority neutral
Social benefits	**1**	1	The management action would be expected to provide positive social benefits
		0	The management action would be expected to provide neutral social benefits
		-1	The management action would be expected to provide negative social benefits
Timeline for implementation	**1**	2	1-5 years
		1	5-10 years
		0	10-20 years

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May 11, 2012

Xavier Fernandez
San Francisco Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Vista Grande Drainage Basin Improvement Project - Preliminary list of potential lake management actions

Dear Mr. Fernandez:

Daly City is in the initial stages of engineering design and environmental review for the proposed Vista Grande Drainage Basin Improvement Project. The South Lake Merced Alternative, which is currently identified as the proposed project, would divert storm water (and authorized non-storm water) flows from the Vista Grande Canal to South Lake Merced. Daly City, in cooperation with the San Francisco Public Utilities Commission (SFPUC), intends to develop a Lake Management Plan which would include a phased program of measures intended to maintain and where feasible improve the water quality of South Lake and Lake Merced in general.

As the first step in developing the Lake Management Plan, Daly City, in cooperation with the SFPUC, has prepared a preliminary list of potential actions intended to help improve water quality in South Lake (attached). The list includes watershed source control measures, treatment options, and lake management options which can be used singularly or collectively. This preliminary list has been expanded into the attached matrix that identifies the intended benefits of each action, the potential improvement of DO and pH levels, application and feasibility considerations, and whether additional evaluation is warranted at this time. Also attached is a description of the types of oxygenation and aeration techniques considered.

The list of potential actions was developed by ESA, EOA, Jacobs Associates and Dr. Alex Horne in consultation with Daly City and SFPUC staff. Dr. Alex Horne provided the evaluation of each action's influence on DO and pH levels. The list includes actions that are currently included in the proposed project, alternative actions that are proposed for further evaluation and possible incorporation into the Lake Management Plan, and those alternative actions that Daly City and SFPUC have determined do not warrant further investigation. The list is not intended as a substitute for the actions and Best Management Practices (BMPs) specified by the Municipal Regional Permit (MRP).

Based on comments provided by the Water Board, Daly City and SFPUC will further evaluate and determine the feasibility and likely effectiveness of the individual alternative actions. During the evaluation, Daly City will work with SFPUC and the Water Board to develop a framework for the Lake Management Plan to identify the criteria and timeline for implementation. Based on this framework and the evaluation of individual actions, Daly

City and SFPUC will develop a Draft Lake Management Plan that will be provided to the Water Board for review, and then finalized.

We appreciate the Water Board's ongoing participation in the review of the Vista Grande project and look forward to reviewing your comments. If you have any questions, please don't hesitate to call me at (510) 740-1720.

Sincerely,

Josh Ferris

cc: Patrick Sweetland, City of Daly City
Obi Nzewi, San Francisco Public Utilities Commission
Nicole Granquist, Downey Brand
Blake Rothfuss, Jacobs Associates
Tom Hall, EOA
Dr. Alex Horne

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
Proposed Vista Grande Components						
1	Return storm water to Lake (proposed for Vista Grand Project)	Watershed/ Source Control	Assist in maintaining Lake at target elevation (potential increase over existing conditions) Increase fisheries habitat Improve recreational benefits Alleviate flooding	Expected to have a minor, if any, impact on DO and pH. Likely to have a negligible impact on nutrient concentrations in South Lake water Depending on the amount of depth increase, there is a potential increase in the duration of stratification events, and corresponding anoxic conditions in the hypolimnion	Need to determine target lake water surface elevation Potential changes to water quality and habitat will need to be evaluated	Yes
2	Solids Screening >5mm (proposed for Vista Grande Project)	Treatment	Reduce levels of gross solids and trash in source water	Minor influence on DO & pH Reduction in nutrient levels would reduce potential for stormwater to stimulate additional algal growth	Space constraints in a constricted utility area Requires maintenance of screening device	Yes
3	Treatment wetland for stormwater flows (low flow wetland proposed for Vista Grande Project) *Also see similar Action #13, Treatment wetland for Lake water*	Treatment	Would remove sediment, suspended solids, metals, and nutrients from stormwater Public amenity, educational value	Potential moderate influence on DO & pH; lake has high background concentration of nutrients at present Reduction in nutrient levels in source water, potential reduction in nutrient concentrations in receiving waters	Need to determine sizing and treatment capacity Need to ensure vector control Aesthetic concerns can be addressed	Yes
Potential Actions to be Evaluated Further						
4	LID Filtration: Bioretention/rain gardens, vegetated filter strips, sand filters, vegetated swales	Watershed/ Source Control	Reduce levels of sediment, nutrients, trash, metals, bacteria, oil and grease, organics and oxygen demanding substances in source water	Minor influence on DO and pH Reduction in particulate-bound nutrient levels would reduce potential for stormwater to stimulate additional algal growth	Most LID projects in Daly City and San Francisco would be implemented with redevelopment and infrastructure projects Need to identify potential sites in the watershed for early implementation	Yes
5	LID Infiltration: Infiltration basins/trenches	Watershed/ Source Control	Promote infiltration and reduce volume and rate of runoff in the watershed Reduce levels of sediment, metals, bacteria and nutrients in source water	Minor influence on DO & pH Reduction in particulate-bound nutrient levels would reduce potential for stormwater to stimulate additional algal growth	Most LID projects would be implemented with redevelopment and infrastructure projects (Daly City and San Francisco) Need to identify potential sites in the watershed for early implementation	Yes
6	Separating stormwater from combined system (San Francisco) and daylighting streams	Watershed/ Source Control	Restore historical drainage to Lake Merced	Minor influence on DO & pH Increase volume of stormwater to Lake Negligible impact on nutrient concentrations in Lake	Separating stormwater from combined system is expected to occur as a part of SFPUC's SSIP Projects may be implemented with major redevelopment and infrastructure projects	Yes

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
7	Pet Waste Management Education program and facilities (clean-up bag stations, trash receptacles)	Watershed/ Source Control	Reduce levels of nutrients, bacteria and oxygen demanding substances in source water	Reduction in levels of oxygen demanding substances and nutrients would reduce potential for stormwater to degrade DO levels and stimulate algal growth in Lake High DO and cool temperatures would reduce harmful effects of BOD from pet waste in winter but summer flows would be more harmful	Coordination of multiple agencies to provide education, implementation, and enforcement	Yes
8	Reduce nutrient sources from upland areas surrounding Lake (woodchips, restrict use of lawn fertilizers, minimize irrigation runoff etc.)	Watershed/ Source Control	Reduce nutrient inputs to South Lake	Potentially moderate influence on DO & pH (if nutrients are currently limiting algae growth) Potential reduction of nutrient inputs to Lake from stormwater runoff. Benefit would be more substantial in summer since warm inflows float in photic zone	Need inventory of nutrient sources May require coordination of multiple agencies to provide education, implementation, and enforcement. May require phased implementation	Yes
9	Expanded Street Sweeping and Maintenance	Watershed/ Source Control	Reduce levels of sediment, trash, metals, oil and grease, organics and oxygen demanding substances in source water	Minor influence on DO & pH Reduction in levels of oxygen demanding substances would reduce potential for stormwater to degrade DO levels in Lake	Street sweeping, and hand cleaning and maintenance of curb returns is currently implemented in Daly City; San Francisco sweeps the streets surrounding Lake Merced. Expanding these existing programs may result in minimal additional benefit	Yes
10	Catch Basin Screening	Watershed/ Source Control	Reduce levels of gross solids and trash in source water	Minor influence on DO & pH Reduction in nutrient levels would reduce potential for stormwater to stimulate additional algal growth	Requires maintenance of catch basin screens Need inventory of contributing catch basins in San Francisco Downstream screening is proposed in Vista Grande basin (catch basin screens may be redundant)	Yes
11	Downspout Disconnection	Watershed/ Source Control	Reduce peak stormwater flows Increase infiltration	Negligible effect to Lake ecology Decrease volume of stormwater to Lake Minor potential to increase the contribution of shallow groundwater (some of which has elevated nitrate levels) into Lake Merced	In Vista Grande Drainage Basin, downspout disconnection would reduce the volume of water available for discharge into South Lake Effectiveness dependent on degree of homeowner participation A permit is required for the disconnection of residential downspouts in San Francisco Need to assess the potential for increased infiltration in the watershed to increase groundwater contribution to Lake Merced. Likewise, need to assess the potential to increase nitrate levels in Lake Merced due to elevated nitrate levels present in some shallow groundwater near the lake.	Yes
12	Rain Barrel/Cisterns	Watershed/ Source Control	Reduce peak stormwater flows Increase infiltration Conserve water for later non-potable use	Negligible effect to Lake ecology since any changes in the volume of water entering the lake is likely to be small relative to lake volume	In Vista Grande Drainage Basin, rainwater harvesting would reduce the volume of water available for discharge into South Lake SFPUC has an existing Discounted Rain Barrel and Cistern Program	Yes

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
13	Treatment wetland for Lake water (recirculation of Lake water) *Also see similar Action #3, Treatment wetland for stormwater flows*	Treatment	Would remove algae, sediment, suspended solids, metals, and nutrients from Lake water	Potential moderate-major influence on DO & pH; direct algal removal reduces summer BOD load to sediments Reduction in nutrient levels in the Lake; much of nutrients in algae removed in wetland (N better removed than P)	Need to determine if sites are available for the development of treatment wetlands Need to determine area requirements Would require pumping from lake (operational pump maintenance and energy cost)	Yes
14	Enhance wetland and riparian habitat around Lake	Treatment	Assist in filtering stormwater runoff Provide beneficial uptake of nutrients	Possible moderate beneficial effect on DO & pH if submerged plants prosper Reduction in nutrient levels in source water, potential reduction in nutrient concentrations in receiving waters	Possible undesirable influence on DO & pH; at night respiration by submerged parts of vegetation will reduce DO and in daytime increase pH. Effect can be moderated if water mixing is used on calm days Need to determine if suitable shallow water sites are available for the development of wetland/riparian habitat SFPUC's Lake Merced Watershed Report recommends potentially reducing the width of some sections of Lake Merced Boulevard, John Muir Drive and Skyline Boulevard to incorporate bioswales and open space.	Yes
15	Alum or phosloc treatment of stormwater	Treatment	Reduce phosphorus levels Reduce or limit the growth of algae	Possible moderate-major short-term influence on DO & pH Potential reduction in phosphorus levels in source water and/or receiving waters will decrease algae and thus drop pH and BOD loading	Public perception of chemical use (concerns on the toxicity of aluminum). Rarely, if ever, used on larger water bodies in California but its use is common in other states. Phosloc, replaces aluminum with lanthanum, which has lower toxicity perceptions	Yes
16	Ferrate treatment of stormwater Use of Ferrate (Iron VI) serves as an oxidant, coagulant, and disinfectant (requires contact time)	Treatment	Reduce levels of bacteria, metals, phosphorus in stormwater	Minor influence on DO & pH Reduction in nutrient levels would reduce potential for stormwater to stimulate additional algal growth	New technology; Need to determine if there have been similar applications Requires contact time – usually accommodated through storage (equalization basins).	Yes
17	Stormwater Filtration Use of filtration systems in catch basins or vaults	Treatment	Reduce levels of suspended solids, nutrients and metals from stormwater	Minor influence on DO & pH Reduction in nutrient levels would reduce potential for stormwater to stimulate additional algal growth	Filtration systems typically handle baseflow and bypass peak flows; limited practicality for a flashy basin like Vista Grande. Requires regular maintenance of vault filters	Yes
18	Aeration Mixing Bubbler devices in Lake bottom create a mixing force that causes circulation of Lake waters	In-lake Management	Causes mixing of the Lake so anoxic layer near bottom is reduced or eliminated Circulate waters to disrupt blue-green algae and favor more beneficial phytoplankton (better food web for fisheries)	Minor direct influence on DO & pH; indirect moderate to major effect likely via transport of surface DO to bottom waters Mixing reduces or eliminates anoxia at depth Potential reduction of pH levels by reducing sunlight exposure to algae and nutrient loading (which would reduce algal production) Depends on algae to produce DO, so aeration can fail on rare occasions if algae become low.	Requires installation and long term maintenance of new infrastructure in lake (air lines and bubble diffusers), and air compressor(s) on shore. Would disrupt stratification of lakes (colder hypolimnion habitat would be lost) affecting habitat that supports an existing recreational trout fishery.	Yes

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
19	Alum Treatment Aluminum sulfate (alum) or Phosloc (see earlier) is applied directly to the Lake, which binds with phosphorus in the water and settles to the bottom creating a barrier to phosphorus uptake	In-lake Management	Removes and controls internal cycling of phosphorus Reduces algae, improves clarity	Minor influence on DO & pH Short-term effect improving DO by reducing oxygen demand Short-term effect improving pH by reducing algae	Lake-wide treatment would be costly, and would only be effective for a limited duration (1-10 years) Effectiveness is limited by ongoing phosphorus inputs to the lake Alum treatment can reduce phosphorus cycling in sediment, may assist in addressing legacy nutrients	Yes
20	Algaecide Treatment Application of peroxides (e. g. PAC 27) directly to the Lake to reduce algae growth *Copper-based algaecides will not be considered*	In-lake Management	Reduces algae, improves clarity	Moderate influence on DO & pH May improve DO by reducing oxygen demand May improve pH by reducing algae	Chemical concerns (concerns on public perception - toxicity of herbicide, impact to fish and consumers of fish) Use of peroxides (e. g. PAC 27) would be effective, but expensive since treatment may be needed several times per year May assist in breaking internal nutrient cycle	Yes
21	Biomanipulation	In-lake Management	Reduces algae in a sustainable fashion. Requires manipulation of zooplankton (increase) & fish populations (removal of small fish by various methods) & presence of a submerged aquatic vegetation zone	Possible moderate influence on DO & pH Reducing algae would reduce sediment oxygen demand and lower pH	Potential disruption in existing fishery, potential sport fishing group opposition Would require coordination of stocking programs conducted by CDFG and SFPUC	Yes
22	Macrophyte harvesting	In-lake Management	Directly removes a small amount of nutrients	May improve DO by reducing oxygen demand	Potential disruption in beneficial uses, especially fishing and boating Need to quantify biomass to determine if harvesting is warranted Need to quantify nutrient reduction potential & weed disposal requirements on land May be combined with biomanipulation (for open water access)	Yes

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
Actions Dismissed from Further Evaluation						
23	Diversion of some flows (with higher pollutant loads) to a wastewater treatment plant	Treatment	Provide treatment of stormwater flows that carry higher pollutant loads.	Negligible effect to Lake (WWTP effluent would be discharged to ocean)	Does not satisfy criteria developed by the Bay Area Stormwater Management Agencies Association for pilot stormwater pump station diversion projects identified in the Municipal Regional Permit: • Land uses are primarily residential and limited commercial without significant sources of mercury or polychlorinated biphenyls (PCBs). • Lack of an existing suitable stormwater pump station. • First flush flows from the Vista Grande Drainage Basin have been and will continue to be conveyed to the ocean. • Dry weather from the Vista Grande Drainage Basin will be diverted and treated via a managed constructed treatment wetland. • Does not address regional water management strategies to increase recycled water use and restore Lake Merced water surface elevation. • Prohibitively expensive capital costs. Inconsistent with efforts to separate stormwater from wastewater and reduce San Francisco's combined sewer overflows.	No (Significant feasibility and regulatory costs with minor water quality benefit, lack of adequate justification for required rate increases)
24	Hypolimnetic Aeration Uses air-lift systems (e.g. LIMNO aerator) that mixes air into the hypolimnion without disrupting stratification	In-lake Management	Increases DO levels in hypolimnion Maintains stratification – this improves quality of deeper, colder waters for cold water fish (trout) Reduces anoxic conditions that support nutrient cycling	Moderate influence on DO, minor effect on pH Directly increases DO levels in hypolimnion Potential reduction of pH levels by reducing sunlight exposure to algae and nutrient loading (which would reduce algal production)	The permitting, capital and O&M costs to implement this action would be high relative to other efforts to improve water quality. Requires installation and long term maintenance of new infrastructure in lake (air-lift aerator(s), air lines), and air compressor(s) on shore Aerator may be located on shore, with lake water pumped to aerator and back to lake	No (significant permitting, capital and maintenance costs) Preliminary evaluation with SFPUC indicates that alternative methods may be more effective in managing lake conditions. Alternative lake management actions should be fully evaluated prior to re-consideration of this alternative.

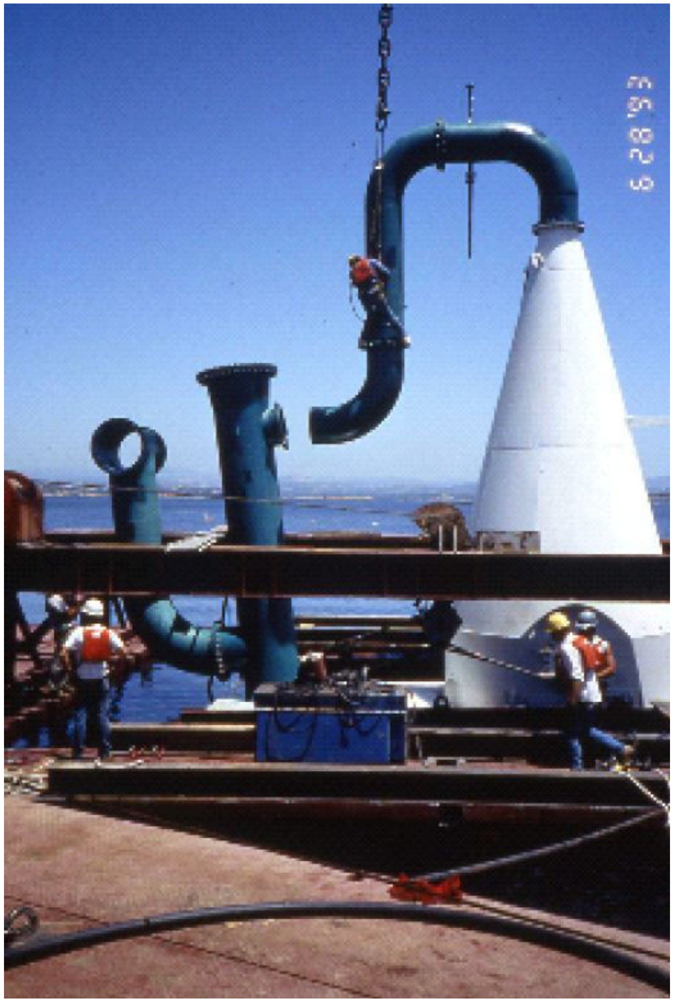
ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
25	Hypolimnetic Oxygenation Speece Cone, TVA-Mobley array, or similar device that mixes oxygen into the hypolimnion without disrupting stratification	In-lake Management	Increases DO levels in hypolimnion Maintains stratification – this improves quality of deeper, colder waters for cold water fish (trout) Reduces anoxic conditions that support nutrient cycling	Possible moderate-major influence on DO & pH Only method that ensures direct increase of DO levels in hypolimnion to a specified level. Potential reduction of pH levels by reducing nutrient loading (which would reduce algal production)	The permitting, capital and O&M costs to implement this action would be very high relative to other efforts to improve water quality. Requires installation and long term maintenance of new infrastructure in lake (Speece cone, oxygen lines), and oxygen storage facility (tank, fencing, access) on shore Cone is usually sited on lake bed so there is no visible structure. Shore based oxygen tanks or generators can be used. Cone can also be located on shore and water pumped in and back to lake	No (significant permitting, capital and maintenance costs) Preliminary evaluation with SFPUC indicates that alternative methods may be more effective in managing lake conditions. Alternative lake management actions should be fully evaluated prior to re-consideration of this alternative.
26	Surface Mixing Use of mixers at the surface to circulate water in the epilimnion and disrupt the growth of blue-green algae	In-lake Management	Vigorous water circulation to disrupt blue-green algae	Minor influence on DO & pH Would distribute DO in epilimnion & improve pH by adding some CO2	Requires installation and maintenance of new infrastructure in lake To have an effect on DO & pH, extensive fountains would be required that would result in visual intrusion and interference with passive and active recreation (i.e., rowing, boating, fishing) Application would be required in deepest areas of the lake, which rowers and other boaters frequent.	No (Significant disruption of beneficial uses, less disruptive methods are available)
27	Mechanical Whole-Lake Mixing Use of mechanical mixers at the Lake surface or in the Lake bottom (propeller) to break up stratification	In-lake Management	Cause mixing of the entire water column to increase DO levels at depth so anoxic layer near bottom is reduced or eliminated	Possible moderate-major influence on DO & pH Mixing reduces or eliminates anoxia at depth Potential reduction of pH levels by reducing nutrient loading (which would reduce algal production) Drawbacks similar to aeration if algae decline too much	The permitting, capital and O&M costs to implement this action would be high relative to other efforts to improve water quality Requires installation and long term maintenance of new infrastructure in lake Large propellers would disturb water surface and present a potential hazard to rowers and boaters. Application would be required in deepest areas of the lake, which rowers and other boaters frequent Visual intrusion, interference with passive and active recreation	No (significant permitting, capital and maintenance costs) Preliminary evaluation indicates that alternative methods may be more effective in managing lake conditions. Alternative lake management actions should be fully evaluated prior to re-consideration of this alternative.
28	Fountain Provides aeration and circulation of epilimnion	In-lake Management	Increase DO in epilimnion and circulate shallow waters Aesthetic feature	Minor influence on DO & pH Would slightly increase and distribute DO in epilimnion	Requires installation and maintenance of new infrastructure in lake. There would be capital and O&M costs to implement this action with only a minor benefit to water quality. May be perceived as a visual intrusion in an otherwise natural setting	No (capital and maintenance costs outweigh minor benefit to water quality).

ID#	Action	Action Type	Intended Benefits	Influence on Lake DO and pH level Factors	Application, Performance and Feasibility Considerations	Additional Evaluation Warranted?
29	Sediment Removal (dredging) Removes legacy nutrients in sediment reducing internal cycling	In-lake Management	Reduce a significant source of nutrients (internal loading) Restore Lake morphology Could change seasonal water mixing regime from current polymictic mixing if sufficient sediment removed (original depth not known)	Moderate influence on DO & pH Reduces nutrients in summer & decreases algal growth DO may improve by lowering sediment oxygen demand pH may improve by reducing algae	Very high sediment evaluation and implementation cost. Would create local disturbance for settling ponds and haulage areas. May not work well if nutrient flux continues at present rate Potential to re-suspend/release nutrients and metals from sediment Would require core sample analysis for age of lake and contaminant concentrations Highly disruptive of Beneficial Uses (recreation, fisheries) Would remove legacy nutrients	No (Significant disruption of beneficial uses, less disruptive methods are available)
30	Algae harvesting (Direct)	In-lake Management	Remove moderate amount of nutrients Directly removes larger nuisance algae	Moderate influence on DO & pH May improve DO by reducing oxygen demand May improve pH by reducing algae	Potential disruption in beneficial uses, especially fishing and boating Very difficult to get substantial amounts of algae separated from the water but could work if the wetlands filter option were used	No (Disruption of beneficial uses, difficult to achieve due to size of algae)
31	Dilution/flushing	In-lake Management	Remove nutrients, reduce nutrient concentrations	Minor-moderate influence on DO & pH Reduce nutrient concentrations and algae	The most effective application would be during the summer Would require a large volume of high quality water supply Lack of lake outlet that would facilitate flushing (would require large outlet/siphon near lake bottom)	No (Lack of adequate water supply and suitable outlet)
32	Selective withdrawal of hypolimnion water	In-lake Management	Remove anoxic water to increase overall DO levels	Moderate influence on DO & pH Would remove low DO water Would reduce pH by reducing internal nutrient cycling	Lack of adequate inflow, would be counterproductive to goal of increasing lake level Would require large siphon. May require treatment for water leaving siphon	No (Lack of adequate water supply and suitable outlet)
33	Shading (dyes)	In-lake Management	Reduce algal growth	Moderate influence on DO & pH May improve DO by reducing oxygen demand May improve pH by reducing algae	Would need to be repeated, dye lasts only a few months Disruptive of Beneficial Uses (recreation, fisheries) Public perception concerns	No (Disruption of beneficial uses, less disruptive methods are available)

General Types of Oxygenation and Aeration

Vista Grande Drainage Basin Improvement Project

Type	**Hypolimnetic** Methods that increase oxygen levels in the hypolimnion without disrupting stratification.		**Mixing (whole lake)** Method that mixes oxygen-rich epilimnion with oxygen-poor hypolimnion to increase oxygen levels near the lake bottom.
	Oxygenation	**Aeration**	**Aeration**
Description	Speece Cone or similar device that dissolves pure oxygen in bottom water in the hypolimnion with no bubbles. See **Figure 1**. TVA-Mobley array that introduces oxygen bubbles into the hypolimnion which dissolve as they rise. See **Figure 2**.	Air-lift systems (e.g. LIMNO aerator) that mixes compressed air and bottom water inside a large pipe. At top of pipe, aerated water flows down back to hypolimnion in outer pipe. Maintains thermal stratification. See **Figure 3**.	Bubbler devices in lake bottom create a mixing force that causes circulation of lake waters. Prevents thermal stratification. See **Figure 4**.
Equipment	Speece Cone, water pump, small diffuser manifold, & oxygen storage facility (tank, fencing, access) on shore. Cone is usually sited on lake bed so there is no visible structure. Shore-based oxygen tanks or generators can be used. Cone can also be located on shore and water pumped in and back to lake. Needs electric power. TVA-Mobley array as Speece Cone but with long lines of pipe diffusers replacing cone & water pump. Can be run without electric power if liquid oxygen is trucked in.	Air-lift aerator(s), air lines, and air compressor(s) on shore. Aerator is usually sited on lake bed. Most designs have a large surface mixing box to vent nitrogen to the air. Some use submerged pipes to vent gas in a very visible air boil. Aerator may be located on shore, with lake water pumped to aerator and back to lake. Aeration is not very efficient at adding oxygen to water so the aerator towers are tall and large. Several may be needed.	Long air lines and bubble diffusers arrays or pipes with holes to release air near bottom in lake, and air compressor(s) on shore. Air flow regulators on each diffuser simplify design in all but flat bottomed reservoirs. Needs electric power. System efficiency increases with depth so more diffusers are needed for shallow lakes.
Purpose	Increases DO levels in hypolimnion to any desired standard Maintains stratification to improve quality of deeper, colder waters for cold water fish (trout). This is accomplished by containing the oxygenation process within a device (e.g., Speece Cone, air-lift system) so that the pumped air or oxygen does not result in the vertical mixing of the water column or by using pure oxygen bubbles (TVA-Mobley system) that are too few to cause destratification. Speece Cone (horizontal flow of oxygenated water over sediments) reduces anoxic (oxygen-poor) conditions that support nutrient cycling from sediments. TVA-Mobley has vertical motion of bubbles so does less well on sediments but is a better method for general hypolimnion oxygenation.		Causes mixing of the lake so anoxic layer near bottom is reduced or eliminated. Circulate waters to disrupt growth of blue-green algae and favor more beneficial phytoplankton (encouraging better food web for fisheries). Cannot guarantee full DO saturation. Depends on algal photosynthesis to provide oxygen and this may be insufficient on occasion.



Speece Cone at Camanche Reservoir (EBMUD)

Speece Cone at Upper Oso Reservoir (Santa Margarita WD)

Source: Schuler Engineering

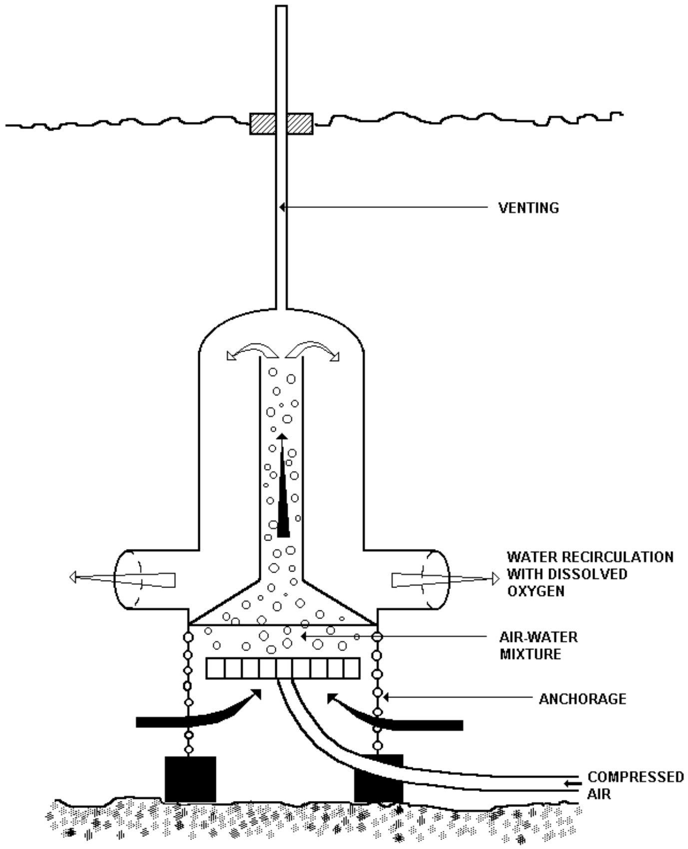
Figure 1
Hypolimnetic Oxygenation – Speece Cone

TVA-Mobley array installation at Calaveras Reservoir (SFPUC).
Line is laid out water surface prior to sinking to bottom of reservoir.

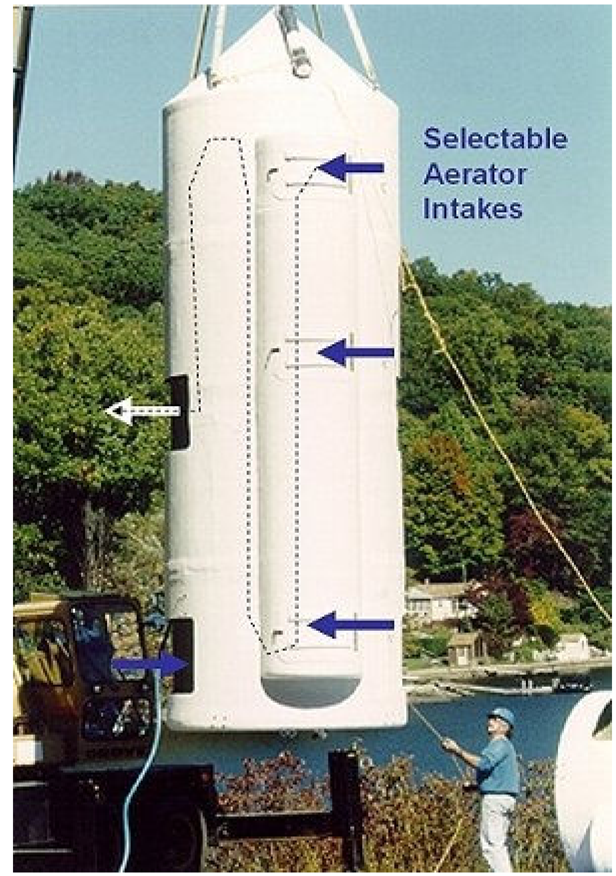
Liquid oxygen facility at Calaveras Reservoir.

Source: Mobley Engineering, Inc.

Figure 2
Hypolimnetic Oxygenation – TVA-Mobley Array



Aerator Diagram



Aerator installed at Lake Waramaug Task, CT

Source: Lake Waramaug Task Force

Figure 3
Hypolimnetic Aeration

Ceramic Diffuser

Installing Diffuser

Source: CLEAN-FLO

Figure 4
Mixing Aeration

APPENDIX B
Scoping Memorandum

ESA Water

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memorandum

date July 10, 2013

to Patrick Sweetland, Robert Ovadia

from Alexandra Kostalas, Alisa Moore

subject Vista Grande Drainage Basin Improvement Project Scoping Process and Comments

This memorandum summarizes the scoping process undertaken for the Vista Grande Drainage Basin Improvement Project (project) draft Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA).

Noticing

The City of Daly City issued a joint Notice of Preparation (NOP) and Notice of Intent (NOI) to prepare a joint Draft EIR-EIS for the project on February 28, 2013. The NOP-NOI described the project, announced the dates and locations of public meetings in support of the scoping process, and requested comments on the scope of the Draft EIR-EIS by April 26, 2013. Notices were mailed to 183 recipients, including the State Clearinghouse; federal, state, and local agencies; organizations; and individuals. Agency recipients received printed copies of the NOP-NOI, and others received postcards briefly describing the project and directing recipients to Daly City's website, where the NOP-NOI was made available electronically, at: http://www.dalycity.org/City_Hall/Departments/public_works/Reports_1119/vistagrande_alts.htm. The NOP-NOI and postcard are included in Attachment A.

Additionally, Daly City posted notices of the public scoping meeting at the City of Daly City Department of Water and Wastewater Resources Administration Office, City of Daly City Office of the City Clerk, and the Westlake Library and John Daly Library, and published a notice in the San Mateo County Times on March 21, 2013.

The National Park Service (NPS) Golden Gate National Recreation Area (GGNRA) sent a message to its electronic mailing list on March 4, 2013, inviting recipients to an open house featuring this and other projects within the GGNRA, and providing a link to Daly City's project website described above, where visitors could access the NOP-NOI. Additionally, the NPS posted a notice at locations within Fort Funston notifying the public about the project and Daly City's scoping meeting. The NPS also published a NOI in the Federal Register on May 8, 2013 (78 FR 26807). The comment period for the Federal Register NOI ended on June 7, 2013. The posted notice and Federal Register NOI are included in Attachment A.

Meetings

Daly City held a public scoping meeting to educate members of the public about the project and to solicit comments on the scope of the Draft EIR-EIS on March 28, 2013, at the Doelger Senior Center Cafe/Kitchen in Daly City. Three members of the public attended. A presentation was given at the meeting that included an overview of the environmental review process and the project background, objectives, and description. Oral comments given at the scoping meeting are summarized below based on notes taken by meeting organizers. All attendees were encouraged to submit written comments and comment cards were made available for that purpose. Meeting materials are included in Attachment B.

The NPS held an open house on March 19, 2013, at the General's Residence at Fort Mason. Several projects and topics were covered at the open house, including the Vista Grande project. Daly City staff and consultants attended the open house and spoke with attendees about the project. Posters depicting the project location and proposed components were available for viewing, and copies of the NOP-NOI were made available for attendees. Comment cards were also given to interested attendees to solicit written comments on the scope of the Draft EIR-EIS.

Comment Letters Received

The table below lists the comment letters received by mail, electronic mail (e-mail), or facsimile (fax) on or before the close of the NOI comment period, June 7, 2013, in the order that they were received. These letters are included in Attachment C. Should further comments be received, they will be considered in the EIR-EIS analysis. Comments not received at least 30 days in advance of the Draft EIR-EIS publication will be considered during preparation of the Final EIR-EIS.

Commenting Agency, Organization, or Individual	Date Received (2013)
California Department of Transportation (Caltrans), District 4; Erik Alm, District Branch Chief	March 5 (fax), March 11 (mail)
San Mateo County Planning and Building Department; Michael Schaller, Senior Planner	March 14
Dick Morten	March 30
Carolyn Cooper	April 3
Golden Gate Audubon Society; Dan Murphy, Conservation Committee	April 26
San Francisco Public Utilities Commission (SFPUC); Steven R. Ritchie, Assistant General Manager, Water	April 26
California State Lands Commission; Cy R. Oggins, Division of Environmental Planning and Management	April 26
Bold, Polisner, Maddow, Nelson & Judson; Robert Maddow, Special Counsel to The Olympic Club	June 7

Summary of Comments on the Scope of the Draft EIR-EIS

The following sections summarize the comments that were received during the scoping period by topic. This summary is limited to comments that are within the scope of CEQA and NEPA analyses.

Project Description and Alternatives

- Provide precise descriptions of the types of equipment and construction methods that may be used, timing and length of all construction activities, maximum work area, and volume of materials and sediments disturbed or removed and locations for disposal.

- Describe in detail the construction methods for the canal and tunnel replacement under State Route 35 (Skyline Boulevard). It was noted by Caltrans that they would not permit cut and cover construction within the State Route 35 right of way.
- Describe in detail how each Project component would contribute to the overall function of the Project, and how the wetland would treat flows.
- Describe how all flow scenarios would be managed in the proposed system.
- Consider an off-shore outfall option.

Required Permits and Authorizations

- A Coastal Development Permit would be required for portions of project within San Mateo County Coastal Zone.
- A Caltrans encroachment permit(s) would be required for work within the state right of way.
- A Caltrans transportation permit(s) would be required for transport of oversized or excessive load vehicles on state roadways.
- Portions of the Project may require authorization and an amended or new lease from the California State Lands Commission, which has jurisdiction and management authority over ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways.
- The EIR-EIS should describe the authority, responsibility, and accountability of all proponents and responsible agencies for all aspects of design, construction, operation, maintenance, and replacement of the Project.

General Comments on Impact Analysis

- Conclusions should be preceded by a reasoned, fact-based analysis of the potential impact.

Aesthetics

- Remove riprap/hard cover added to Lake Merced shore after canal overflows.
- Limit night lighting near Lake Merced to only when necessary, and include night lighting mitigation measures described in the Vista Grande Drainage Basin Alternatives Evaluation Report.[1]
- Describe the effects of the treatment wetland on views from The Olympic Club.

Biological Resources

- Conduct database searches to identify special-status plant or wildlife species that may occur in the Project area.
- Consult and coordinate with U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and National Oceanic and Atmospheric Administration’s (NOAA) Fisheries Service to obtain information on species that may be present and potential mitigation for significant impacts, such as species-specific construction periods.
- Conduct a native plants assessment and consider seed collection and replanting on site or at Lake Merced as mitigation for removal of native plants (in particular, oak trees along John Muir Drive). Acorns should be

[1] Volume 4, Section 3 of this report contains suggested mitigation and is available at http://www.dalycity.org/Assets/Departments/Public+Works/pdf/Vol4-Sec3.pdf

collected in fall and planted at Lake Merced, the edge of Harding Golf Course, the edge of the Olympic Club, along Brotherhood Way, or in other nearby open space, in an area unlikely to be disturbed.

- Acknowledge that the existing canal provides habitat for migrating birds in the fall season.
- Consider the effects of construction on nesting birds, including the cliff swallows that nest on the bridge between South Lake and Impound Lake, and the bank swallow colony at the northern end of the Fort Funston bluffs.
- Evaluate the potential impacts on birds and fish from noise and vibration from construction, restoration, and/or flood control activities.
- Consider installing swallow nesting boxes on trees along the wetland to attract swallows to help control insects.
- Survey the Project site for Western Snowy Plover. This species may be present on the beach, and are known to be present north of Sloat Boulevard in San Francisco from mid July through mid May.
- Consider effects of any proposed night lighting on birds, such as collisions and increased predation.
- Acknowledge that special-status species present at Lake Merced include San Francisco common yellowthroat, which nests in bulrush marsh. Avoid construction that may disrupt nesting yellowthroats between March 1 and July 15.
- Acknowledge that tri-colored blackbird is also present but does not nest at the lake. Other special-status species may occur in the willows and wetlands near the concrete bridge and along the canal during fall migration (September-October).
- Avoid the start of construction in wetlands and woodlands during the February 15 to July 15 nesting season.
- Consider the potential for the Project to encourage the establishment or proliferation of invasive species, such as the quagga mussel or other aquatic or terrestrial species. Potential mitigation measures could include using local construction vehicles or boats, requiring hull cleaning, procedures for removal of invasive species, and post-construction monitoring.
- Use mosquito-eating fish in the wetland to reduce insects.
- Consider the potential for the wetland to attract wildlife from Lake Merced across John Muir Drive, which may increase the likelihood of wildlife roadkills. Consider installing a wildlife crossing structure as mitigation.

Cultural Resources

- Include documentation of a current (no more than 5 years old) archaeological record search of California Historical Resources Information System (CHRIS).
- If needed, a cultural resource study should be conducted by a qualified professional archaeologist
- Undertake Native American consultation in compliance with CEQA Sections 5024.5 and 5097, applicable sections of NEPA, and Caltrans requirements if work would occur within a state right of way.
- Evaluate potential impacts on submerged cultural resources in the Project area, such as known and potential shipwrecks, which are under the jurisdiction of the State Lands Commission.

Geology and Soils

- Consider effects of liquefaction potential under the bridge between South Lake and Impound Lake.

Greenhouse Gas Emissions and Climate Change

- Identify a threshold of significance for greenhouse gas emissions and quantify emissions to compare to this threshold.
- If the Project would result in significant greenhouse gas emissions, identify mitigation measures that would avoid, reduce, or compensate to the extent feasible.
- Consider effects of climate change on weather patterns and lake levels for future operations.
- Consider the effects of sea level rise on the Project and on all resources potentially affected by the Project. If applicable, indicate how the Project would address sea level rise and what adaptation measures are planned throughout the operational phase.

Hazards and Hazardous Materials; Public Health

- Consider the potential effects of the wetland on the prevalence of disease vectors such as mosquitoes.
- For safety and security reasons, the Project should not propose to allow public access onto property owned by The Olympic Club.

Hydrology and Water Quality

- Consider the effects of Vista Grande discharges to Lake Merced on recharge of the Westside Aquifer.
- Describe the effectiveness of the debris screening device under storm flow conditions.
- Describe the proposed water quality monitoring methods and schedules at the proposed wetland and ocean outfall.
- Consider the use of injection wells to aquifer.
- Describe effects of beach discharges.
- Describe the effects on the Project components and adjacent properties of storms that would be larger than the 25-year storm event or design storm.

Land Use and Planning

- Consider the Project's consistency with the San Mateo County Local Coastal Program and other land use plans and policies.

Noise and Odor

- Describe the potential for the proposed treatment wetland to produce odors that would be noticeable from adjacent properties, particularly after a large storm event.

Recreation

- Characterize current public uses of the Project area and analyze potential impacts of the Project on public uses such as boating, swimming, surfing, or other recreational uses. If appropriate, identify alternative access points for public access to recreational resources, and post signs to minimize the impact to recreational users.
- Acknowledge that the shoreline of Lake Merced is closed to fishing except in those areas of shoreline designated for fishing, such as at the Boathouse Picnic Area and at the south end of South Lake.
- Use of water from the Vista Grande Watershed to raise the level of Lake Merced would provide a recreational benefit to lake users.

- The existing canal is used by birders in September and October to view migrating birds. Consider providing viewing access for the wetland and canal to support this use.

- Consider the potential for the Project to adversely affect recreational and tournament uses at The Olympic Club, and provide as much advance notice of nearby site preparation or construction as possible.

Transportation

- Acknowledge that the project proponent would be responsible for mitigation related to improvements to state highways.
- Preparation of a Traffic Impact Study (TIS) may be required.
- If traffic restrictions and detours would affect state highways, a Caltrans-approved Transportation Management Plan (TMP) or construction TIS may be required.

Cumulative Impacts

- Evaluate the potential cumulative effects of this project in combination with the SFPUC's proposed projects that would affect Lake Merced, as well as other projects planned in San Francisco and/or Daly City.

Mitigation

- Present mitigation measures that are specific, feasible, enforceable obligations, or as formulas containing performance standards.
- Include an explanation of the logical connection between significance conclusions, mitigation measures, and residual impacts after mitigation measures are implemented.

Comments Outside the Scope of the Draft EIR-EIS

Several comments received were outside the scope of CEQA and NEPA and are not considered in the Draft EIR-EIS, including:

- General statements of support for the Project;
- The operational and maintenance cost of the proposed system;
- Public availability of water quality monitoring data; and
- Whether building the outfall at Lake Merced would complicate later removal of the SFPUC sewer between South Lake and Impound Lake.

ATTACHMENT A
Public Notices

NOTICE OF PREPARATION / NOTICE OF INTENT TO PREPARE A JOINT EIR / EIS FOR THE VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT

The City of Daly City, as the Lead Agency under the California Environmental Quality Act (CEQA), and the National Park Service (NPS), as the Lead Agency under the National Environmental Policy Act (NEPA), will prepare a joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the proposed project referenced above, and would like your views regarding the scope and content of the environmental analysis. If applicable, this EIR/EIS may be used by your agency when considering any discretionary approvals for this project.

The project location, description, and a summary of the probable environmental effects of the project are attached. These effects and all issue areas required by CEQA and NEPA will be evaluated in the Draft EIR/EIS. The Draft EIR/EIS is anticipated to be published in late 2013.

This Notice of Preparation/Notice of Intent is being circulated for a public comment period, beginning on February 28 and ending on April 26, 2013. Please identify a contact person, and send your comments on the proposed scope and content of the EIR/EIS in writing to:

City of Daly City, Department of Water and Wastewater Resources
Attn: Patrick Sweetland, Director
153 Lake Merced Blvd., Daly City, CA 94015
Phone: (650) 991-8201, e-mail: psweetland@dalycity.org

The City of Daly City will hold a Public Scoping Meeting to provide an opportunity for the public and regulatory agencies to learn about the Project and be informed about how to submit comments on the scope of the Draft EIR/EIS analysis. The NPS will also host an open house, which will include information about the Project and opportunities to comment. You are welcome to attend and provide your input on the scope of the Draft EIR/EIS so that it addresses all relevant environmental issues. The date and location of each meeting is as follows:

Daly City Scoping Meeting
March 28, 2013
7:00 p.m. to 9:00 p.m.
Doelger Senior Center
Cafe/Kitchen
101 Lake Merced Boulevard
Daly City, CA

National Park Service Open House
March 19, 2013
4:30 p.m. to 6:30 p.m.
General's Residence at Fort Mason
San Francisco, CA

For more information visit:
http://www.nps.gov/goga/parkmgmt/publicinvolvement.htm

Patrick Sweetland, Director
City of Daly City, Department of Water and Wastewater Resources

Date: February 28, 2013

Project Location

The City of Daly City is proposing the Vista Grande Drainage Basin Improvement project in Daly City, unincorporated Broadmoor Village in northwestern San Mateo County, and the City and County of San Francisco. The Vista Grande Watershed Drainage Basin (Basin) is located in Daly City and unincorporated Broadmoor Village. The Basin is approximately 2.5 square miles in area and is bordered by the City and County of San Francisco to the north, the Colma Creek watershed to the south and east, and the Pacific Ocean on the west. Stormwater that falls within the Basin is drained through the Vista Grande Canal and Tunnel, which are located in the City and County of San Francisco, adjacent to John Muir Drive and the southwestern shoreline of Lake Merced. The tunnel outfall is located at the Pacific Ocean at Fort Funston, which is managed by the National Park Service (NPS) as part of the Golden Gate National Recreation Area (GGNRA). **Figures 1** and **2** (presented at the end of this Notice of Preparation/Intent) show the project's location and the locations of planned improvements.

Project Description

Daly City is proposing the project to address storm-related flooding that currently occurs in the Basin and to provide other environmental benefits, including restoration and management of water levels within Lake Merced. Lake Merced is made up of four individual but connected lakes (East, North, South, and Impound Lakes) and is owned by the City and County of San Francisco. The San Francisco Public Utilities Commission (SFPUC) maintains the lake as a non-potable emergency water supply for the San Francisco and is a responsible agency for this project. Historically, the Basin was part of the Lake Merced Watershed. The Vista Grande Canal and Tunnel were built in the 1890s to divert stormwater away from the lake to an outfall at the Pacific Ocean, below what is now Fort Funston. The existing canal and tunnel do not have adequate hydraulic capacity to convey peak storm flows, and flooding into adjacent low-lying residential areas and along John Muir Drive periodically occurs during storm events. The existing outfall structure and a portion of the Vista Grande Tunnel, once enclosed within the cliffs at Fort Funston, have become exposed due to the ongoing erosion of the cliff face. The project would alleviate flooding and improve the ocean outfall while reconnecting a significant portion of the lake's historic watershed.

The project would consist of the following structural components (further described below):

- Partial replacement of the existing Vista Grande Canal to incorporate a debris screening device, a treatment wetland, and diversion and outfall structures to route some stormwater (and authorized non-storm water) flows from the Vista Grande Canal to Lake Merced;
- Replacement of the existing Vista Grande Tunnel to increase its peak capacity and extend its operating life; and
- Replacement of the existing ocean outfall structure at Fort Funston.

The locations of these components are shown in Figure 2. Additionally, operational components of the project would include management of water elevations in Lake Merced and a Lake Management Plan that would implement water quality best management practices.

Vista Grande Canal Improvements and Diversion to Lake Merced

The existing Vista Grande Canal is a 3,600-foot-long brick-lined channel with a flow capacity of 500 cubic feet per second (cfs). The canal carries storm flows as well as low flows (also referred to as base flows), which consist of authorized non-stormwater flows such as irrigation runoff that are present in the canal all year. Under the project, a portion of the canal would be replaced with several new facilities to improve storm water quality and conveyance capacity. A collection box, debris screening device, box culvert, and diversion structure would replace the upstream portion of the canal. A treatment wetland would be developed over the box culvert (Figure 2). From the diversion structure, Daly City would construct a box culvert under John Muir Drive and install a screened outfall structure at the edge of South Lake or Impound Lake. Key components are described in more detail below.

Collection Box and Debris Screening Device

A collection box would replace the upstream portion of the existing Vista Grande Canal to collect flows from the contributing storm drains. A debris screening device would be installed downstream of the collection box to trap debris greater than 5 millimeters in diameter, which would be removed using vacuum trucks on a scheduled basis.

Box Culvert

A reinforced concrete box culvert would replace approximately 1,500 feet of the existing canal directly downstream of the debris screening structure. The box culvert would run underneath the proposed treatment wetland described below.

Constructed Treatment Wetland

A constructed treatment wetland would be developed to improve water quality. The treatment wetland would be located along John Muir Drive, partially over the box culvert described above. The treatment wetland would be planted with emergent reeds such as cattails or bulrush, which would improve water quality by intercepting and settling out suspended particulates. After passing through the wetland, the treated water would flow through the diversion structure to the outfall at Lake Merced. During periods of very low or no flow, a recirculating pump would draw water from South Lake to maintain flow in the wetland.

Diversion and Lake Outfall Structures

A semi-automated hydraulic diversion structure would be constructed directly downstream of the box culvert and treatment wetlands to direct flows to either the Pacific Ocean or to a submerged outfall structure into Lake Merced. The specific location of the outfall structure will be determined based on further engineering and environmental review. The diversion of flows would be conducted as described in the Lake Management Plan section below.

Lake Merced Overflow

An existing Lake Merced overflow structure, consisting of a brick and masonry riser and tunnel, connects South Lake with the Vista Grande Canal. Under the proposed project, a portion of the existing Lake Merced overflow would be replaced with an adjustable-height weir that would be used to control the lake level and allow water to be diverted back into the Vista Grande Canal.

Vista Grande Tunnel Replacement

The existing Vista Grande Tunnel has a hydraulic capacity of 170 cfs. The tunnel would be enlarged to increase its capacity to 500 cfs or greater to accommodate storm flows and reduce flooding in the Basin, and to extend its operating life by replacing the aging structure. Alternatively, a new tunnel could be bored adjacent to and parallel with the existing tunnel. Under either option, the new tunnel would incorporate a 30-inch diameter pipeline to transport treated effluent from the Daly City Wastewater Treatment Plant to the ocean outfall. At Fort Funston, the existing tunnel and outfall are located within an existing utility easement,.

Ocean Outfall

Daly City's existing outfall structure, which is located on the beach below Fort Funston, discharges flows from the Vista Grande Tunnel, and also connects an existing 30-inch effluent force main from the Daly City Wastewater Treatment Plant with a subsurface and sub-marine outfall pipeline. Erosion of the cliff face by the surf and waves of the Pacific Ocean has resulted in the outfall structure, a segment of the Vista Grande Tunnel, and the force main segment being exposed and lying across a portion of the beach. The project would remove the existing Daly City outfall structure and replace it with a low-profile outfall structure set into the existing cliff face to reduce future erosion. The existing 30-inch force main would also be removed and replaced with a similar configuration set back into the cliff face. The existing submarine outfall pipeline and diffuser would be renovated to protect it from erosion.

Other Project Components

Lake Level Management

The project would divert some stormwater and authorized non-stormwater flows to Lake Merced to aid the SFPUC in operating Lake Merced within desired water levels. The water surface elevation (WSE) of Lake Merced has fluctuated historically from Elevation (El.) 13 feet (San Francisco City Datum) in the 1940s to a low of El. -3.2 feet in 1993. From 2006 to 2010, the lake had an average WSE of approximately El. 5.8 feet. SFPUC has identified a goal of raising the WSE in the lake compared to current conditions to serve beneficial uses and provide a reliable emergency water supply for firefighting and sanitation purposes. The EIR will evaluate range of average WSEs from El. 6.5 to El. 8.5 feet.

Lake Management Plan

Daly City and SFPUC propose to develop a Lake Management Plan (LMP) as part of the proposed project to maintain and where feasible improve the water quality of Lake Merced. The LMP will include an operational plan for the proposed Vista Grande diversions, a water quality monitoring plan, and best management practices that would be implemented by Daly City and SFPUC. The LMP will be developed in consultation with the San Francisco Bay Regional Water Quality Control Board.

Potential Environmental Impacts of the Project

The EIR/EIS will describe the existing environmental conditions on the project site and will identify the significant environmental impacts anticipated to result from development of the project as proposed. Where potentially significant environmental impacts are identified, the EIR/EIS will also discuss mitigation measures that may make it possible to avoid or reduce significant impacts, as appropriate. The EIR/EIS will address all environmental issue areas required under CEQA and NEPA. The following paragraphs describe key environmental issues that will be addressed in the EIR/EIS.

Aesthetics/Visual Resources

The EIR/EIS will discuss the visual and aesthetic resources of the site and its surroundings, particularly from publicly accessible locations on or near the project site, and evaluate potential impacts on scenic vistas and scenic resources that could occur as a result of the project.

Air Quality

The EIR/EIS will describe the federal, state, and local air quality policies, regulations, and standards as they pertain to the project. The EIR/EIS will also describe local air quality based on air quality data from nearby monitoring stations and will identify locations of sensitive land uses in the project area. The EIR/EIS will then evaluate the project's potential air quality impacts. The analysis will include an assessment of local community risk related to emissions of toxic air contaminants and fine particulate matter from construction activities.

Biological Resources

The EIR/EIS will evaluate impacts of the project on biological resources such as sensitive habitats and special-status species including, but not limited, to San Francisco spineflower, bank swallow, Western snowy plover, Peregrine falcon, California brown pelican, and San Francisco wallflower. The analysis will also address potential effects on aquatic habitat associated with diverting flows from the Vista Grande Canal to Lake Merced and raising the WSE of the lake.

Cultural and Archaeological Resources

The EIR/EIS will describe the project's potential effects on cultural and archaeological resources. Because a portion of the project would be located within a historic landscape at Fort Funston, the analysis will include an evaluation of the project's conformance with standards set by the state and federal historic preservation regulations.

Greenhouse Gas Emissions

The EIR/EIS will describe existing federal, state and local regulations related to greenhouse gases and climate change in the project area, quantify direct and indirect GHG emissions that would be associated with the project, examine the potential for the project to result in global climate change impacts and discuss the measures included in the project to minimize impacts and reduce greenhouse gas emissions.

Hazards and Hazardous Materials

The EIR/EIS will discuss hazards and hazardous material present in the project area, including hazardous material spills, leaks or cleanups, wildland fire risk, and other public safety issues. The EIR/EIS will evaluate the potential impacts related to hazards and hazardous materials including potential for soil contamination from existing and previous uses at the project site and the potential for accidental release of hazardous materials during project construction and operation.

Hydrology and Water Quality

The EIR/EIS will analyze the project in light of applicable requirements under the Clean Water Act, state objectives to protect beneficial uses of water bodies, and policies concerning stormwater reuse and water quality. The EIR/EIS will evaluate the project's potential effects from erosion and sedimentation during construction and impacts on groundwater levels, flooding, and water quality in Lake Merced.

Land Use

The EIR/EIS will identify the land uses and development on and around the project site, assess consistency with applicable local plans and policies governing land use in the project area, and evaluate potential land use impacts, including the project's compatibility with existing and proposed land uses in the project area.

Noise and Vibration

The EIR/EIS will describe relevant noise policies, regulations and standards and discuss noise and vibration levels likely to be generated by project construction and operation. The EIR/EIS will evaluate the potential for project construction and operation to adversely affect adjacent land uses or violate applicable noise control ordinances. The analysis will also evaluate continuous vibrations produced by project construction (shaft construction, tunnel boring and muck handling) based on the potential to impact sensitive receptors.

Public Services and Utilities

The EIR/EIS will describe existing fire protection, emergency medical services, and public utilities in the project area and will evaluate impacts on these services resulting from the proposed project.

Recreation

The EIR/EIS will describe existing publicly accessible recreational facilities in the project area and evaluate the impacts of the project on recreational facilities in surrounding areas including Lake Merced, Fort Funston, and the Olympic Club Golf Course. The analysis will identify feasible mitigation measures that would reduce any significant recreation impacts of the proposed project.

Socioeconomics/Environmental Justice

Consistent with NEPA requirements, the EIR/EIS will present the socioeconomic conditions in the action area, including demographic information on the local population. The EIR/EIS will assess the effects of project construction and operation activities on minority and low-income populations in the vicinity of the project area.

Soils, Seismicity and Geologic Resources

The EIR/EIS will discuss the existing geologic and soil conditions on the project site. Potential impacts to be evaluated include seismic hazards and/or increased exposure of structures to seismic hazards related to ground-shaking in the event of an earthquake, exposure of structures to geologic hazards (such as liquefaction, poor soil conditions, or unstable slopes), and soil erosion. The EIR/EIS will also include an evaluation of the effects of removal and replacement of the ocean outfall structure on the rate and occurrence of coastal erosion and bluff retreat, including the consequences of sea level rise on those processes.

Traffic and Transportation

The EIR/EIS will identify describe current traffic conditions within the project area. The traffic analysis will describe and assess impacts to roadway conditions, circulation patterns, parking, transit systems, traffic hazards, emergency access and bicycle and pedestrian facilities.

Alternatives to the Project

The EIR/EIS will consider a range of alternatives, including alternative tunnel alignments and capacities, stormwater detention structures, and lake level scenarios. The EIR/EIS will also identify and evaluate alternatives that might reasonably be assumed to reduce project impacts, especially significant impacts. Pursuant to CEQA Guidelines Section 15126.6(e) and NEPA Regulations Section 1502.14(d), the EIR/EIS will also evaluate a No Project/No Action alternative to provide decision-makers the information necessary to compare the relative impacts of approving and not approving the project. For each alternative, the EIR/EIS will assess the degree to which it might reduce one or more project impacts, whether it could result in other or increased impacts, its feasibility, and the degree to which it is consistent with the project objectives. The EIR/EIS will also identify the Environmentally Preferable/Superior Alternative.

Cumulative Impacts

The EIR/EIS will include a discussion of the potentially significant cumulative impacts of the project when considered with other past, present, and reasonably foreseeable future projects in the area. This section will cover all relevant subject areas discussed in the EIR/EIS (e.g., traffic, air quality, and noise) and will specify which of the areas are anticipated to experience significant cumulative impacts.

Other Required Sections

The EIR/EIS will also include other information typically required for an EIR/EIS. These other sections include the following: 1) Growth Inducing Impacts; 2) Significant and Unavoidable Impacts; 3) Significant Irreversible Environmental Changes; 4) Irreversible and Irretrievable Commitment of Resources; 5) References; and 6) EIR/EIS Authors. Relevant technical reports will be provided as technical appendices.

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 1
Project Location

SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 2
Project Components

NOTICE OF PREPARATION / INTENT TO PREPARE A JOINT EIR/EIS AND PUBLIC MEETINGS

An electronic copy of the NOP/NOI is available at http://www.dalycity.org/City_Hall/Departments/public_works/Reports_1119/vistagrande_alts.htm. Requests for hard copies of the NOP should be sent to vistagrande@esassoc.com. The NOP is also available at the Westlake Branch of the Daly City Public Library and the Merced Branch of the San Francisco Public Library.

The scoping period begins on February 28, 2013 and **closes at 5:00 p.m. on April 26, 2013**. The City of Daly City will hold a Public Scoping Meeting to provide an opportunity for the public and regulatory agencies to learn about the Project and be informed about how to submit comments on the scope of the Draft EIR/EIS on **March 28, 2013**: 7:00 p.m. to 9:00 p.m. at the Doelger Senior Center Cafe/Kitchen, 101 Lake Merced Blvd, Daly City, CA.

Additionally, the National Park Service will host an open house, which will include information about the Project and opportunities to comment, on **March 19, 2013**: 4:30 p.m. to 6:30 p.m. at the General's Residence at Fort Mason in San Francisco, CA. More information can be obtained from the National Park Service at http://www.nps.gov/goga/parkmgmt/publicinvolvement.htm. The Draft EIR/EIS is anticipated to be published in late 2013. Input on the scope of the environmental analysis may be submitted either at the Scoping Meeting or in writing via mail, fax, or email. Please send comments, and include a name, address, and telephone number of a contact person for all future correspondence on this subject, to:

City of Daly City Department of Water and Wastewater Resources
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015
Fax: (650) 991-8220
Email: psweetland@dalycity.org

NOTICE OF PREPARATION / INTENT TO PREPARE A JOINT EIR/EIS AND PUBLIC MEETINGS

An electronic copy of the NOP/NOI is available at http://www.dalycity.org/City_Hall/Departments/public_works/Reports_1119/vistagrande_alts.htm. Requests for hard copies of the NOP should be sent to vistagrande@esassoc.com. The NOP is also available at the Westlake Branch of the Daly City Public Library and the Merced Branch of the San Francisco Public Library.

The scoping period begins on February 28, 2013 and **closes at 5:00 p.m. on April 26, 2013**. The City of Daly City will hold a Public Scoping Meeting to provide an opportunity for the public and regulatory agencies to learn about the Project and be informed about how to submit comments on the scope of the Draft EIR/EIS on **March 28, 2013**: 7:00 p.m. to 9:00 p.m. at the Doelger Senior Center Cafe/Kitchen, 101 Lake Merced Blvd, Daly City, CA.

Additionally, the National Park Service will host an open house, which will include information about the Project and opportunities to comment, on **March 19, 2013**: 4:30 p.m. to 6:30 p.m. at the General's Residence at Fort Mason in San Francisco, CA. More information can be obtained from the National Park Service at http://www.nps.gov/goga/parkmgmt/publicinvolvement.htm. The Draft EIR/EIS is anticipated to be published in late 2013. Input on the scope of the environmental analysis may be submitted either at the Scoping Meeting or in writing via mail, fax, or email. Please send comments, and include a name, address, and telephone number of a contact person for all future correspondence on this subject, to:

City of Daly City Department of Water and Wastewater Resources
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015
Fax: (650) 991-8220
Email: psweetland@dalycity.org

VISTA GRANDE DRAINAGE BASIN IMPROVEMENT PROJECT OVERVIEW

The City of Daly City, as Lead Agency under the California Environmental Quality Act (CEQA), and the National Park Service, as Lead Agency under the National Environmental Policy Act (NEPA), are preparing a joint Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) for the Vista Grande Drainage Basin Improvement project. Daly City proposes this project to address storm-related flooding that currently occurs in the Basin and proposes to provide other environmental benefits, including restoration and management of water levels within Lake Merced. The project would consist of partial replacement of the existing Vista Grande Canal to incorporate a debris screening device, a treatment wetland, and diversion and outfall structures to route some stormwater (and authorized non-storm water) flows from the Vista Grande Canal to Lake Merced; replacement of the existing Vista Grande Tunnel to increase its peak capacity and extend its operating life; and replacement of the existing ocean outfall structure at Fort Funston. Operational components of the project would include management of water elevations in Lake Merced and a Lake Management Plan that would implement water quality best management practices.

City of Daly City Department of Water
and Wastewater Resources,
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015

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City of Daly City Department of Water
and Wastewater Resources,
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015

Notice of Public Meeting
Vista Grande Drainage Basin Improvement Project

The City of Daly City, as Lead Agency under the California Environmental Quality Act (CEQA), and the National Park Service, as Lead Agency under the National Environmental Policy Act (NEPA), are preparing a joint Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) for the Vista Grande Drainage Basin Improvement project.

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Construction activities at Fort Funston would include the development of a construction shaft and staging area near the main parking lot, and construction of the ocean outfall on the beach.

Existing Outfall

Proposed Outfall

The public is invited to participate in the scoping process for this project by attending the public meeting, reviewing the documents on the internet at ***http://www.dalycity.org/City_Hall/Departments/public_works/Reports_1119/vistagrande_alts.htm***, and submitting comments to:

City of Daly City Department of Water and Wastewater Resources
Attn: Patrick Sweetland, Director
153 Lake Merced Boulevard, Daly City, CA 94105

Daly City will hold a **Public Scoping Meeting** to provide an opportunity for the public and regulatory agencies to learn about the Project and be informed about how to submit comments on the scope of the Draft EIR/EIS:

March 28, 2013: 7:00 p.m. to 9:00 p.m. – Doelger Senior Center Cafe/Kitchen, 101 Lake Merced Blvd, Daly City, CA.

AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

consumption and have no connection with energy policy.

Executive Order 13352, Facilitation of Cooperative Conservation

In accordance with Executive Order 13352, the BLM has determined that the proposed supplementary rules would not impede facilitating cooperative conservation; would take appropriate account of and consider the interests of persons with ownership or other legally recognized interests in land or other natural resources; would properly accommodate local participation in the Federal decision-making process; and would provide that the programs, projects, and activities are consistent with protecting public health and safety.

Paperwork Reduction Act

These proposed supplementary rules do not contain information collection requirements that the Office of Management and Budget must approve under the Paperwork Reduction Act of 1995, 44 U.S.C. 3501–3521.

Author

The principal author of these proposed supplementary rules is Kristi Murphy, Outdoor Recreation Planner, BLM, Gunnison Field Office.

V. Proposed Rules

For the reasons stated in the Preamble, and under the authority of 43 U.S.C. 315a, 1733(a), and 1740, and 43 CFR 8365.1–6, the State Director proposes supplementary rules for public lands within the Gunnison Field Office, Colorado, to read as follows:

Supplementary Rules for the Gunnison Basin Travel Management Plan Area

Definitions

Camping means erecting a tent or a shelter of natural or synthetic materials, preparing a sleeping bag or other bedding material for use, or parking a motor vehicle, motor home, or trailer for the purpose or apparent purpose of overnight occupancy.

Designated travel routes means roads and trails open to specified modes of travel and identified on a map of designated roads and trails that is maintained and available for public inspection at the Bureau of Land Management (BLM) Gunnison Field Office, Colorado. Designated roads and trails are open to public use in accordance with such limits and restrictions as are, or may be, specified in the resource management plan (RMP) or travel management plan (TMP), or in future decisions implementing the RMP. This definition excludes any road or trail with BLM-authorized restrictions that prevent use of the road or trail. Restrictions may include signs or physical barriers such as gates, fences, posts, branches, or rocks.

Existing travel routes means immediately recognizable motor vehicle travel routes or two-track trails that are not identified as closed to motorized vehicle use by a BLM sign or map.

Public land means any land or interest in land owned by the United States and administered by the Secretary of the Interior through the BLM without regard to how the United States acquired ownership.

Mechanized vehicle means a human-powered mechanical device, such as a bicycle; not powered by a motor.

Motorized vehicle means a vehicle that is propelled by a motor or engine, such as a car, truck, off-highway vehicle, motorcycle, or snowmobile.

Prohibited Acts

1. Except as provided by Rule 2 below, you must not operate or possess a motorized or mechanized vehicle in an area designated as closed to such use by a BLM sign or map.

2. You must not operate or possess a mechanized or motorized vehicle except in areas designated or routes identified for such use by a BLM sign or map, unless:

- You are using a mechanized game cart for the purpose of retrieving a large game animal outside of Congressionally designated wilderness areas or wilderness study areas; or
- You are using a motorized vehicle for the purpose of parking or camping within 30 feet of the edge of a designated travel route or on existing travel routes within 300 feet of a designated travel route.

3. You must not operate or possess a motorized vehicle from March 15 to May 15 in specific areas of priority sage-grouse habitat as designated by a BLM sign or map, except to access private inholdings with proper authorization.

Exceptions

These supplementary rules do not apply to emergency, law enforcement, and Federal or other government vehicles while being used for official or other emergency purposes, or to any other vehicle use that is expressly authorized or otherwise officially approved by the BLM.

Penalties

Under Section 303(a) of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1733(a) and 43 CFR 8360.0–7), any person who violates any of these supplementary rules may be tried before a United States Magistrate and fined no more than $1,000 or imprisoned for no more than 12 months, or both. Such violations may also be subject to the enhanced fines provided for by 18 U.S.C. 3571.

Helen M. Hankins,

Bureau of Land Management, Colorado State Director.

[FR Doc. 2013–10896 Filed 5–7–13; 8:45 am]

BILLING CODE 4310–JB–P

DEPARTMENT OF THE INTERIOR

National Park Service

[NPS–PWR–PWRO–12638; PPPWGOGAY0 PPMPSAS1Z.YP0000]

Vista Grande Drainage Basin Improvement Project, Fort Funston, Golden Gate National Recreation Area, San Francisco County, CA

AGENCY: National Park Service, Interior.

ACTION: Notice of Intent to Prepare an Environmental Impact Statement.

SUMMARY: In accordance with § 102(2)(C) of the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA) Guidelines Section 15082, the National Park Service, together with the City of Daly City, intends to prepare a joint Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) to evaluate the potential environmental effects of the proposed Vista Grande Drainage Basin Improvement Project (Project). The EIS/EIR will address proposed improvements to Daly City's infrastructure to address storm-related flooding in the Vista Grande Watershed Drainage Basin and the effects of coastal erosion. The National Park Service (NPS) is the lead agency for the environmental review under NEPA. The City of Daly City is the lead agency for the environmental review under CEQA.

DATES: All written comments must be postmarked not later than June 7, 2013.

Background: The Vista Grande watershed area is located in the City of Daly City and unincorporated Broadmoor Village, in northwestern San Mateo County. This watershed is approximately 2.5 square miles in area and is bordered by San Francisco County to the north, Colma Creek watershed to the south and east, and the Pacific Ocean on the west. The Vista Grande watershed is drained through the Vista Grande Canal and Tunnel, which are located in the City and County of San Francisco, adjacent to John Muir Drive and the southwestern shoreline of Lake Merced. The Vista

Grande Tunnel is a sub-surface tunnel beneath Fort Funston, which is owned and managed by NPS as part of the Golden Gate National Recreation Area (GGNRA). The Vista Grande Tunnel connects the Vista Grande watershed to an outfall located on the beach below the Fort Funston bluffs, through which stormwater flows are discharged into the Pacific Ocean.

The City of Daly City has proposed the Project to address storm-related flooding in the Vista Grande Watershed Drainage Basin. The existing Vista Grande Canal and Tunnel do not have adequate hydraulic capacity to convey peak storm flows. As a result, during storm events, flooding periodically occurs in adjacent low-lying residential areas and along John Muir Drive. The Project would involve upgrades to the Vista Grande watershed collection system upstream of the Vista Grande Canal; partial replacement of the existing Vista Grande Canal to incorporate a gross-solid screening device, a treatment wetland, and diversion and discharge structures to route some stormwater (and authorized non-storm water) flows from the Vista Grande Canal to Lake Merced; replacement of the existing Vista Grande Tunnel to expand its capacity; and replacement of the existing outfall structure at Fort Funston.

SUPPLEMENTARY INFORMATION: Along with evaluating a No-Action Alternative, the EIS/EIR will consider a range of alternatives, including various combinations of facilities, such as alternative tunnel alignments and capacities, storm water detention structures, lake level scenarios, and groundwater recharge facilities. The Project would increase the hydraulic capacity of the canal and tunnel and extend its operating life. In addition, the Project would utilize stormwater to restore the level of Lake Merced, which declined in the late-1980s and early-1990s and has not fully recovered. Under the Project, an adjustable-height weir would be used to control the lake level and allow water to be diverted back into the Vista Grande Canal.

The existing outfall, a segment of the Vista Grande Tunnel, and the force main segment are presently exposed to the surf and waves, which have cansed significant damage to the structure. The Project would reconfigure these structures to provide protection from the surf and waves. The existing Daly City outfall structure would be removed and replaced with a low-profile outfall structure set into the existing cliff face to reduce future erosion. The existing force main would also be removed and replaced with a similar configuration set back into the cliff face. The existing submarine outfall pipeline and diffuser would be renovated to protect it from erosion and extend its operating life.

FOR FURTHER INFORMATION CONTACT: Steve Ortega, Golden Gate NRA, Fort Mason, Building 201, San Francisco, CA 94123; telephone (415) 561–2841 or email *goga_planning@nps.gov*.

Public Scoping and Comment: Notice is hereby given that a public scoping process and comment phase has been initiated for the EIS/EIR. The purpose of the public scoping process is to elicit public comment regarding the full spectrum of issues and concerns, a suitable range of alternatives, the nature and extent of potential environmental impacts or ecological benefits, and appropriate mitigation strategies that should be addressed in preparing a draft EIS/EIR. Preliminary issues to be addressed in the EIS/EIR include habitat for fish and wildlife, ecosystem conditions and processes, effects on special status plant and animal species, hydrology, flood hazards, traffic, air quality, visitor access, and visitor experience. Public scoping meetings will be scheduled in San Francisco and San Mateo Counties. Meeting dates, times, and locations will be publicized through local and regional news media, by email to the park mailing list (to be included on the Project email list, please visit: *http://ww.nps.gov/goga* and click the "Join the Mailing List" link), and via the Project Web site: *http://parkplanning.nps.gov/Vista_Grande*. This Project Web site will also provide relevant information, including the Project description, planning process updates, meeting notices, reports and documents, and useful links associated with the Project.

All written comments should be mailed to the following address: Superintendent, Golden Gate National Recreation Area; Attn: Vista Grande Project; Fort Mason, Building 201, San Francisco, CA 94123. Before including your address, phone number, email address, or other personal identifying information in your comment, yon should he aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Decision Process: At this time, it is anticipated that the draft EIR/EIS will be distributed for public review in late 2013. Availability of the document for review will be announced by the publication of a Notice of Availability in the **Federal Register**, through local and regional news media, via the Project Web site, and by email to Project email recipients. Additional public meetings will be held, and further opportunities for public comment will be provided, after the draft EIS/EIR is distributed. Following due consideration of all comments received on the draft EIS/EIR, preparation of the final document is anticipated to be completed in 2014. Because this is a delegated EIS, the official responsible for approval of the Project is the Regional Director, Pacific West Region. Subsequently the official responsible for implementation of the approved Project is the Superintendent, Golden Gate National Recreation Area.

Dated: March 15, 2013.

Christine S. Lehnertz,

Regional Director, Pacific West Region.

[FR Doc. 2013–10914 Filed 5–7–13; 8:45 am]

BILLING CODE 4312–FF–P

DEPARTMENT OF LABOR

Office of the Secretary

Agency Information Collection Activities; Submission for OMB Review; Comment Request; Well-being Supplement to the American Time Use Survey

ACTION: Notice.

SUMMARY: The Department of Labor (DOL) is submitting the Bureau of Labor Statistics (BLS) sponsored information collection request (ICR) titled, "Well-being Supplement to the American Time Use Survey," to the Office of Management and Budget (OMB) for review and approval for continued use in accordance with the Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 et seq.).

DATES: Submit comments on or before June 7, 2013.

ADDRESSES: A copy of this ICR with applicable supporting documentation; including a description of the likely respondents, proposed frequency of response, and estimated total burden may be obtained free of charge from the RegInfo.gov Web site, *http://www.reginfo.gov/public/do/PRAMain*, on the day following publication of this notice or by contacting Michel Smyth by telephone at 202–693–4129 (this is not a toll-free number) or sending an email to *DOL_PRA_PUBLIC@dol.gov*.

Submit comments ahout this request to the Office of Information and Regulatory Affairs, Attn: OMB Desk

ATTACHMENT B

Scoping Meeting Materials

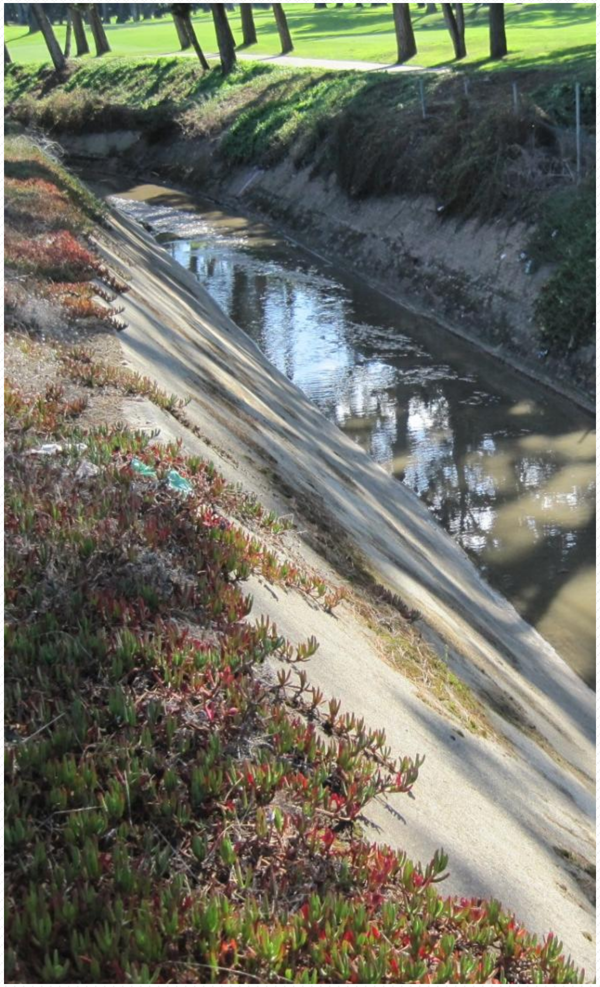
Vista Grande Drainage Basin Improvement Project

Scoping Meeting

City of Daly City
Department of Water and Wastewater Resources

March 28, 2013

Meeting Agenda



- Agencies and roles
- Purpose of public scoping
- Project introduction
- Next steps
- How to comment
- Questions

Agencies and Roles

Project Proponent
(Water and Wastewater Resources)

Administers Ft. Funston

Manages Lake Merced

CEQA Lead Agency

NEPA Lead Agency

Responsible Agency

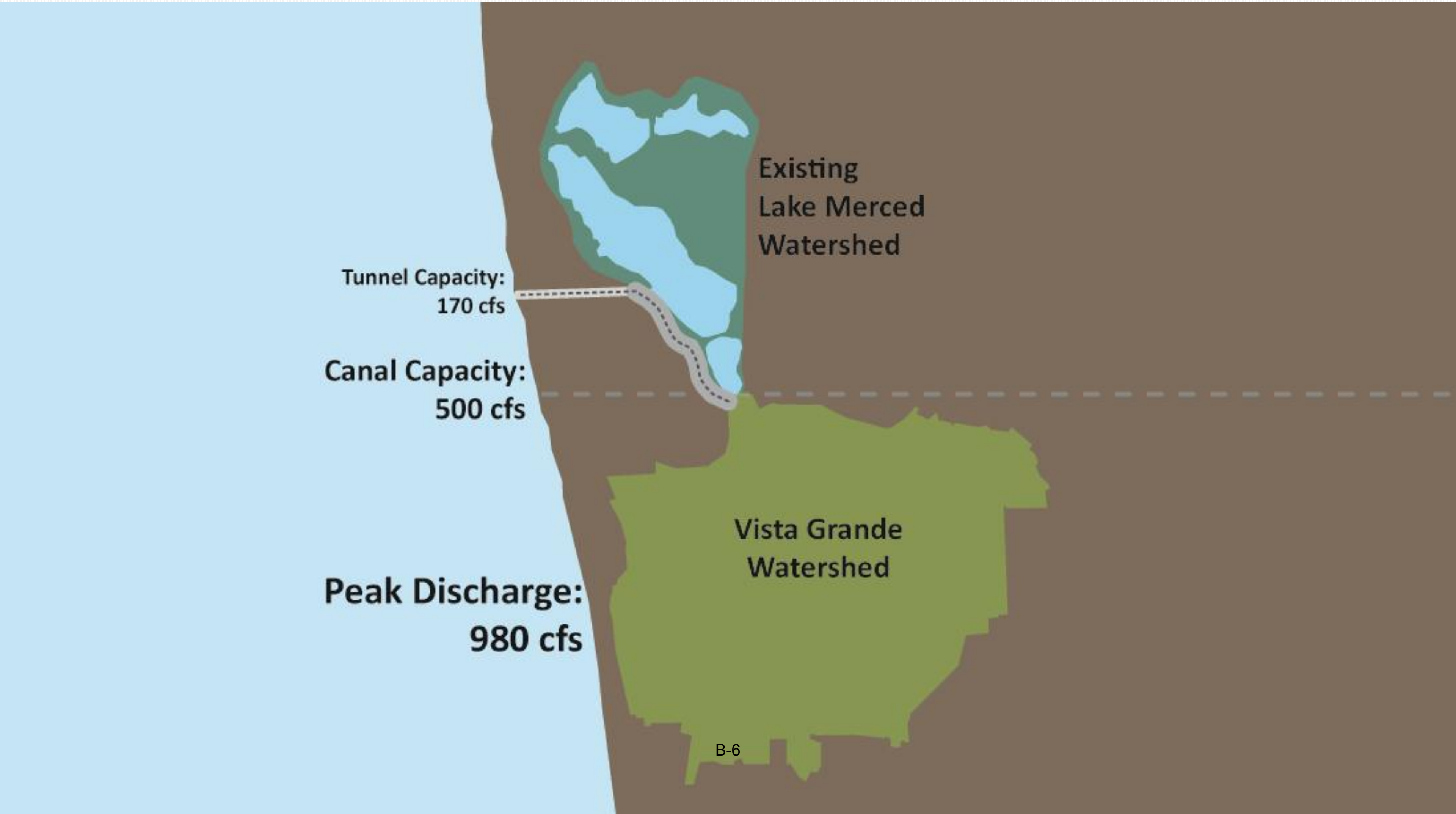
Prepare Joint EIR/EIS

Purpose of Public Scoping

- Determine the scope of the environmental analysis
- Solicit input from agencies and the public on:
  - the Project
  - range of alternatives
  - potential significant impacts
  - mitigation measures

To ensure that your input is accurately understood and considered, please submit your comments in writing.

Need for Project



Project Objectives

- Reduce flooding hazards and property damage
- Improve quality of storm water discharges
- Provide a non-groundwater sustainable water source to maintain Lake Merced at desired levels
- Protect and improve lake water quality
- Provide lake overflow capacity to minimize damage

Existing Vista Grande System

Existing Structures

Existing Canal

Existing Tunnel (historic outfall)

B-9

Existing Outfall

Overflow Incident

Overflow Impact

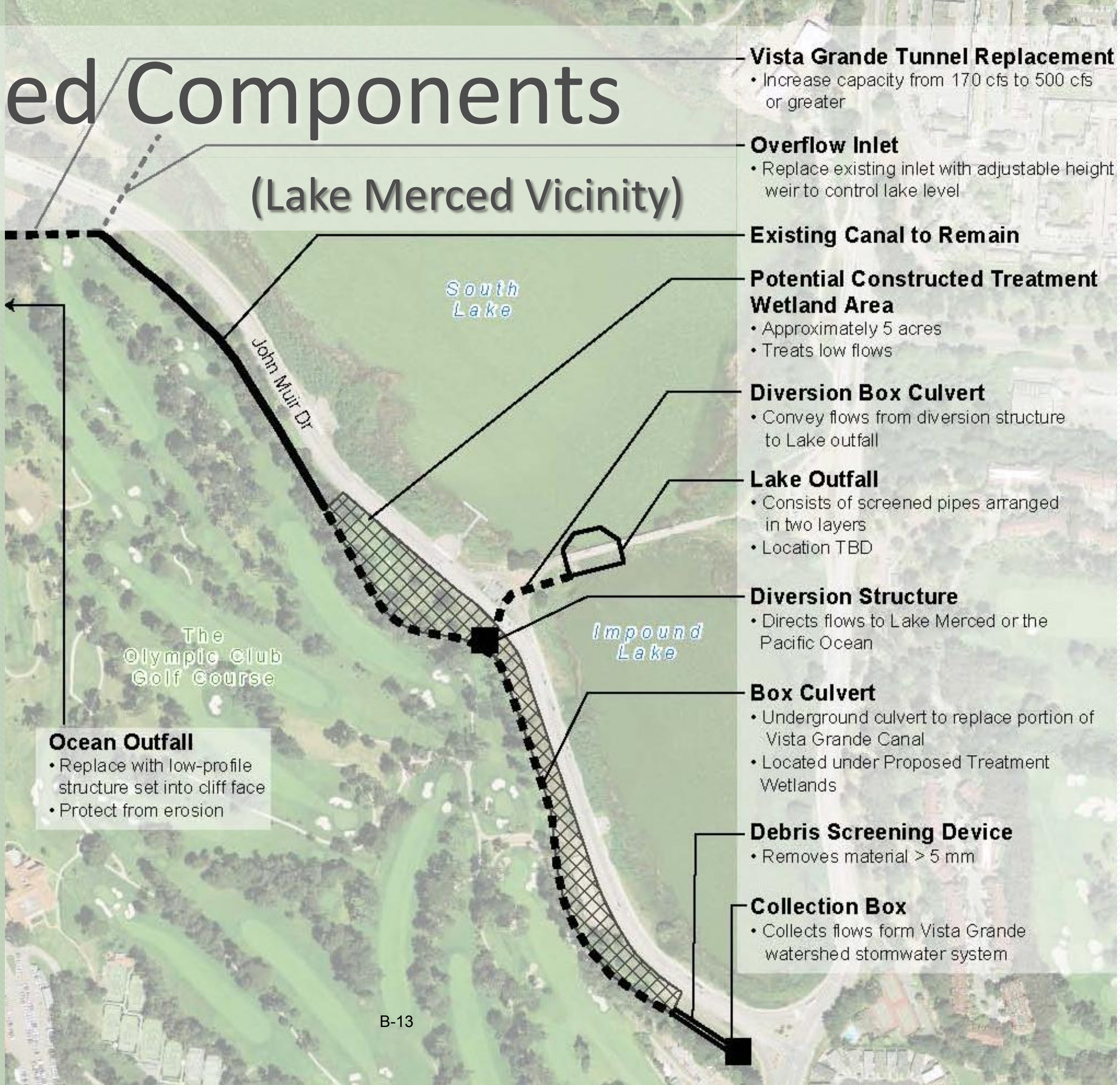
B-11

Overflow Impact

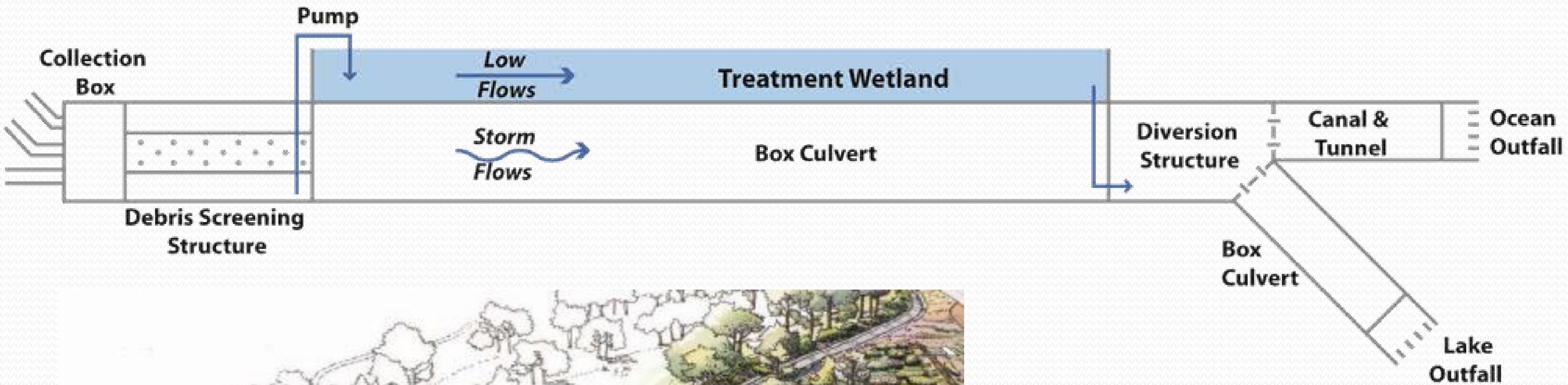
B-12

Proposed Components

(Lake Merced Vicinity)



Culvert and Wetland Design



Artist Rendering. Wetland would be built over box culvert rather than alongside open canal.

Ocean Outfall

Existing beach discharge structure

Proposed beach discharge structure

B-15

Next Steps

- Complete Scoping
  - Notice of Preparation /Notice of Intent was circulated to solicit input from agencies and the public: You can submit comments on the scope and contents of the EIR/EIS on or before April 26, 2013.
  - This meeting is part of the scoping process.
- Continue preliminary engineering in support of EIR/EIS
- Draft EIR/EIS and public comment period (late 2013)
- Final EIR/EIS (early 2014)
- Daly City Council certification of Final EIR/EIS
- National Park Service consideration of the EIR/EIS and other factors, issuance of a Record of Decision
- Daly City approval of Project, National Park Service issuance of ROW grant

How to Comment

Please submit written comments on the scope of the environmental analysis by **April 26, 2013** to:

City of Daly City, Department of
Water and Wastewater Resources
Attn: Patrick Sweetland, Director
153 Lake Merced Blvd., Daly City, CA 94015

e-mail: psweetland@dalycity.org

Questions?

Vista Grande Drainage Basin Improvement Project

SCOPING MEETING SIGN-IN SHEET

Doelger Senior Center Cafe/Kitchen

Daly City, California

March 28, 2013, 7:00-9:00 PM

Name	Organization/Agency	Mailing Address	Email Address	Check here to be added to paper mailing list	Check here to be added to email list
Diac Allen	Lake Merced			[illegible]	✓
Jeff Gilman	SFPUC				✓
Dan Murphy	Golden Gate Audubon				✓
DICK MORTEN					✓

City of Daly City Dept. of Water & Wastwater Resources
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015

City of Daly City Department of Water and Wastewater Resources
Attenton: Patrick Sweetland, Director
153 Lake Merced Boulevard
DALY CITY, CA 94015

- -

To mail this form, fold on the dashed line so the address is visible, tape closed (no staples please), and drop in the mail.
Please print your name and address below.

Name: ______________________________

Address: ______________________________

City/State/Zip: ______________________________

E-mail address: ______________________________

Note: Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Vista Grande Drainage Basin Improvement Project

Public Open House – March 2013

City of Daly City

Public Scoping Comment Form

The project team values your feedback regarding the scoping for the Vista Granda Drainage Basin Improvement Project.
Please provide your comments and questions below.
If submitting comments by mail, **please post no later than April 26, 2013.**

Thank you for your interest.

ATTACHMENT C
Scoping Comments

DEPARTMENT OF TRANSPORTATION
111 GRAND AVENUE
P. O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-6053
FAX (510) 286-5559
TTY 711

RECEIVED
MAR 11 2013
DWWR

Flex your power!
Be energy efficient!

March 5, 2013

SM035092
SM-35-0.5

Mr. Patrick Sweetland, Director
Department of Water and Wastewater Resources
City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015

Dear Mr. Sweetland:

Vista Grande Drainage Basin Improvement Project -Notice of Preparation/Notice of Intent

Thank you for including the California Department of Transportation (Caltrans) in the early stages of the environmental review process for the above project. The following comments are based on the Notice of Preparation/Notice of Intent. As the lead agency, the City of Daly City (City) is responsible for all project mitigation, including any needed improvements to state highways. Since an encroachment permit is required for work in the state right of way (ROW), and Caltrans will not issue a permit until our concerns are adequately addressed, we strongly recommend that the City work with Caltrans to ensure that our concerns are resolved during the environmental process, and in any case prior to submittal of an encroachment permit application. Further comments will be provided during the encroachment permit process; see the end of this letter for more information regarding encroachment permits.

Cultural Resources
Caltrans requires that a project environmental document include documentation of a current archaeological record search from the Northwest Information Center of the California Historical Resources Information System if construction activities are proposed within the state ROW. Current record searches must be no more than five years old. Caltrans requires the records search, and if warranted, a cultural resource study by a qualified, professional archaeologist, and evidence of Native American consultation to ensure compliance with California Environmental Quality Act, Section 5024.5 and 5097 of the California Public Resources Code, and Volume 2 of Caltrans' Standard Environmental Reference (http://ser.dot.ca.gov). These requirements, including applicable mitigation, must be fulfilled before an encroachment permit can be issued for project-related work in state ROW; these requirements also apply to National Environmental Policy Act documents when there is a federal action on a project. Work subject to these requirements includes, but is not limited to: tunneling, lane widening, channelization, auxiliary lanes, and/or modification of existing features such as slopes, drainage features, curbs, sidewalks

"Caltrans improves mobility across California"

and driveways within or adjacent to state ROW.

Environmental Maintenance
The environmental document and the plans must detail the method of construction that will be used for the Vista Grande tunnel replacement under State Route (SR) 35. A cut and cover method of construction will not be acceptable.

Traffic Impact Study
Construction and construction related activities of this project may generate traffic at volumes sufficient to impact the operation of nearby state highway facilities, and it may be necessary to prepare a Traffic Impact Study (TIS). We recommend using the Department's *"Guide for the Preparation of Traffic Impact Studies"* for determining which scenarios and methodologies to use in the analysis. The guide can be accessed from the following webpage: http://www.dot.ca.gov/hq/traffops/developserv/operationalsystems/reports/tisguide.pdf

1. The project would generate over 100 peak hour trips assigned to a state highway facility.

2. The project would generate 50 to 100 peak hour trips assigned to a state highway facility, and the affected highway facilities are experiencing noticeable delay; approaching unstable traffic flow (level of service (LOS) "C" or "D") conditions.

3. The project would generate 1 to 49 peak hour trips assigned to a state highway facility, and the affected highway facilities are experiencing significant delay; unstable or forced traffic flow (LOS "E" or "F") conditions.

Transportation Management Plan
If it is determined that traffic restrictions and detours are needed on or affecting the state highway system, a Transportation Management Plan (TMP) or construction TIS may be required and approved by Caltrans prior to construction. TMPs must be prepared in accordance with *California Manual on Uniform Traffic Control Devices* (CA-MUTCD). This includes impacts to bicycle and pedestrian facilities as well as motor vehicles. Further information is available for download at the following web address:
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2012/Part6.pdf

Please ensure that such plans are also prepared in accordance with the transportation management plan requirements of the corresponding jurisdictions. For further TMP assistance, please contact the Office Traffic Management Plans at (510) 286-4647.

Transportation Permit
Project work that requires movement of oversized or excessive load vehicles on state roadways, such as SR 35, requires a transportation permit that is issued by Caltrans. To apply, a completed transportation permit application with the determined specific route(s) for the shipper to follow from origin to destination must be submitted to the following address: Transportation Permits Office, 1823 – 14th Street, Sacramento, CA 95811-7119. See the following website link for more information: http://www/hq/traffops/permits/

Encroachment Permit
Please be advised that any work or traffic control that encroaches onto the state ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating the state ROW must be submitted to: Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans during the encroachment permit process. See the website link below for more information.
http://www.dot.ca.gov/hq/traffops/developserv/permits/

Please forward at least one hard copy and one CD of the environmental document, along with the TIS, including Technical Appendices, and a CD of the plan set to the following address as soon as they are available: Sandra Finegan, Associate Transportation Planner, Office of Transit and Community Planning, Mail Station 10D, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660.

Please feel free to call or email Sandra Finegan at (510) 622-1644 or sandra_finegan@dot.ca.gov with any questions regarding this letter.

Sincerely,

ERIK ALM, AICP
District Branch Chief
Local Development – Intergovernmental Review

County of San Mateo
Planning & Building Department
455 County Center, 2nd Floor
Redwood City, California 94063
650/363-4161 Fax: 650/363-4849
Mail Drop PLN122
plngbldg@smcgov.org
www.co.sanmateo.ca.us/planning

RECEIVED
MAR 14 2013
DWWR

March 12, 2013

City of Daly City, Department of Water and Wastewater Resources
Attn: Patrick Sweetland, Director
153 Lake Merced Blvd., Daly City, CA 94015

Dear Mr. Sweetland:

SUBJECT: Notice of Preparation - Vista Grande Drainage Basin Improvement Project

Thank you for including San Mateo County in the distribution of the NOP for this project. Please be advised that a portion of the project, specifically the collection box adjacent to Lake Merced Blvd. (APN 002-012-060), lies within San Mateo County's jurisdiction. This parcel is also within the Coastal Zone as established by the California Coastal Commission. Please include consistency with the San Mateo County Local Coastal Program in your EIR analysis. Also, please be advised that those portions of the project within the County's Coastal Zone require the issuance of a Coastal Development Permit.

Sincerely,

M. Schaller

Michael Schaller
Senior Planner

From: Morten
Sent: Saturday, March 30, 2013 9:50 AM
To: Patrick Sweetland
Cc: Dick Morten; Jerry Cadagan; Dick Allen; Richard Roos-Collins; Mondy Lariz; Dan Murphy; Tim Colen
Subject: Aquifer recharge and Vista Grand Canal EIR

Patrick, The aquifer recharge should be within the scope of the Vista Grand Canal EIR because Lake Merced treated stormwater infusions from the canal should have an impact on the aquifer.

I am not sure if the EIR for Sunset well ground water extractions discuss this point.

The text below was sent me by an interested non-cowboy although he too may be a cranky, old guy on issues related to the PUC, especially Sunset wells.

Dick Morten

Perhaps you'd like to have the numbers below, too. The aquifer is the Westside aquifer. While the South Westside Aquifer is the subject of the management plan of July 2012, it's all one aquifer. The South part is just south of SF. You can't study (or manage) half of it; it's all one.

-------- Original Message --------

Subject: Re: A good news story about the "workshop"
Date: Sat, 30 Mar 2013 09:08:10 -0700
From:
To:

On 3/30/2013 6:51 AM, Jerry Cadagan wrote:

> one comment below the story makes the obvious point that pumping more groundwater is NOT going to benefit the water level situation. But we've learned that Steve Ritchie thinks that whatever he says, no matter how ridiculous, is supposed to be accepted as the gospel truth.

According to numbers that emerged last year, the aquifer will be over-subscribed. South of the line (San Mateo County users) uses, and is expected to use, 8600 acre feet (formerly 8700). The aquifer's annual yield is estimated to be 10,600 AF. The difference, using the latest numbers that are better for SF, 2000 AF. SF intends to pump about 4500 AF of groundwater once its program gets going; it does ramp up to that level, and will monitor.

But, they claim, the aquifer is not really over-subscribed because they plan to capture water that now flows out into the ocean. Impliedly this is not included in the aquifer's yield number. The capture figure is 2160 AF. While that is still less than 2500, it is deemed close enough. All figures are estimates. Maybe they are conservative ones. They will closely monitor to see whether the aquifer water levels fall. That's the party line these days.*

It raises my eyebrows. They are real keen to use groundwater. While you are probably right about "Ritchie knows best" and Lake Merced is unconnected to the aquifer--have faith--I'm not sure the best tactic is to call him ridiculous. Perhaps the best tactic is to insist on the strict monitoring, *and* add reporting on the internet site. Then we'll see what happens. Once it is proven by experience that--what a surprise!--the Lake and aquifer are indeed connected (who knew?), then they will do what they've committed to do: stop pumping. Oh, that's another thing to get now: a *firm commitment* to actually respond when the monitoring shows that the aquifer is suffering.

As far as I know there's only vague implication, not real commitment. Advocates should get the commitment in a resolution. You won't if you belittle Ritchie for being ridiculous. The above will require long memory and follow-up. That's my unsolicited advice. I'm not part of this fight. I only follow what's happening. I hardly use the Lake. Take it FWIW. Best, SL * Note, I *think* that's the party line; it would be best to verify. They've not objected to these numbers, but the numbers come from a management plan that SFPUC may have helped fund, but did not sign off on or anything. The numbers are from the Southwestside Aquifer management plan done by Will Anderson; did I get you the ftp site? I think so. The 4500 and 2160 are Ritchie's. If Ritchie has other numbers he's keeping them close.

From: carolyn cooper
Sent: Wednesday, April 03, 2013 1:41 PM
To: Patrick Sweetland
Subject: Vista Grande comments

I would like to provide a comment on the scope of the Environmental Impact Report (EIR) for the Vista Grande Drainage Basin Improvement project. Like many people, I visit Lake Merced to view wildlife. There is already a high number of roadkilled animals on the roadways around the lake. With the plans to construct wetlands across John Muir Boulevard from the lake, it seems likely that more animals will want to cross the road in that area. Would you please consider adding a culvert or another type of wildlife crossing in that area to try to help make the area safer for their passage? Thank you.

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102
T 415.554.3155
F 415.554.3161
TTY 415.554.3488

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APR 26 2013
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A

April 25, 2013

Mr. Patrick Sweetland
Director, Department of Water and Wastewater Resources
City of Daly City
153 Lake Merced Blvd.
Daly City, CA 94015

Subject: Vista Grande Drainage Basin Improvement Project

Dear Mr. Sweetland,

The San Francisco Public Utilities Commission (SFPUC) is pleased to support the City of Daly City (Daly City) in its efforts to implement the proposed infrastructure improvement project, *The Vista Grande Drainage Basin Improvement Project*, to address storm related flooding in the Vista Grande Watershed Drainage Basin (Basin) while providing the benefit of restoring the level of Lake Merced. The SFPUC supports Daly City's approach for implementing improvements to the drainage basin.

The proposed project would alleviate flooding that periodically occurs in low lying residential areas in the Basin and along John Muir Drive by reconnecting a significant portion of the historic Lake Merced Watershed and diverting some stormwater and authorized non-storm flows into Lake Merced; and would protect the ocean outfall on the beach below Fort Funston from ongoing coastal erosion.

The SFPUC is working closely with Daly City and the San Francisco Bay Regional Water Quality Control Board in the development of this project and the accompanying Lake Management Plan. Daly City, in cooperation with the National Park Service, intends to prepare a joint Environmental Impact Report/ Environmental Impact Statement for the proposed project in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act. The SFPUC is a responsible agency for this project under CEQA.

If you have any questions, please contact Obi Nzewi at (415) 554-1876 or onzewi@sfwater.org.

Sincerely,

Allen Levin

for Steven R. Ritchie
Assistant General Manager, Water

Edwin M. Lee
Mayor

Art Torres
President

Vince Courtney
Vice President

Ann Moller Caen
Commissioner

Francesca Vietor
Commissioner

Anson Moran
Commissioner

Harlan L. Kelly, Jr.
General Manager

SEAL OF THE CITY AND COUNTY OF SAN FRANCISCO

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 FAX (916) 574-1810
California Relay Service From TDD Phone **1-800-735-2929**
from Voice Phone **1-800-735-2922**

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APR 26 2013
DWWR

***Contact Phone:* (916) 574-1900**
***Contact FAX:* (916) 574-1885**

April 26, 2013

File Ref: SCH # 2013032001

City of Daly City, Department of Water and Wastewater Resources
Attn: Patrick Sweetland, Director
153 Lake Merced Blvd.
Daly City, CA 94015

Subject: Notice of Preparation/Notice of Intent (NOP/NOI) to Prepare a Joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Daly City Vista Grande Drainage Basin Improvement Project (Project), San Francisco County.

Dear Mr. Sweetland:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP/NOI prepared by Daly City (City). The City, as a public agency proposing to carry out the subject Project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) and the National Park Service is the lead agency under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 as amended). The CSLC is a trustee agency with responsibility of natural resources held in trust for the people of the State of California which may be affected by a project, as provided in CEQA and the State CEQA Guidelines.[1] The CSLC will act as a trustee agency because of its trust responsibility for projects that could directly or indirectly affect sovereign lands, their accompanying Public Trust resources or uses, and the public easement in navigable waters. Additionally, if the Project involves work within sovereign lands, the CSLC will act as a responsible agency.

<u>CSLC Jurisdiction and Public Trust Lands</u>

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

[1] The State "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

Because the Pacific Ocean at this location is ungranted sovereign land, the CSLC has jurisdiction over a portion of this Project. However, the CLSC Land Management Division has not made a determination as to the location of the ordinary high tide line at this location insofar as it would define the limit of State ownership. The uplands at this location are located within lands the State acquired and patented under a 500,000 acre federal grant. An easement over sovereign State land at this location was granted in 1962 to North San Mateo County Sanitation District for a sanitary sewer outfall line. Please contact the Public Land Management Specialist identified at the end of this letter for further information about determining the extent of the CSLC's sovereign ownership and leasing requirements.

Project Description

The proposed Project is located in the Grande Drainage Basin (Basin) which is approximately 205 square miles in unincorporated Broadmoor Village area in Daly City. The Basin is bordered by the City and County of San Francisco to the north, the Colma Creek watershed to the south and east, and the Pacific Ocean on the west. The stormwater within the Basin is drained through the 1890s constructed Vista Grande Canal and Vista Grande Tunnel located adjacent to John Muir Drive and the southwestern shoreline of Lake Merced. These structures were built to divert stromwater away from the Lake to an outfall at the Pacific Ocean, below what is now Fort Funston.

Because these existing structures do not have adequate hydraulic capacity to convey peak storm flows and flooding, the adjacent low-lying residential areas and John Muir Drive periodically experience flooding during storm events. The proposed Project will address storm-related flooding and provide other environmental benefits such as restoration and management of water levels within Lake Merced, improve the ocean outfall, and reconnect a significant portion of the Lake's historic watershed by the following Project components:

- Partial replacement of the existing Vista Grande Canal to incorporate a debris screening device, a treatment wetland, and diversion and outfall structures to route some stormwater (and authorized non-storm water) flows from the Vista Grande Canal to Lake Merced;
- Replacement of the existing Vista Grande Tunnel to increase its peak capacity and extend its operating life; and
- Replacement of the existing ocean outfall structure at Fort Funston.

Environmental Review

CSLC staff requests that the following potential impacts be analyzed in the Draft EIR/EIS.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the Draft EIR/EIS in order to facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. The Project Description should be as precise as possible in describing details of all allowable activities (e.g., types of equipment or methods that may be used, maximum area of impact or volume of sediment removed or disturbed, seasonal work windows, locations for material disposal, etc.), as well as the details of the timing and length of activities for all components of the Project listed in Figure 2 of the NOP. Please provide detailed discussions of how each individual Project component will contribute to the overall function of the entire proposed Project. Thorough descriptions (including images and diagrams) will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required.

Biological Resources

2. Sensitive Species: The City should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. However, these queries alone should not be used as a substitute for coordination with the CDFW and USFWS, as well as direct surveys or data collection. The City should also consult directly with CDFW, USFWS, and possibly the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries or NMFS) for information on species that may be present, their life histories, and possible mitigation for any significant impacts. The Draft EIR/EIS should use this information to analyze the potential for such species to occur in the Project area, and if impacts to special-status species are found to be significant, the Draft EIR/EIS should identify feasible mitigation measures that would avoid or reduce the impact.

3. Construction Noise: The Draft EIR/EIS should evaluate noise and vibration impacts on fish and birds from construction, restoration or flood control activities in the water, on the levees, and for land-side supporting structures to be added to the proposed "Noise and Vibration" section on page 6 of the NOP. Mitigation measures (see "Deferred Mitigation" discussion below) could include species-specific work windows as defined by CDFW, USFWS, and NOAA Fisheries. Again, CSLC staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species.

4. Deferred Mitigation: In order to avoid the improper deferral of mitigation, mitigation measures should either be presented as specific, feasible, enforceable obligations, or should be presented as formulas containing "performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way" (State CEQA Guidelines, §15126.4, subd. (b)). For example, possible impacts to a specific biological resource should discuss how these impacts will be mitigated by specific formulas like applying a ratio of 1:1 to reduce possible impacts to the extent feasible. In addition, the conclusions in the Draft EIR/EIS should always be preceded by a reasoned, fact-based analysis of the potential impact, including an explanation of the logical connection between identified mitigation measures and the resulting significance conclusion.

5. Invasive Species: Because introduced species are one of the major stressors in California waterways, the Draft EIR/EIS should consider the Project's potential to encourage the establishment or proliferation of aquatic invasive species (AIS) such as the quagga mussel, or other nonindigenous, invasive species including aquatic and terrestrial plants to be included in the proposed "Hydrology and Water Quality" section on page 6 of the NOP. For example, construction boats and barges brought in from long stays at distant projects may transport new species to the Project area via hull biofouling, wherein marine and aquatic organism attach to and accumulate on the hull and other submerged parts of a vessel. If the analysis in the Draft EIR/EIS finds potentially significant AIS impacts, possible mitigation (see "Deferred Mitigation" discussion above) could include contracting vessels and barges from nearby, or requiring a certain degree of hull-cleaning from contractors. The CDFW's Invasive Species Program could assist with this analysis as well as with the development of appropriate mitigation (information at www.dfg.ca.gov/invasives/).

   In light of the recent decline of native pelagic organisms and in order to protect at-risk fish species, the Draft EIR/EIS should examine if any elements of the Project (e.g., changes in bankside vegetative cover) would favor non-native fisheries within Lake Merced by discussing implementation of the following provisions:

   - Environmental training of operational and maintenance personnel to inform them about invasive species;
   - Actions to be taken to prevent the release and spread of marine and/or terrestrial invasive species;
   - Procedures for safe removal and disposal of any invasive taxa observed; and
   - A post-operations and maintenance report identifying what, if any, invasive species were found attached to and/or removed from equipment and materials, as well as the treatment/handling/disposal of identified invasive species.

Climate Change

6. Greenhouse Gases: The NOP on page 5 proposes to include greenhouse gas (GHG) emissions analysis in the Draft EIR/EIS, which is consistent with the California Global Warming Solutions Act (AB 32) and required by the State CEQA Guidelines. This analysis should identify a threshold for significance for GHG emissions, calculate the level of GHGs that will be emitted as a result of construction

and ultimate build-out of the Project (including GHG emissions of all equipment expected to be used), and determine the significance of the impacts of those emissions. If impacts are significant, identify mitigation measures that would avoid, reduce, or compensate for them to the extent feasible.

7. Sea Level Rise: The "Other Required Sections" discussion on page 8 of the NOP does not state the document will address sea level rise. CSLC staff recommends the Draft EIR/EIS consider these effects on all resource categories potentially affected by the proposed Project. At its meeting on December 17, 2009, the CSLC approved the recommendations made in a previously requested staff report, "A Report on Sea Level Rise Preparedness" (Report), which assessed the degree to which the CSLC's grantees and lessees have considered the eventual effects of sea level rise on facilities located within the CSLC's jurisdiction. (The Report can be found on the CSLC's website, www.slc.ca.gov.) One of the Report's recommendations directs CSLC staff to consider the effects of sea level rise on hydrology, soils, geology, transportation, recreation, and other resource categories in all environmental determinations associated with CSLC leases.

   Please note that, when considering lease applications, CSLC staff is directed to: (1) request information from applicants concerning the potential effects of sea level rise on their proposed projects; (2) if applicable, require applicants to indicate how they plan to address sea level rise and what adaptation strategies are planned during the projected life of their projects; and (3) where appropriate, recommend project modifications that would eliminate or reduce potentially adverse impacts from sea level rise, including adverse impacts on public access.

Cultural Resources

8. Submerged Resources/Title to Resources: The Draft EIR/EIS should evaluate potential impacts to submerged cultural resources in the Project area. The CSLC maintains a shipwrecks database that can assist with this analysis. CSLC staff requests that the City contact Senior Staff Counsel Pam Griggs at the contact information noted at the end of this letter to obtain shipwrecks data from the database and CSLC records for the Project site, and include these discussion in the proposed "Cultural and Archaeological Resources" section on page 5 of the NOP. The database includes known and potential vessels located on the State's tide and submerged lands; however, the locations of many shipwrecks remain unknown. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant.

   The Draft EIR/EIS should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the City consult with Senior Staff Counsel Pam Griggs at the contact information noted at the end of this letter, should any cultural resources on state lands be discovered during construction of the proposed Project.

Public Trust Concerns

9. Public Access. Because public access and recreation on navigable waters are protected under the Public Trust, the Draft EIR/EIS should characterize current public uses of the Project site and explain how Project-related activities might impact public uses such as, but not limited to, kayaking, canoeing, swimming, surfing, etc. The Draft EIR/EIS should also discuss how members of the public will be notified of Project-related activities in the Project area. CSLC staff recommends identifying alternate access points, if needed, and posting signage, in advance, at and around the proposed Project in order to minimize the impact to recreationalists and other members of the public. Other discussions of notification and operational or construction practices should be addressed in the Draft EIR/EIS (proposed under "Recreation" section on page 6 of the NOP) in order to minimize the impacts to members of the public.

Thank you for the opportunity to comment on the NOP for the Project. As a responsible agency, the CSLC will need to rely on the Final EIR/EIS for the issuance of any amended/new lease as specified above and, therefore, we request that you consider our comments prior to certification of the EIR/EIS. Please send additional information on the Project to the CSLC as plans become finalized.

Please send copies of future Project-related documents, including electronic copies of the Final EIR/EIS, Mitigation Monitoring and Reporting Program (MMRP), Notice of Determination (NOD), CEQA Findings and, if applicable, Statement of Overriding Considerations when they become available, and refer questions concerning environmental review to Afifa Awan, Environmental Scientist, at (916) 574-1891 or via e-mail at Afifa.Awan@slc.ca.gov. For questions concerning archaeological or historic resources under CSLC jurisdiction, please contact Senior Staff Counsel Pam Griggs at (916) 574-1854 or via email at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Al Franzoia, Public Land Management Specialist, at (916) 574-0992, or via email at Al.Franzoia@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
Afifa Awan, DEPM, CSLC
Jennifer DeLeon, DEPM, CLSC
Al Franzoia, LMD, CSLC
Pamela Griggs, Legal, CSLC
Jessica Rader, Legal, CSLC

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APR 26 2013
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2945 Ulloa St.
San Francisco, CA 94116
murphsf@comcast.net
April 27, 2013

Patrick Sweetland
City of Daly City
Department of Water and Wastewater Resources
Attention: Patrick Sweetland, Director
153 Lake Merced Boulevard
Daly City, CA 94015

Re: Vista Grande Drainage Basin Alternative Analysis (2013)

Dear Mr. Sweetland:

The Golden Gate Audubon Society (GGAS), representing about 4000 memberships in the greater Bay Area is very pleased to support the Lake Merced Alternative, the preferred alternative, proposed in the "Vista Grande Drainage Basin Alternatives Analysis (2013). Though we have a few reservations and concerns, we certainly support this project for a number of reasons. We have had an active interest in Lake Merced since our founding in 1917. Briefly we are very pleased that some of the waters from the Vista Grande Watershed will be made available for Lake Merced. Given the real possibility we will experience water shortages in coming years, this is a very significant contribution to the lake which serves as a major recreational asset for residents of both Daly City and San Francisco. Much more of the water from the watershed will be available to recharge the Westside Aquifer as well and that too is significant. Both of those benefits will ultimately benefit wildlife and that is of particular interest to our organization. The following paragraphs are our concerns about the project.

A native plant assessment needs to take place. Seeds from native species that occur on the project site should be collected and either planted on the project site if there is adequate space, or included in native plant restoration at Lake Merced. This is particularly the case with the oak trees on the wetland site if they are removed. The oaks probably represent a gene pool native to this area and as such, measures should be taken to preserve that local bit of our historic flora. Acorns should be collected in fall and should be planted at either Lake Merced, the edge of Harding Golf Course, the edge of the Olympic Club, along Brotherhood Way or in other nearby open space. Care should be taken so that wherever they are planted they are at sites unlikely to be disturbed in the future.

On p. 5 in the description of fishing at Lake Merced there is an error. Rather than state "Fishing is permitted along all shorelines except for those areas designated "No Fishing", it would be more accurate to say the entire shoreline is closed to fishing except areas of shoreline that are posted for fishing. That includes fishing infrastructure and the beaches at the Boathouse Picnic Area on the North Lake and the beaches at the ends of the concrete bridge/viaduct at the south end of South Lake. Historically fishing was also permitted on a small beach at the north end of the North Lake, but because of neglect that beach is now covered by a dense marsh. Prior to the mid 90's the entire shore of the lake, except for the sites mentioned above were posted "No Fishing".

This is based on regulations that were in place prior to the decline of the recreational fishery and the infrastructure that supported it.

GGAS agrees that "using a natural storm water treatment process, e.g. surface flow wetlands, for low flow storm water and authorized non-storm water flows, and screening for diverted high flows, the Lake Merced Alternative could satisfy multiple project objectives. This alternative would provide the CCSF with supplemental storm water to operate Lake Merced within a desired water level range from the Vista Grande Drainage Basin in the City." (p.9) This offers a water source for the lake which is historically natural and desirable at the present time and into the foreseeable future. Including the use of high flow storm water, it seems likely water levels at that lake could be maintained at a reasonably high level. In addition, the proposed project would provide a water resource which would otherwise be wasted. Though not stated, this also provides a recreational benefit to the many people who use the lake for a number of activities and who reside both in Daly City and San Francisco.

We are satisfied with assurances that waters from the Vista Grande Watershed that reach the lake will meet quality standards necessary to maintain the lake's water quality in terms of dissolved oxygen and pH. Meeting standards set by the Clean Water Act and regulated by the State and Regional Water Quality Boards should assure water quality.

It would be beneficial to the public if some type of view access is made available for the wetland and the remainder of the Vista Grande Canal. The canal provides a rich habitat for migrating birds in fall and is used by many birders during September and October. Public access or view points offer the opportunity for birders to continue to view migrating birds during the fall, and they offer Daly City the opportunity to provide some interpretation of this program. (p. 12)

Permitting Workbook
Aesthetics: Night lighting. GGAS is opposed to the use of night lighting in areas like Lake Merced. This is a sensitive area that attracts large numbers of birds, particularly during migration. It is well documented that night lighting, particularly in foggy areas, can attract night flying birds, disorient them and cause fatal collisions with the light structures. It also creates conditions more favorable to predators and less favorable to prey organisms. Should lighting be a requirement for this project one reasonable mitigation feature, in addition to those mentioned in Vol 4, would be to use the lighting only when necessary and to turn it off at other times. San Francisco presently uses timers to control lighting at playing fields, but apparenlty doesn't have an on/off switch to override the timers. This project should include measures to turn off the lights when they aren't necessary. That would permit lighting for necessary operations at night, but would eliminate the light at other times. This is a very important issue and we hope this simple solution will be incorporated in the project.

Special-Status Species
It is unlikely the Bank Swallow colony will be impacted. Most recently it was sited at the north most end of the Fort Funston bluffs, across from the Westside Sewage Treatment Plant in San Francisco. A more likely, though still unlikely candidate for impacts, is the Western Snowy Plover. Since the area of the beach where the project will take place is not monitored for plovers, it should be noted they are present north of Sloat Blvd in San Francisco from mid July through mid May. They are not known to breed locally. The site should be surveyed for plovers. The National Park Service may have some data on this site.

At Lake Merced we have an unknown number of special status species. The ones we know of there are "San Francisco" Common Yellowthroat and Tri-colored Blackbird. The yellowthroat is a permanent resident that nests in the bulrush marsh. Since it is a skulker and very hard to find once it starts nesting, the best course would be not to commence construction that require impacts on a marsh area between March 1 and July 15. That should avoid impacting any nests of this and any other species that is not of special concern. The other species that could be impacted is the Tri-colored Blackbird. It does not nest at Lake Merced, but small numbers turn up annually as part of post breeding disbursal. They are usually present from September through December. We do not know of any measures that can be used to mitigate impacts on this species at this site. If they are present when works begins, they will fly out with other blackbirds. Unknown special-status species are likely to occur at Lake Merced during fall migration. They are likely to occur in the willows and wetlands along the edge of the concrete bridge (viaduct), and along the Vista Grande Canal. If they occur they would most likely be present for a brief period during the period of September through October. It would be best not to start construction operations on the south side of the concrete bridge during that time. Most such migrants that use the Vista Grande corridor are found immediatley north of the northern part of the project site.

One additional biological resource mitigation measure that we recommend is to avoid the start of construction in wetlands and woodlands during the nesting season, between February 15 and July 15. If construction is ongoing during that time, nests of that season wouldn't be destroyed since birds would be unlikely to construct nests in the construction zone.

We have two recommendations to include at the end of this project. First regards the overflow chutes on John Muir Dr. They were installed with the understanding between GGAS, Cal Trout, the San Francisco PUC, and we understand subsequently Daly City for the purpose of an immediate, but temporary fix to curtail flooding. The understanding was structured rip rap would be placed to break sheet flows from the Vista Grande Canal and when the long term problem was addressed, the rip rap would be removed and replaced with either a soft or hard fix that would be permanent. Rip rap is not an acceptable permanent remedy for the flooding problem. This needs to be addressed. The second recommendation is that it would be prudent to install swallow nesting boxes on trees along the wetland site. This would require the cooperation of the Olympic Club, since most of the trees are on their property. The most likely birds to nest there would be Tree Swallows. They nest in the area, but in natural cavities in trees. Placement of nest boxes near the project site would increase the numbers of swallows and would help control insects without the use of chemicals. Mosquito eating fish should be part of the wetland as well. It would also be necessary to take the boxes down and clean them annually.

Thank your for the opportunity to comment on this project. We look forward to providing any information or support Daly City may need for the successful completion of the project.

Very truly yours,

Dan Murphy
Conservation Committee

ROBERT B. MADDOW
CARL P. A. NELSON
CRAIG L. JUDSON

JEFFERY D. POLISNER
(RETIRED)

BOLD, POLISNER, MADDOW, NELSON & JUDSON
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SHARON M. NAGLE
DOUGLAS E. COTY
MICHAEL W. NELSON

FREDERICK BOLD, JR.
(1913-2003)

June 7, 2013

Superintendent
Golden Gate National Recreation Area
Attn: Vista Grande Project
Fort Mason, Building 201
San Francisco, CA 94123

Re: **Proposed Vista Grande Drainage Basin Improvement Project**

Dear Madam or Sir:

This law firm serves as special counsel to The Olympic Club (Club), which owns the majority of the real property on, under, or adjacent to which the subject Project has been proposed (i.e., other than real property which we understand to be owned by the National Park Service, Olympic believes that it owns all of the land that will be utilized for the proposed Project). Olympic offers these comments in response to the Notice of Intent to Prepare an Environmental Impact Statement that appeared in the Federal Register on May 8, 2013.

In one form or another, Olympic has been dealing with the subject Project, or with the planning and analysis being done by or on behalf of the City of Daly City and/or the City and County of San Francisco on the direct antecedents of the proposed Project, since at least 2006. Olympic's representatives have participated in numerous meetings with officials and agents of both entities, and Olympic has offered its comments and observations on a number of previous occasions. Upon review of the Federal Register Notice mentioned above and Daly City's February 28, 2013 Notice of Preparation/Notice of Intent to Prepare a Joint EIR/EIS for the Vista Grande Drainage Improvement Project, we reviewed some of the past correspondence and believe it is still strikingly relevant to the present Project proposal. We have therefore attached copies of Olympic's letters of October 19, 2007 to San Francisco's Manager of Water Resources Planning, and of October 15, 2008 to the City Manager of Daly City. Although each letter deals with a slightly different subject than the proposed Project, both touch on areas which were and still remain of significant concern to Olympic.

Olympic owns and operates two world-renowned golf courses, and has a large membership which utilizes both golf courses to their fullest extent. One of them has played host to the United States Open (i.e., the national championship of American golf, and one of the world's four top annual golf events) on five occasions, the most recent of which was 2012, and Olympic is in the running to be selected for another Open in the near future. It will also be announced soon that Olympic will host the inaugural USGA Amateur Four-Ball Championship in late April of 2015, and it has been the site of the U.S. Amateur Championship three times.

When Olympic hosts an Open, it is one of the most significant events that occurs in the Bay Area in that year, with as many as 50,000 attendees per day for the four days of competition, and large numbers of people who attend the pre-tournament practice rounds and related activities, many of which are hosted by leading national and international corporations. Television coverage is extensive, worldwide, and reaches a huge audience. Preparation for the tournament takes more than one year prior to the competition, and if neighboring construction or related activities have the potential to in any way delay or disrupt that work, the United States Golf Association may decide that the Open should be held elsewhere. Olympic therefore needs the maximum possible advaance notice from the proponents of the proposed Project prior to the commencement of any site preparation or construction activities

The proposed Project will involve the partial replacement of the Vista Grande Canal, construction of a "treatment wetlands" in or above a portion of the Canal, and replacement of the Vista Grande Tunnel. The Canal is on Olympic-owned property, over which San Francisco owns an easement that has been assigned to Daly City. It is immediately adjacent to large portions of the golf course on which the U.S. Open and the other significant tournaments are played.

The Tunnel, which conveys both treated wastewater and stormwater that emanate primarily from Daly City to the Pacific Ocean, is located under Olympic-owned property in which San Francisco owns an easement; that easement was leased to Daly City in 2007, so that it could continue to operate and maintain the Tunnel. We understand that the lease will expire in 2017. Daly City's wastewater system also includes a treated wastewater "force main" 30 inches in diameter and that occupies still another easement under Olympic-owned property. Unlike the Canal and the Tunnel which are generally on, under, or adjacent to the periphery of Olympic's property, the force main crosses it diagonally. We understand that each of these elements of the Daly City system is in some way involved in the proposed Project, and we believe that work related to each of these elements has the potential to adversely impact the use and enjoyment of Olympic's properties in a potentially significant way.

Although Olympic has looked at the materials related to the proposed Project that have been issued by or on behalf of Daly City, Olympic remains somewhat concerned about what actually happen on, under or adjacent to its property. At various times over the past decade, both Daly City and San Francisco have analyzed, planned and even preliminarily designed various public works projects involving the Canal and its relationship to Lake Merced (located directly across the street from Olympic). The degree to which the planning and project proposals were integrated or coordinated by the two Cities was usually not clear to Olympic, and therefore this type of concern has been voiced several times (including in each of the attached comment letters). Daly City's principal concern has been stormwater management for the Vista Grande watershed and upgrading of its stormwater/wastewater systems and conveyance capacity; among San Francisco's principal concerns are water supply issues and management of the water surface elevation in Lake Merced. At various times, and sometimes jointly, the two entities have looked at a proposed wetlands to be constructed above or along the Canal, but it is not clear to Olympic whether the current proposed Project represents the final coordinated and consolidated positions of both entities. Olympic has attempted to make the point for many years that planning and management of the watershed and of facilities like the Canal and any wetlands element should be the product of a thorough integrated approach to resources policies and planning.

One example of why Olympic remains concerned about the apparently lack of coordination between the efforts of Daly City and those of San Francisco is that San Francisco has issued a draft Environmental Impact Report (DEIR) for a proposed water supply improvement project involving conjunctive use of surface water and groundwater in areas south and east of Olympic. That proposed Project, in which Daly City is also involved (although it is not the proponent) is primarily intended to assist San Francisco in coping with the yield limitations of its Hetch Hetchy water supply importation system, but the DEIR indicates that one of its potential adverse impacts could be to reduce the water levels of Lake Merced. Should that happen, Olympic is concerned that the design, operation, and maintenance of Daly City's proposed Vista Grande Project might be modified in an effort to offset adverse impacts of San Francisco's proposed regional groundwater project (e.g., might there be an effort to increase the production capacity of the proposed treatment wetlands to assist with Lake Merced water levels, and might such an effort result in consideration of expanding the wetlands onto more of Olympic's property?). The EIR/EIS for the proposed Vista Grande Project should evaluate the linkage and cumulative effects between these and other current and planned projects by either City.

Also as indicated in the attached letters, Olympic remains particularly concerned about the wetlands element of the proposed Project. Olympic still does not have a clear picture of what it will mean to have a large constructed "treatment wetlands" on its property at the edge of its golf course. Comments have periodically been made about concerns about aesthetics, odors, and insects, largely because Olympic is unable to thoroughly describe what this new facility would look (or smell) like. Olympic prides itself on being an excellent steward of the lands it owns, and has been recognized for that ethic and for vigorously implementing it – e.g., it has received certification by the Audubon Society for its environmentally sensitive management practices. One component of such certification deals with use of best management practices with regard to safe and protective use of fertilizers and pesticides as a part of a successful golf course; Olympic is concerned that construction of the proposed wetlands immediately adjacent to its golf course not adversely restrict or otherwise impact its operations in this or any other regard. Establishment of a new sensitive habitat or facility on or adjacent to Olympic's property should not expressly or implicitly create any new form of liability, responsibility, or any other form of obligation for Olympic. Olympic would object to inclusion of provision for public access into its property as part of any treatment wetlands element of the proposed Project, primarily for safety and security reasons.

Similarly, if the proposed wetlands should provide new or enhanced habitat for animal or plant species not now present on or adjacent to Olympic's property, Olympic should not bear any responsibility whatsoever for such species, and the proponents of the proposed Project should expressly acknowledge and agree to permanently assume all such responsibility. The proponents of the proposed Project should also be made expressly responsible for preventing spread or migration of attracted species onto Olympic's property. Olympic should not have any responsibility for provision or establishment of any form of buffer between the proposed wetlands and Olympic's golf course, nor for any aspect of the physical, biological, chemical, hydrological or any other form of security for the wetlands or for any other portion of the Canal. For example, Olympic has its principal maintenance facility near the uppermost portion of the Canal, and should not be limited or restricted in its use, maintenance, or replacement of its facilities as a result of any element of the proposed Project.

It is Olympic's understanding the proposed Project is intended to be able to cope with stormwater resulting from a storm that can be statistically predicted to occur once every 25 years, with the most concentrated rainfall coming in a 4-hour period. As it has noted several times in the past, Olympic is quite concerned about what will happen in a more severe storm, particularly in light of what Olympic understands to be the current scientific consensus about the types, magnitudes, and frequency of recurrence of storms that might be predicted as a result of climate change. In marked contrast to the 25-year storm design criterion, Olympic understands that the 2004 storm event that resulted in significant flooding near the site of the proposed Project is believed by some experts to have been a 1000-year event. Olympic needs to know what is predicted to happen to the wetlands, the Canal, and Olympic's adjacent property if the facilities in the proposed Project are subjected to a more severe storm than the design criteria. The post-storm-wetlands are probably the most critical among Olympic's concerns in this regard (e.g., what will it look and smell like, and for how long?), and Olympic believes that the proponents of the proposed Project must expressly accept all responsibility for cleaning up, restoring or remediating the site after any flood or similar incident affecting the proposed Project.

Each of the elements of the proposed Project of which Olympic is aware, save for the westerly part of the Tunnel and outfall structure, will involve construction on, under, or adjacent to Olympic's property. Olympic tries hard to operate and maintain its property in a responsible manner that does not intrude upon or disrupt the community. Olympic expects that the implementation of the proposed Project will be undertaken with a similar respect for and sensitivity to the need to control construction activities so that they are as carried out as carefully as possible given the nature of the special setting in which the construction will occur. To the extent that doing so will require special efforts and components of construction management, Olympic believes that the proponents of the proposed Project must expressly accept full responsibility to provide and pay for such efforts.

Olympic believes it is critical that the planned EIR/EIS clearly describe the authority, responsibility, and accountability of the proponents of the proposed Project for all aspects of its design, construction, operation, maintenance, and replacement. The proposed Project will, if approved and implemented, be a massive undertaking in a location that is serene, quiet, and aesthetically unique. Olympic, as the owner of so much of the property that would be utilized for the proposed Project, should not have and does not want to have any increased responsibilities if that Project is ever built. Clear and unambiguous delineation of the responsibilities of the parties involved in the proposed Project should be provided. Similarly, Olympic believes that the environmental analysis should be accompanied with a thorough description of the financial plan and program that will be used to fund the proposed Project, as well as a detailed listing of the approval and permitting procedures (federal, state and local) and milestones that will be part of the process leading up to the ultimate Project approval steps. Olympic is particularly concerned that there be assurance that if approved and started, there will not be a set of circumstances in which the undertaking is then abandoned or delayed for a protracted period, resulting in unsightly, intrusive, or disruptive site conditions in the area where work had been started.

Olympic appreciates the opportunity to provide these comments during the federal aspect of the scoping for the planned EIR/EIR. Olympic will continue to track and monitor project planning and environmental documentation work, and reserves the right to make further comments when and if it deems that to be necessary.

Very truly yours,

Robert B. Maddow

Robert B. Maddow

Attachments
cc: Pat Finlen, Olympic Club
Patrick Sweetland, Daly City

THE OLYMPIC CLUB

October 19, 2007

Ms. Paula Kehoe
Manager of Water Resources Planning
San Francisco Public Utilities Commission
1145 Market Street, Suite 401
San Francisco, CA 94103

Re: Comments on Draft Alternatives Analysis Report for Lake Merced Water Level Restoration

Dear Ms. Kehoe:

The Olympic Club is pleased to comment on the September 24, 2007 Draft Alternative Analysis Report which concerns establishing the desired water surface elevation of Lake Merced and identifying the preferred alternative sources of supplemental water to maintain that elevation (AAR). As the owner of real property across John Muir Drive, the Olympic Club has been involved for many years with San Francisco and the City of Daly City (Daly City) with issues related to the proper management of the entire watershed, including Lake Merced water levels. We support the continuing efforts of the San Francisco Public Utilities Commission (SFPUC) and Daly City to work with a wide variety of people and entities in seeking to find ways to enhance Lake Merced as a regional amenity and as part of an environmentally sound integrated watershed management program.

Draft Alternatives Analysis Report

We have reviewed the AAR and two Technical Memoranda that SFPUC staff issued in September, 2007; attended a public presentation at your office on October 1, 2007; and were able to meet with you and others (from the San Francisco Public Utilities Commission (SFPUC) and City Attorney's office and one of your planning consultants) on October 12. As the Club told you then, we were surprised to learn of the AAR so long after it apparently had been under discussion with a number of organizations; but appreciate the fact you indicated the Club has until October 19 to submit its written comments on the AAR. It should be noted these comments are based upon my review of the documents, with assistance of the Club's professional advisers. The AAR has not yet been reviewed by the Club's Board of Directors, and thus this should not be construed as the Club's final position; the Club may have additional comments in the future.

AMERICA'S OLDEST ATHLETIC CLUB

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We understand, at this time, staff intends to present the AAR, public comments, and SFPUC staff's responses to the Commission on or about November 13, 2007; but that no action is scheduled at that time. We also have been informed after the Commission hears from staff and others, staff may commence conceptual engineering for the preferred alternative(s), culminating in design up to the 10% level, and may also start the process of environmental documentation. Beyond that, we do not understand the process you are following or the selection criteria that will be used to determine which alternatives will be pursued.

Our fundamental concern is that this AAR may represent a backtracking from the earlier integrated watershed management approach that was being pursued by San Francisco in cooperation with Daly City. From an environmental perspective, integrated approaches to managing whole watersheds have become the preferred, if not mandatory, approach. In addition, for environmental review purposes, consideration of the possible implications for public and private actions in interrelated parts of the watershed is required. This is true, as you know, whether or not all of the public works project(s) or all of the watershed is under the San Francisco's jurisdiction. Finally, the prudent use of public resources would indicate that what Daly City may do should be understood and factored into San Francisco's approach to a part of the watershed. This holistic integrated approach has been reflected in prior work, and we do hope San Francisco intends to continue in that manner.

In addition, we have reviewed the Draft Programmatic Environmental Impact Report for the SFPUC's Water Supply Improvement Program (DPEIR), and note that maintaining the Lake Merced water level is one of the many program elements. Much of the discussion of this element focuses on use of recycled water and groundwater as supplemental sources of water for the Lake. Use of stormwater as such a source is also discussed, but frequent reference is made to requiring "advanced treatment." We do not understand whether the AAR's proposed Wetlands would constitute the advanced treatment technique to which the DPEIR refers; if not, the Technical Memorandum attached to the AAR needs to be revised or updated. If the proposed Wetlands is considered the advanced treatment that is said to be required, the DPEIR should be carefully reviewed prior to being certified because we did not find a reference to using a constructed Wetlands as an alternative treatment method. Either way, it appears to us that consideration of the constructed Wetlands project that is proposed in the AAR will need to be included in the DPEIR, or be the subject of a parallel environmental impact report.

Similarly, we have previously reviewed the Vista Grande Watershed Study prepared for Daly City and the SFPUC concerning flood control issues. That Study also included a wetlands proposal—one that was larger than the AAR's proposed Wetlands, and that would have been located on the property now occupied by the Vista Grande Canal. The AAR does not explain the manner in which it is being coordinated with the current flood control planning and studies being pursued by Daly City. We have had and will continue to have discussions with the SFPUC staff and with the City Manager and staff of Daly City concerning the relationships between the various planning processes that are being followed and how they might affect the Club. At this point, we do not yet have a clear understanding of what is likely to be the outcome of either of the two cities' planning efforts; or whether the results will be compatible with one another and with the interests of the Club. We are even more uncertain about the timing of any resulting project(s).

As you know, The Olympic Club owns a substantial amount of property in San Francisco and San Mateo Counties; including two golf courses that are universally deemed to be among the best in the world. The Club's property includes land on both sides of the Vista Grande Canal, which is located in an easement held by San Francisco. Because a principal focus of the AAR is to build and operate a "constructed wetland" adjacent to the Canal on San Francisco property and on a portion of the Club's property, we have a great deal of interest in both the AAR and the Technical Memo concerning the proposed Wetlands. If we proposed to build such a project on San Francisco property, you certainly would have the same kind of concerns. In addition, as the owner of the privately held property in closest proximity to the proposed project, and as a long-time stakeholder in policy issues and projects in the Lake Merced area, our comments are intended to provide a constructive contribution to the SFPUC's analysis and consideration of the issues raised in the AAR.

Because of the Club's historic reliance on groundwater for irrigation and in light of what led to the decisions concerning switching to recycled water, we also looked carefully at the discussion of groundwater as a new source of water for the Lake. The work reflected in the AAR's Technical Memo on the groundwater alternative demonstrates that such a project is likely to be compatible with protection of the Westside Basin aquifer for other beneficial uses.

Our other comments at this time about the groundwater alternative concern the need for long-term monitoring to validate the Technical Memo and to ensure that new pumping for the benefit of the Lake will not have adverse impacts on other groundwater uses. As you know, the Club continues to rely on some groundwater pumping for irrigation and to back up the recycled water system, and expects to do so permanently. However, the proposed new pumping for the Lake, especially in combination with the SFPUC's new program to pump and inject groundwater directly into the San Francisco potable water supply (and with your expansion of the conjunctive use program being pursued jointly with utilities in San Mateo County) can create new demands and patterns of use for the Westside Basin aquifer that should be observed and tracked with data that is publicly available. Such monitoring needs to include both quantity considerations regarding the yield and stability of the aquifer, and water quality considerations.

Our principal concerns with the AAR's proposed Wetlands to be located between the Canal and John Muir Drive are:

- As stated above, the proposal does not appear to be part of an integrated watershed management approach but, rather, a piecemeal response to one part of the overall problems of the watershed.
- The proposal has the potential for significant adverse impact on the Club. Several of these potential impacts concern the location and design of the proposed Wetlands, which are discussed below.

A. Wetlands water supply

The only information we have seen concerning the availability of stormwater for the proposed Wetlands is cursory and conclusory. The Technical Memo fails to address the quantity of water that will be available for the proposed Wetlands in wet and dry months and in wet and dry annual cycles. The water supply for the proposed Wetlands must be well understood before any such project is selected and pursued. Flow rates and volume in winter and summer periods should be known, as well as the quality of the water that will be available in each period. If quantities are limited or if quality considerations prevent or limit the use of the available water, we are concerned there will be periods when the proposed Wetlands might "dry up," and we have no understanding of what that would mean for the Club. For example, we understand there is a relatively high level of coliform bacteria in the water found in the Canal throughout the year, but we do not know the significance of that fact in terms of the feasibility or operation/maintenance of the proposed Wetlands. We also do not understand how water will be introduced into or discharged from the proposed Wetlands; and we are not yet certain about the regulatory requirements with which the proposed Wetlands would have to comply.

B. Normal operating conditions

After reviewing the AAR and Technical Memo, we remain somewhat uncertain about what we will see on the ground if the Wetlands are built and operated in the manner proposed in the AAR. We fully recognize you are only at the preliminary planning stage and that considerable engineering and environmental analysis will be required before you can commence detailed design, but we are concerned that we really don't know what to expect. Will we have a permanent or seasonal marsh next to our property? What will it look like and smell like? Will there be insect problems or will the plant species and perhaps animal species to be introduced onto our property create new land management issues or otherwise impact our golf courses? Will the traffic barrier be a wall between the wetland and John Muir Drive?

C. Sustainability in flood events

We do not understand how the proposed Wetlands will work in a period of high stormwater flows that exceed the capacity of the Vista Grande Canal and tunnel and lead to overtopping and flood flows toward the Lake. We understand that the Wetlands is designed to be able to receive and detain some flood flows, but we do not yet understand whether it would be susceptible to damage that might render it inoperative, unsightly, or cause it to generate unpleasant odors or insect problems after a flood. For example, if the vegetation in the wetland cells is washed out, or if the mosquito fish that are intended to control insects are displaced or killed, what will the ensuing conditions be and how long would they last? What flood frequency and intensity will the Wetlands be planned to survive, and how severe a flood would have to occur before its sustainability is threatened? If Daly City decides to pursue the larger wetlands preliminarily described in the jointly funded Study, what impact will that have on the operation and sustainability of the proposed Wetlands? Will the Wetlands project include result in any change in the frequency, severity, or duration of the accumulation of stormwater on the Club's property? Will the presence of the traffic barrier or the Wetlands access road result in more stormwater backing up onto Club property?

D. Compatibility with Lake level

We understand the AAR proposes a long-term water surface elevation for the Lake that will exceed levels that have occurred for many years. In the past, SFPUC representatives have told us that a Lake level above about 4.5 feet City datum (or about 22 feet on the L.M. Gage Board) will result in South Lake "spilling" into Impound Lake, and the two Lakes equilibrating. Based on our discussions with Daly City, we believe that the long-term Vista Grande solution may not be determined or implemented for quite some time. If the AAR is implemented, South Lake and Impound Lake will be fully connected and may not be able to accommodate as much stormwater as in recent years. We do not understand how that will be reflected in the SFPUC's consideration of the AAR or in the coordination of the planning being done by the SFPUC and Daly City, and we do not know how that will impact the likelihood of greater stormwater accumulation and resulting damage to Club property.

E. Timing

Finally, assuming the problems described above can be resolved satisfactorily, a remaining critical issue is the timing of the implementation of this project, which due to a unique circumstance, we believe you should take into account in any possible project planning and scheduling.

In 2012, the Club will host its fifth United States Open Golf Tournament. This event is the national championship of professional golf, and , since World War II, the Club is one of only three golf courses at which the Open has been held this many times. The United States Golf Association (USGA) selection process for the tournament location is extremely competitive, in part because it is the most prestigious event in all of professional golf; and, in part, because it always is a very substantial source of revenue to the community in which it is held.

The Club is concerned about the uncertainty and confusion that can arise from an announcement about a proposal to build a major public works project immediately adjacent to the golf course before or during the Open that might affect the golf course playing surface and areas that will be used by competitors, spectators, sponsors, and the media. Any such uncertainty could lead to a decision by the USGA to revisit its previous decision about the award of the tournament to our Club and to San Francisco.

Current estimates are that the Open will draw as many as 50,000 people per day, from all over the world, to the City and to the Club for the four days of competition, and smaller, but still significant, numbers for the tournament preparation period and for the several days of practice rounds. National and international television and radio networks, and a wide variety of print media will cover the Open. Many large corporations will be sponsors of the event and will have a large presence before and during the tournament. The Club is convinced a major construction project like the proposed Wetlands adjacent to the Canal would be incompatible with the tournament (i.e., with the Open itself and with the related traffic and logistics management) if construction is underway at the same time as or just prior to the competition.

The Club is also concerned that construction of the Wetlands adjacent to the golf course could create unsightly or undesirable conditions if the project is incomplete or has not been successful by the time of the tournament. The Club therefore believes if the construction and complete implementation of the Wetlands project (including full maturation of plants in each of the Wetlands cells) cannot be completed well prior to the Open, then the commencement of construction should be delayed until after the Tournament has finished. We do not purport to be experts in the design, construction, or operation of Wetlands, but we believe that the proposed John Muir Wetlands would have to be completed and fully implemented for at least one full year prior to the summer of 2012 in order to avoid the type of uncertainty that we have described above.

We appreciate the opportunity to present these comments, and look forward to continuing our discussions with the SFPUC staff and with Daly City about the subjects of current public works planning that involve our mutual and individual concerns. To reiterate, we are especially concerned that both the SFPUC and Daly City give ample consideration of the impacts of the various project proposals on the Club and particularly on the U.S. Open. If you have any questions about any aspect of these comments, please do not hesitate to contact me.

Very truly yours,

Dennis P. Bouey

Dennis P. Bouey
General Manager

DB/cp

cc: Patricia Martel, City Manager, Daly City
Zane Gresham
Robert B. Maddow

THE OLYMPIC CLUB

October 15, 2008

Patricia Martel
City Manager
City of Daly City
333 90th Street
Daly City, CA 94015

Re: Vista Grande Canal Alternatives Analysis Report and Supplemental Analysis

Dear Pat:

I write once again in our on-going effort to work collaboratively with the City of Daly City and the City and County of San Francisco to address the problems with stormwater and flooding in the Vista Grande Watershed.

This letter concerns the Vista Grande Canal Alternatives Analysis Report of December 2007 ("AAR") and Supplemental Analysis of August 2008 ("SA"). The Olympic Club has reviewed the AAR, and I want to share directly with you our observations and concerns. As the Olympic Club is an owner of substantial land in the Vista Grande Watershed, including the site of the Vista Grande Canal and the land under which the current Vista Grande Tunnel is located, efforts to address stormwater and flooding issues are important to us. We appreciate the efforts of the City and other local agencies to find long-term solutions to flooding in the watershed. However, in candor we must question the adequacy of the AAR and related documentation to provide the City and the City Council with reliable information and coherent analysis so critical to the City's meaningful decision-making.

As you know, the Olympic Club has monitored and participated in the current watershed planning process since its early stages. Drawing on the counsel of experts in watershed management, we have previously submitted letters communicating our concerns with the Vista Grande Stormwater Conceptualization Study and Vista Grande Watershed Plan, as well as the San Francisco Public Utilities Commission's ("SFPUC") efforts to manage water levels in Lake Merced, and have engaged in ongoing discussions concerning the status of planning with both Daly City and SFPUC. Our comments, while responding specifically to the AAR and SA, build upon these previous communications. Specifically, the Club has continually expressed its support for realistic, effective solutions that do not unnecessarily disrupt the use of the Club's property. We continue to believe that any effective solution

Bill R. Poland, *President* William L. Timoney, *Vice President* Maurice Monserez, *Secretary* E. Jeffrey Banchero, *Treasurer* David J. Bonelli
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must be the product of a unified watershed management plan, rather than fragmented, piecemeal, and inconsistent approaches by the various individual municipalities and agencies.

We understand the City's planning for possible stormwater improvements is far from complete, and not all details can be anticipated or fully addressed at this stage. Nevertheless, a review of the AAR analysis reveals major gaps and inconsistencies that need to be remedied before the City Council reasonably should be asked to commit any more resources to a preferred option or particular outcome. As the completion of the AAR and SA, collectively, appear to represent an important step for the City, we feel it is important to communicate candidly our concerns. Moreover, it is essential that the City Council understands the limitations of the analysis to date, and takes those limitations seriously before committing irretrievably to an inadequately studied course of action.

The public now has three separate reports addressing issues and options for the Vista Grande Watershed from Daly City alone – not including SFPUC's recent studies concerning options for Lake Merced. At the most basic level, it is confusing and cumbersome for the public and other agencies to navigate among the Vista Grande Watershed Plan, AAR, and SA, and SFPUC documents. More crucially, even the Daly City documents do not present a coherent point of view. Rather, numerous inconsistencies exist within and among the three studies. Let me share with you in summary the key deficiencies of these reports, and especially the AAR.

Failure to Adopt Integrated Watershed Management

Since 2006, the Olympic Club has emphasized, in its communications with both the City and SFPUC, the need for the two entities to plan improvements for the entire Vista Grande watershed through a single integrated process. From an environmental perspective, the strongly preferred approach is to manage the entire watershed as an integrated whole. Additionally, the sensible use of public resources would require the two entities to collaborate toward a unified solution. As it stands, however, Daly City and the SFPUC's planning processes appear disconnected at best.

As the specific examples in the following discussion illustrate, our overarching concern is that the AAR and SA represent a step backward from the earlier integrated watershed management approach San Francisco and Daly City were pursuing in collaboration, as of at least 2006. An integrated approach would have significant benefits with respect to environmental impacts (and the environmental review process), land use planning, constructability, operability, and expenditure of public resources. Conversely, if Daly City proceeds with stormwater improvements in isolation, without considering the relationship to the wetlands and Lake Merced improvements, the result is likely to be increased costs, increased environmental impacts, construction and operational conflicts, and ultimately delayed and/or reduced public benefits.

Fragmented and Inconsistent Analysis Regarding Wetlands

Responsibility for Planning and Implementing Wetlands Project. Some of the most problematic inconsistencies concern the description of the responsibility for the wetlands that have been proposed for construction near Lake Merced. Although the Watershed Plan contemplated a cooperative project between Daly City and San Francisco, the AAR leaves a reader wondering whether the proposed project would in fact be a "holistic," "joint," "integrated" one between the cities (see, e.g., AAR Executive Summary; sec. 4.1.5; sec. 10.2), or a "separate" one handled by San Francisco, and divorced from the Vista Grande stormwater improvements (e.g., sec. 4.7.2; sec. 6.1.1).

Although it is difficult to discern the AAR's basic assumptions regarding responsibility for the wetlands, the report clearly represents a departure from previous efforts to integrate planning for Vista Grande stormwater improvements with SFPUC's plans for improvements to Lake Merced and adjacent wetlands.

Relationship to Other Improvements. Moreover, the description of the relationship between the proposed stormwater improvements and wetlands is unclear and inconsistent. An example of the failure to consider improvements in an integrated manner is the treatment of the AAR's Alternative 10, which called for stormwater re-use through wetlands development and/or groundwater replenishment. The AAR noted that Alternative 10 could be used in combination with various other alternatives (although we note the AAR made no attempt to quantify impacts/benefits of doing so, or how stormwater re-use would affect the ultimate weighing of alternatives; and AAR Chapter 6, addressing constructability issues, omitted discussion of Alternative 10 entirely). Yet Alternative 10 is inexplicably absent from the SA – either on its own or as a supplemental opportunity for addressing stormwater impacts – and rather, the SA appears to assume that the wetlands will simply be a part of the "future baseline" of conditions.

Working from this future baseline, the analysis does not adequately account for the creation of wetlands areas beyond those contemplated earlier by the Watershed Plan. The AAR (sec. 4.7.2) states that up to 2.4 acres of additional wetlands could be created under Alternative 5B, 6, or 7, "on top of the proposed box culvert." However, the box culverts in each alternative (as depicted in Appendix C to the AAR) appear to be located in areas already contemplated for wetlands; therefore, would the box culvert areas truly be "additional"? If so, the location of the box culvert relative to the wetlands should be explained more clearly. Has Daly City discussed the proposed addition of wetlands with SFPUC – the agency intending to develop and maintain those wetlands? How would the expansion fit in with

SFPUC's existing plans? Would these additional areas be located on the Olympic Club's property, and if so, has Daly City considered the process for reaching agreement on the location and operation of these wetlands?

Similarly, the AAR and SA provide no real consideration of how plans for the Vista Grande Canal will fit into Lake Merced water level management plans. This lack of analysis raises several questions. For example, will Lake Merced require use of water from the new canal? Will water entering Lake Merced be filtered through the new, constructed wetlands? How will Lake Merced plans fit with the Olympic Club's use of recycled water and groundwater for irrigation – and will there be "competition" for these resources? To the extent that these issues have been considered in previous studies, the AAR and SA fail to incorporate the analysis or conclusions.

Relationship to Stormwater Detention. Finally, the AAR and SA fail to reconcile what appear to be conflicting statements regarding the interplay between stormwater detention facilities and creation of new wetlands. Table 4.3 to the AAR indicates that diversion of 1,000 cfs would "reduce" or "significantly reduce" wetlands opportunities, depending upon the alternative. However, we could find no mention in the report's text of decreasing wetlands opportunities, and in fact, section 4.6.5 states that Alternative 9, providing for storage of up to 30.8 MG, "would not affect the current planning for wetlands" adjacent to the Vista Grande Canal. In the SA, all three of the "finalist" alternatives contemplate 4 MG storage for peak stormwater flow, and the SA never mentions that this diversion would affect wetlands construction. Perhaps Table 4.3 referred to ongoing diversion, rather than diversion only at peak flow, but the lack of explanation in the table or text can only leave us wondering

Flawed Environmental Assumptions

The AAR and SA are flawed in relying on questionable underlying assumptions about the environmental "baseline" – particularly with regard to consideration of the impact of climate change on existing conditions. The analysis assumes, for purposes of determining the need for stormwater improvements, that storm events will be "statistically average" (SA at 1). Is this a realistic view given climate change, which is likely to affect both the intensity and frequency of storms? A "statistically average" storm in 2020 may look very different from a "statistically average" storm in 2008, yet the analysis does not even acknowledge, let alone try to quantify, the potential for climate change to affect the need for stormwater diversion.

Additionally, the AAR and SA rely upon a "recent" rate of coastal retreat (two feet per year) to predict impacts on the proposed new outfall structure (SA at 6). The analysis fails to address, however, whether it is realistic to assume that this rate will continue unchanged in the face of rising sea levels, which may be caused by global climate change.

As the courts and the Legislature have made clear, local agencies must study and consider seriously the effect of climate change, both in the assessment of baseline conditions and in the determination of significant impacts. Given the regulatory landscape and the potential for climate change to affect the effectiveness of the project itself, it is essential to take a hard look at shifting environmental conditions even at this stage in the planning process.

Constructability Analysis

The "constructability" analysis in both the AAR and SA disregards or discounts important practical factors.

Impacts on Olympic Club. The analysis to date continues to understate grossly the significance of impacts on the site of most of the proposed improvements: the Olympic Club. All alternatives currently under consideration (Alternatives 5B, 6B, and 7) involve substantial tunneling under the Olympic Club's golf courses. In the past, City representatives assured that the tunneling would occur so far underground that there would be no effects on the surface. However, the AAR reverses those assurances and state flatly that tunneling for thousands of feet under the Olympic Club will have adverse effects on the surface. Neither the AAR nor the SA offers any real analysis of the nature or extent of these construction-related effects, or takes into consideration the impact on the painstaking design and unique playing characteristics of the Club's world-class golf course.

Additionally, the SA offers alternative locations for a tunnel inlet portal and staging (at Fort Funston). It concludes that these alternatives would, respectively, "significantly affect" and "significantly disrupt" operations at the Olympic Club. Again, the SA does not explain whether these significant impacts on the Club would be greater or less than the original proposals, or explain whether the analysis takes into account the special characteristics of the Club.

The Olympic Club takes these issues very seriously, and would expect that the City would do the same. The consultants' work to date, however, is wholly inadequate to inform either the City or the Olympic Club of the risks and costs associated with possible damage to an internationally renowned sports venue.

Coordination of Timing & Project Components. Although the AAR notes that the timing construction of stormwater improvements could affect wetlands construction, these matters are only dealt with cursorily. In reference to each alternative, the AAR simply states that tunnel alignment would affect the areas being considered for wetlands development, but that "scheduling the wetlands development to follow the tunnel construction would eliminate this conflict" (e.g., AAR sec. 9.1.3). The report fails to consider, for example, whether SFPUC would find this arrangement acceptable; how long wetlands construction would be delayed; or whether the timing would exacerbate or prolong environmental or flooding effects in the interim. Additionally, the SA concludes that, although Alternatives 5B and 6B receive the same weighted ranking in the comparative analysis, 6B is preferred because it "provides a greater opportunity to support the SFPUC's efforts to improve Lake Merced's water quality" (SA at 9). However, the SA provides no indication as to what specific factors in Alternative 6B support Lake Merced water quality to a greater extent than 5B, or how the report arrived at this conclusion.

Conclusion

The above observations by no means are comprehensive. There are many other issues raised by the AAR and SA, but what I have indicated is representative of the scope of our concerns. We offer these comments in the spirit of cooperation, as part of the community directly affected by the on-going Vista Grande Watershed issues, and efforts to address them. We have a major stake in seeing Daly City succeed in its efforts to prevent flooding. However, the deficiencies in the analysis to date frankly are troubling. We hope that the City will demand better information and cogent analysis from its consultants, in order to allow the public to comment meaningfully and then for the City Council to make informed decisions about the nature, location, and construction of an integrated watershed improvements that are bound to have substantial financial and physical effects on Daly City, its residents and businesses.

Sincerely,

Dennis

Dennis P. Bouey
General Manager

cc: Patrick Sweetland
Robert Ovadia

APPENDIX C
Air Quality

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Summary

Summary of Criteria Pollutants Emissions (CEQA)

Average Daily Construction-related Emissions (lbs/day)

	ROG	CO	NOX	SOX	PM2.5	PM10
Off-road	2.8	15.6	23.1	0.0	1.5	1.5
On-road	1.1	8.0	21.5	N/A	0.4	0.5
Combined	**3.9**	**23.6**	**44.6**	**0.0**	**1.9**	**1.9**

Annual Construction Related Emissions (MT/year)

	Year 2016	Year 2017	Year 2018	All Years
	CO2e	CO2e	CO2e	CO2e
Off-road	175.1	436.0	119.5	730.6
On-road	845.3	550.1	97.9	1,493.2
Combined	**1,020.4**	**986.1**	**217.3**	**2,223.8**

Summary of Criteria Pollutants Emissions (NEPA)

Year 2016:

	ROG	CO	NOX	SOX	PM2.5	PM10
Off-road	0.2	1.1	1.8	0.0	0.1	0.1
On-road	0.1	0.9	2.5	N/A	0.0	0.1
Combined	**0.4**	**2.0**	**4.3**	**0.0**	**0.2**	**0.2**

Year 2017:

	ROG	CO	NOX	SOX	PM2.5	PM10
Off-road	0.5	2.8	4.1	0.0	0.3	0.3
On-road	0.2	1.4	3.5	N/A	0.1	0.1
Combined	**0.7**	**4.2**	**7.5**	**0.0**	**0.3**	**0.3**

Year 2018:

	ROG	CO	NOX	SOX	PM2.5	PM10
Off-road	0.1	0.8	1.2	0.0	0.1	0.1
On-road	0.0	0.2	0.6	N/A	0.0	0.0
Combined	**0.2**	**1.0**	**1.8**	**0.0**	**0.1**	**0.1**

Construction Equipment Usage by Project Component

Provided by Project Applicant

Equipment	**Construction Usage**			
	Project Component	**Number**	**Duration of Use (weeks)**	**Daily Use (hours/day)**
Crane (150 ton)	Tunnel	1	90	24
Excavator (CAT 320E L)	Shaft/Ocean Outlet and Tunnel Portal	1	18	6
Excavator with hammer (750 Hitachi)	Canal and Wetlands	1	18	6
Excavator to clean ditch (CAT 320E L)	Canal and Wetlands	1	18	6
Road Header (Alpine EBZ132) or mini-excavator	Tunnel Drive (each)	1a	28a	16
Loader (CAT 966 or 950)	Tunnel/Ocean Outlet and Tunnel Portal/Canal and Wetlands	1	110	8
Pile Driver	Shaft/Ocean Outlet and Tunnel Portal/Canal and Wetlands	1	18	8
Drill Rig	Ocean Outlet and Tunnel Portal	1	2	6
Compactor (CAT 563)	Canal and Wetlands	1	26	6
Air Compressor	Tunnel	1	90	24
Ventilation Fan (100 HP)	Tunnel	2	90	24

Note: Equipment use hours split up evenly between project components, when applicable.

Off-road Equipment Inventory

Project Equipment Use Summary - 2016

Equipment	total hours	Total workdays
Excavator with hammer (750 Hitachi)	540	90
Excavator to clean ditch (CAT 320E L)	540	90
Crane (150 ton)	2,623	109
Loader (CAT 966 or 950)	874	109
Air Compressor	2,623	109
Ventilation Fan (100 HP)	2,623	109
Excavator (CAT 320E L)	540	90
Drill Rig	40	10
Pile Driver	360	90
See tables below for details		

Project Equipment Use Summary - 2017

Equipment	total hours	Total workdays
Compactor (CAT 563)	780	130
Crane (150 ton)	6,257	261
Road Header (Alpine EBZ132) or mini-excavator	4,480	140
Loader (CAT 966 or 950)	2,086	261
Pile Driver	360	90
Drill Rig	40	10
Air Compressor	6,257	261
Ventilation Fan (100 HP)	6,257	261
See tables below for details		

Project Equipment Use Summary - 2018

Equipment	total hours	Total workdays
Crane (150 ton)	2,057	86
Loader (CAT 966 or 950)	686	86
Air Compressor	2,057	86
Ventilation Fan (100 HP)	2,057	86
See tables below for details		

Vista Grande Canal

Equipment	No.	hours/day	days/location	total hours	Total days	Year*	
Excavator with hammer (750 Hitachi)	1	6	90	540	90	2016	Assuming occurs in first phases of construction activity, in 2016
Excavator to clean ditch (CAT 320E L)	1	6	90	540	90	2016	Assuming occurs in first phases of construction activity, in 2016
Compactor (CAT 563)	1	6.0	130	780	130	2017	Assuming occurs in middle phases of construction activity, in 2017
Pile Driver	1	4.0	90	360	90	2016	Assuming occurs in early phases of construction activity, in 2016

Vista Grande Tunnel

Equipment	No.	hours/day	days/location	total hours	Total days	Year*	
Crane (150 ton)	1	24.0	109	2,623	109	2016	
Crane (150 ton)	1	24.0	261	6,257	261	2017	
Crane (150 ton)	1	24.0	86	2,057	86	2018	
Road Header (Alpine EBZ132) or mini-excavator	2	16	140	4,480	140	2017	Assuming occurs in middle phases of construction activity, in 2017
Loader (CAT 966 or 950)	1	8.0	109	874	109	2016	Loader emissions assigned to Tunnel only, for simplicity
Loader (CAT 966 or 950)	1	8.0	261	2,086	261	2017	Loader emissions assigned to Tunnel only, for simplicity
Loader (CAT 966 or 950)	1	8.0	86	686	86	2018	Loader emissions assigned to Tunnel only, for simplicity
Pile Driver	1	4	90	360	90	2017	Assuming occurs in middle phases of construction activity, in 2017
Drill Rig	1	4	10	40	10	2017	Assuming occurs in middle phases of construction activity, in 2017
Air Compressor	1	24	109	2,623	109	2016	
Air Compressor	1	24	261	6,257	261	2017	
Air Compressor	1	24	86	2,057	86	2018	
Ventilation Fan (100 HP)	1	24	109	2,623	109	2016	
Ventilation Fan (100 HP)	1	24	261	6,257	261	2017	
Ventilation Fan (100 HP)	1	24	86	2,057	86	2018	

Ocean Outlet

Equipment	No.	hours/day	days/location	total hours	Total days	Year*	
Excavator (CAT 320E L)	1	6	90	540	90	2016	Assuming occurs in first phases of construction activity, in 2016
Drill Rig	1	4	10	40	10	2016	Assuming occurs in middle phases of construction activity, in 2016

All equipment designated to each project component, by year, based on project parameters provided by the applicant, unless otherwise noted.

Year 2016

Emission Source	ROG	CO	NOX	SOX	PM	CO2	
	Off-road: Average Daily Construction Emissions (pounds)						
Excavator with hammer (750 Hitachi)	10.57	71.98	115.29	0.14	5.67	14,783.87	
Excavator to clean ditch (CAT 320E L)	10.57	71.98	115.29	0.14	5.67	14,783.87	
Crane (150 ton)	70.78	284.08	801.28	0.54	36.36	56,888.82	
Loader (CAT 966 or 950)	25.37	105.24	245.58	0.21	13.70	22,385.95	
Air Compressor	107.79	539.05	690.43	0.94	57.82	80,028.25	
Ventilation Fan (100 HP)	198.42	1119.92	1449.88	2.11	106.18	179,948.98	
Excavator (CAT 320E L)	10.57	71.98	115.29	0.14	5.67	14,783.87	Tunnel Portal
Drill Rig	0.92	9.55	13.30	0.02	0.39	2,377.52	
Sum (pounds):	**435**	**2,274**	**3,546**	**4**	**231**	**385,981.1**	
Sum (metric tons):						**175.1**	

Year 2017

Emission Source	ROG	CO	NOX	SOX	PM	CO2
	Off-road: Average Daily Construction Emissions (pounds)					
Compactor (CAT 563)	11.53	99.03	135.98	0.18	0.05	18,343.16
Crane (150 ton)	151.95	677.85	1,723.67	1.30	76.84	135,742.37
Road Header (Alpine EBZ132) or mini-excavator	81.83	597.01	867.09	1.17	42.66	122,626.80
Loader (CAT 966 or 950)	55.85	251.10	531.59	0.51	29.62	53,412.37
Pile Driver	12.91	47.47	108.15	0.08	8.47	8,531.36
Drill Rig	0.83	9.55	11.55	0.02	0.03	2,376.63
Air Compressor	238.16	1,281.64	1,550.45	2.24	125.44	190,917.10
Ventilation Fan (100 HP)	434.44	2,660.08	3,262.20	5.04	231.33	429,289.89
Sum (pounds):	**988**	**5,624**	**8,191**	**11**	**514**	**961,240**
Sum (metric tons):						**436.0**

Year 2018

Emission Source	ROG	CO	NOX	SOX	PM	CO2
	Off-road: Average Daily Construction Emissions (pounds)					
Crane (150 ton)	49.96	222.86	566.69	0.43	25.26	44,627.63
Loader (CAT 966 or 950)	16.65	74.29	188.90	0.14	8.42	14,875.88
Air Compressor	84.54	422.78	541.52	0.74	45.35	62,767.26
Ventilation Fan (100 HP)	142.83	874.55	1072.50	1.66	76.06	141,136.40
Sum (pounds):	**294**	**1,594**	**2,370**	**3**	**155**	**263,407**
Sum (metric tons):						**119.5**
Total Sum for all years (pounds)	1,716	9,492	14,107	18	901	1,610,628
Total Sum for all years (MT)						731
Average pounds/day	**2.81**	**15.56**	**23.13**	**0.03**	**1.48**	**2,640.37**

On-road Criteria Pollutant Emissions

Note: All trips are round trips

Construction Vehicle ROUND Trips PER DAY

Provided by the Project Applicant

Trip Type	Tunnel / Staging Area	Project Component: Ocean Outlet and Tunnel Portals	Canal and Wetlands
Concrete Truck*	30	2	5
Haul Truck**	17	3	40
Worker Vehicle	70	5	10
Maximum Total	**117**	**10**	**55**

*Concrete Truck Staging Area trips would occur for 30 days, according to the project applicant, and are assumed to occur in 2017.

**Haul truck staging area trips would occur for 280 days, according to the project applicant, and are assumed to occur in 2017.

All other trips are assumed to occur for the full length of the project component, for each year construction is expected to occur.

Construction Vehicle Round Trips in 2016

Calculated

Trip Type	Tunnel / Staging Area	Project Component: Ocean Outlet and Tunnel Portals	Canal and Wetlands	Totals
Concrete Truck	-	219	1,304	1,522
Haul Truck	-	328	10,429	10,756
Worker Vehicle	7,650	546	2,607	10,804
Totals	7,650	1,093	14,339	

Construction Vehicle Round Trips in 2017

Calculated

Trip Type	Tunnel / Staging Area	Project Component: Ocean Outlet and Tunnel Portals	Canal and Wetlands	Totals
Concrete Truck	900	44	1,304	2,248
Haul Truck	4,760	66	10,429	15,255
Worker Vehicle	18,250	111	2,607	20,968
Totals	23,910	221	14,339	

Construction Vehicle Round Trips in 2018

Calculated

Trip Type	Tunnel / Staging Area	Project Component: Ocean Outlet and Tunnel Portals	Canal and Wetlands	Totals
Concrete Truck	-	-	350	350
Haul Truck	-	-	2,800	2,800
Worker Vehicle	6,000	-	700	6,700
Totals	6,000	-	3,850	

Total Workdays per year: 261

Emission Factors

Vehicle Type	Units	Running Exhaust Emission Factors: ROG	NOx	PM10	PM2.5	CO	CO2
Light duty truck (LDT2 gas)*	g/mile	0.04	0.20	0.00	0.00	1.63	411.65
Light duty truck (LDT2 gas)	lb/mile	0.00	0.00	0.00	0.00	0.00	0.91
Light duty truck (LDT2 diesel)*	g/mile	0.04	0.59	0.03	0.03	0.23	293.27
Light duty truck (LDT2 diesel)	lb/mile	0.00	0.00	0.00	0.00	0.00	0.65
Heavy duty truck (T7 diesel)*	g/mile	0.25	4.80	0.10	0.09	1.21	1657.64
Heavy duty truck (T7 diesel)	lb/mile	0.00	0.01	0.00	0.00	0.00	3.65

* Emission factor obtained online from EMFAC 2011 for 2016, San Mateo County, average model years, and average speed

2016 Total Worker and Material Delivery/Haul-off Trips Criteria Pollutant Emissions

Vehicle Type	Trips/year	miles/trip	ROG	NOx	PM10	PM2.5	CO
Light duty truck (gas)	5,402	24.8	12.4	60.1	0.6	0.5	480.4
Light duty truck (diesel)	5,402	24.8	12.3	173.4	9.7	8.9	68.3
Heavy duty truck - Haul	10,756	40.0	233.8	4548.6	92.3	84.9	1147.8
Heavy duty truck - Vendor	1,522	14.6	12.1	234.9	4.8	4.4	59.3
Total Annual Emissions (pounds/year)			**271**	**5,017**	**107**	**99**	**1,756**
Average 2016 Daily Emissions (lbs/day)			**1.04**	**19.24**	**0.41**	**0.38**	**6.73**

2017 Total Worker and Material Delivery/Haul-off Trips Criteria Pollutant Emissic

Vehicle Type	Trips/year	miles/trip	ROG	NOx	PM10	PM2.5	CO
Light duty truck (gas)	10,484	24.8	24.2	116.6	1.1	1.0	932.3
Light duty truck (diesel)	10,484	24.8	23.9	336.6	18.8	17.3	132.6
Heavy duty truck - Haul	15,255	40.0	331.6	6451.0	130.9	120.4	1627.9
Heavy duty truck - Vendor	2,248	14.6	17.8	347.0	7.0	6.5	87.6
Total Annual Emissions (pounds/year)			**380**	**6,904**	**151**	**139**	**2,780**
Average 2017 Daily Emissions (lbs/day)			**1.46**	**26.48**	**0.58**	**0.53**	**10.66**

2018 Total Worker and Material Delivery/Haul-off Trips Criteria Pollutant Emissic

Vehicle Type	Trips/year	miles/trip	ROG	NOx	PM10	PM2.5	CO
Light duty truck (gas)	175	24.8	0.4	1.9	0.0	0.0	15.6
Light duty truck (diesel)	175	24.8	0.4	1.9	0.0	0.0	15.6
Heavy duty truck - Haul	2,800	40.0	10.4	1184.1	24.0	22.1	298.8
Heavy duty truck - Vendor	350	14.6	0.5	54.0	1.1	1.0	13.6
Total Annual Emissions (pounds/year)			**11**	**1,188**	**24**	**22**	**344**
Average 2018 Daily Emissions (lbs/day)			**0.04**	**4.56**	**0.09**	**0.08**	**1.32**

Total Construction Period - Total Worker and Material Delivery/Haul-off Trips Criteria Pollutant Emissi

	ROG	NOx	PM10	PM2.5	CO
Average Daily Emissions (lbs/day)	**1.08**	**21.49**	**0.46**	**0.43**	**8.00**

All trips per day are round-trips. The light-duty truck trips represent employee commute trips. Trips lengths based on CalEEMod v2103.2.2 defaults for San Mateo County.

It is assumed that half of total trips would be associated with light-duty diesel vehicles and half would be associated with light-duty gasoline vehicles.

On-road GHG Emissions

CH4 and N2O Emission Factors

Vehicle Type	Running Exhaust Emission Factors (pounds/mile)	
	CH4***	N2O***
Light duty truck (gas)	0.0001	0.0001
Light duty truck (diesel)	0.0001	0.0001
Heavy duty truck	0.0000	0.0000
Total	0.0003	0.0002

** Emission factor obtained online from EMFAC 2011, for San Mateo County, average model years, and average speed

*** California Climate Action Registry, General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009. Tables C.3 and C.6.

2016 Worker and Material Delivery/Off-haul Trips GHG Emissions

Vehicle Type	Trips/year	miles/trip	CO2	CH4	N2O	CO2e
Light duty truck (gas)	5,402	24	53.37	0.01	0.00	54.93
Light duty truck (diesel)	5,402	24	38.02	0.01	0.00	39.58
Heavy duty truck - Haul	10,756	40	713.22	0.00	0.00	713.92
Heavy duty truck - Vendor	1,522	14.6	36.84	0.00	0.00	36.87
Total (metric tons)	**NA**	**NA**	**841.45**	**0.02**	**0.01**	**845.31**

2017 Worker and Material Delivery/Off-haul Trips GHG Emissions

Vehicle Type	Trips/year	miles/trip	CO2	CH4	N2O	CO2e
Light duty truck (gas)	173	24	1.7	0.5	0.3	112.5
Light duty truck (diesel)	173	24	1.2	0.0	0.0	1.3
Heavy duty truck - Haul	6,451	40	427.7	0.0	0.0	428.2
Heavy duty truck - Vendor	337	14.6	8.1	0.0	0.0	8.2
Total (metric tons)	**NA**	**NA**	**438.82**	**0.52**	**0.34**	**550.05**

2018 Worker and Material Delivery/Off-haul Trips GHG Emissions

Vehicle Type	Trips/year	miles/trip	CO2	CH4	N2O	CO2e
Light duty truck (gas)	27	24	0.3	0.1	0.1	17.5
Light duty truck (diesel)	27	24	0.2	0.0	0.0	0.2
Heavy duty truck - Haul	1,188	40	78.8	0.0	0.0	78.8
Heavy duty truck - Vendor	54	14.6	1.3	0.0	0.0	1.3
Total (metric tons)	**NA**	**NA**	**80.53**	**0.08**	**0.05**	**97.86**

Total Construction Period - Total Worker and Material Delivery/Haul-off Trips Criteria Pollutant Emissions

	CO2	CH4	N2O	CO2e
Total (metric tons)	**1,360.80**	**0.62**	**0.40**	**1,493.22**
Average Daily Emissions (lbs/day)	**4,918**	**0.00**	**0.00**	**4,918**

All trips per day are round-trips. The light-duty truck trips represent employee commute trips. Trips lengths based on CalEEMod v2103.2.2 vehicles.

Notes: 0.907194 metric tons = 1 ton; 2000 pounds = 1 ton.
Global Warming Potential for CH4 = 23; GWP for N2O = 296.

Gasoline emission factors for GHG

0.0563 g CH4/mile (CCAR, 2009)
0.03639 g NO2/mile (CCAR, 2009)

Diesel emission factors for GHG (CCAR, 2009)

0.0048 g CH4/mile (CCAR, 2009)
0.0051 g NO2/mile (CCAR, 2009)

Reference:

California Climate Action Registry, General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009. Tables C.3 and C.6.

Off-road Output

Emission factors below are provided by the Road Construction Emissions Model, which is based off of OffRoad 2011 Model factors.

Year 2016

			ROG	CO	NOX	SOX	PM	CO2	Load Factors	ROG	CO	NOX	SOX	PM	CO2
Equipment Type	**Horsepower**	**Max HP**	**g/hp/hr**							**g/hr**					
Crane	226.2	250	0.188	0.754	2.126	0.001	0.096	150.967	0.288	**12.2**	**49.1**	**138.6**	**0.1**	**6.3**	**9,838**
Excavator	162.7	175	0.143	0.973	1.559	0.002	0.077	199.859	0.382	**8.9**	**60.5**	**96.8**	**0.1**	**4.8**	**12,418**
Rubber Tired Loader	170	175	0.214	0.888	2.072	0.002	0.116	188.830	0.362	**13.2**	**54.6**	**127.4**	**0.1**	**7.1**	**11,614**
Trencher	80.8	120	0.414	1.473	3.468	0.003	0.272	264.741	0.503	**16.8**	**59.8**	**140.8**	**0.1**	**11.0**	**10,749**
Bore/Drill Rigs	205.8	250	0.101	1.047	1.458	0.002	0.043	260.705	0.503	**10.5**	**108.3**	**150.8**	**0.3**	**4.4**	**26,961**
Roller	145	175	0.133	1.059	1.590	0.002	0.074	196.123	0.375	**7.2**	**57.6**	**86.5**	**0.1**	**4.0**	**10,670**
Air Compressor	105.7	120	0.367	1.837	2.353	0.003	0.197	272.784	0.480	**18.6**	**93.2**	**119.4**	**0.2**	**10.0**	**13,840**
Ventilation Fan	100	120	0.464	2.617	3.388	0.005	0.248	420.542	0.740	**34.3**	**193.7**	**250.7**	**0.4**	**18.4**	**31,120**

Year 2017

			ROG	CO	NOX	SOX	PM	CO2	Load Factors	ROG	CO	NOX	SOX	PM	CO2
Equipment Type	**Horsepower**	**Max HP**	**g/hp/hr**							**g/hr**					
Crane	226.2	250	0.169	0.754	1.917	0.001	0.085	150.998	0.288	**11.0**	**49.1**	**125.0**	**0.1**	**5.6**	**9,840**
Excavator	162.7	175	0.133	0.973	1.413	0.002	0.070	199.819	0.382	**8.3**	**60.4**	**87.8**	**0.1**	**4.3**	**12,416**
Rubber Tired Loader	170	175	0.197	0.888	1.880	0.002	0.105	188.858	0.362	**12.1**	**54.6**	**115.6**	**0.1**	**6.4**	**11,616**
Trencher	80.8	120	0.401	1.473	3.356	0.003	0.263	264.749	0.503	**16.3**	**59.8**	**136.3**	**0.1**	**10.7**	**10,749**
Bore/Drill Rigs	205.8	250	0.091	1.047	1.267	0.002	0.036	260.607	0.503	**9.4**	**108.3**	**131.0**	**0.3**	**3.8**	**26,951**
Roller	145	175	0.123	1.059	1.453	0.002	0.068	196.072	0.375	**6.7**	**57.6**	**79.1**	**0.1**	**3.7**	**10,667**
Air Compressor	105.7	120	0.340	1.831	2.215	0.003	0.179	272.784	0.480	**17.3**	**92.9**	**112.4**	**0.2**	**9.1**	**13,840**
Ventilation Fan	100	120	0.426	2.606	3.196	0.005	0.227	420.542	0.740	**31.5**	**192.8**	**236.5**	**0.4**	**16.8**	**31,120**

Year 2018

			ROG	CO	NOX	SOX	PM	CO2	Load Factors	ROG	CO	NOX	SOX	PM	CO2
Equipment Type	**Horsepower**	**Max HP**	**g/hp/hr**							**g/hr**					
Crane	226.2	250	0.146	0.754	1.663	0.001	0.072	150.973	0.288	**9.5**	**49.1**	**108.4**	**0.1**	**4.7**	**9,839**
Excavator	162.7	175	0.109	0.973	1.117	0.002	0.054	199.828	0.382	**6.8**	**60.4**	**69.4**	**0.1**	**3.4**	**12,416**
Rubber Tired Loader	170	175	0.170	0.888	1.580	0.002	0.088	188.862	0.362	**10.4**	**54.6**	**97.2**	**0.1**	**5.4**	**11,616**
Trencher	80.8	120	0.346	1.472	2.972	0.003	0.226	264.562	0.503	**14.1**	**59.8**	**120.7**	**0.1**	**9.2**	**10,742**
Bore/Drill Rigs	205.8	250	0.081	1.043	1.082	0.002	0.031	259.656	0.503	**8.4**	**107.9**	**111.9**	**0.3**	**3.2**	**26,852**
Roller	145	175	0.104	1.059	1.194	0.002	0.055	196.125	0.375	**5.7**	**57.6**	**64.9**	**0.1**	**3.0**	**10,670**
Air Compressor	105.7	120	0.312	1.825	2.073	0.003	0.160	272.784	0.480	**15.9**	**92.6**	**105.2**	**0.2**	**8.1**	**13,840**
Ventilation Fan	100	120	0.387	2.595	2.999	0.005	0.204	420.542	0.740	**28.6**	**192.0**	**222.0**	**0.4**	**15.1**	**31,120**

0.002205	pounds per gram
2000	pounds per ton
2204.62	pounds per metric ton
610	Approx # of Days of Construction Activity:

Road Dust Calculations

Source: AP-42 Handbook, Chapter 13.2.1, page 5

Equation:

E equals $[k\ (sL)^{0.91} \times (W)^{1.02}]*(1-P/4N)$

where:

k	=	particle size multiplier for particle size range and units of interest. k = particle size multiplier. The AP-42 value for PM10 is 1.00 g/mile and that for PM2.5 is 0.25 g/mile.
sL	=	road surface silt loading (grams per square meter)
W	=	average weight (tons) of *all the vehicles* traveling the road (2.4 tons)
P	=	number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N	=	number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly)

For the Existing Scenario (San Francisco Bay Area):

For PM_{10}			For $PM_{2.5}$		
k	=	1	k	=	0.25
sL	=	0.1	sL	=	0.1
W	=	2.4	W	=	2.4
P	=	64	P	=	64
N	=	365	N	=	365
Therefore:			Therefore:		
E	=	**0.287308**	E	=	**0.071827**

2016 Road Dust

Miles Travelled = 711766.1

PM10 Emissions =	204496.3	gm/yr	=	0.225418 ton/yr
PM2.5 Emissions =	51124.06	gm/yr	=	0.056355 ton/yr

Fugitive Dust Calculations

1.Truck Loading

Processes such as truck dumping on the pile or loading out from the pile to a truck with a front-end loader also cause fugitive dust emissions.
Calculated emissions use the methodology described in Section 13.2, Introduction to Fugitive Dust Sources, of USEPA AP-42.
The emission factor that is based on the material moisture content and mean wind speed is calculated using the following formula:

A. Emission factors

EF = k x (0.0032) x ((u/5)^1.3/(M/2)^1.4)

Where:
EF = Emission factor (lb/ton)
k = particle size multiplier (AP-42)
U = mean wind speed (mph)
M = material moisture content (%)

k =	0.35	pm10
	0.053	pm2.5
U =	10.3	mph (SFO)
M =	12	% (cover)
EF_{pm10} =	2.33E-04	lb/ton
$EF_{pm2.5}$ =	3.53E-05	lb/ton

B. Emissions

Emissions = EF x throughput (tons)

i. 2016

Truck trips =	10,756	daily round trips (loads)
Assume 18 cy/truck =	193615.7	cy/year

Annual thoughput =	193615.7	cy/year			
Loam density =	1.264	tons/cy (CalEEmod)			
Annual throughput =	244730.3	tons			
PM10 emissions =	57.08	lb/yr	=	0.028542	ton/yr
PM2.5 emission =	8.64	lb/yr	=	0.004322	ton/yr

ii. 2017

Truck trips =	15,255	daily round trips (loads)
Assume 18 cy/truck =	274590	cy/year

Annual thoughput =	274590	cy/year			
Loam density =	1.264	tons/cy (CalEEmod)			
Annual throughput =	347081.8	tons			
PM10 emissions =	80.96	lb/yr	=	0.04048	ton/yr
PM2.5 emission =	12.26	lb/yr	=	0.00613	ton/yr

iii. 2018

Truck trips =	2,800	daily round trips (loads)
Assume 18 cy/truck =	50400	cy/year

Annual thoughput =	50400	cy/year			
Loam density =	1.264	tons/cy (CalEEmod)			
Annual throughput =	63705.6	tons			
PM10 emissions =	14.86	lb/yr	=	0.00743	ton/yr
PM2.5 emission =	2.25	lb/yr	=	0.001125	ton/yr

APPENDIX D
Biological Resources

This appendix includes:

- Special-status Species occurrence tables
- Vegetation change analysis methodology associated with Lake Merced water level changes

Special-status Species Occurrence Tables

TABLE 1
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**CRPR Ranking**	**Habitat Description / Blooming Period**	**Potential to Occur in the Study Area**
PLANT SPECIES LISTED OR PROPOSED FOR LISTING					
Franciscan manzanita *Arctostaphylos franciscana*	FE	--	1B.1	Open, rocky, serpentine outcrops in chaparral. February – April	**Low.** No suitable habitat present. This species was believed to be extinct in the wild (although still extant through cultivation), but was rediscovered in Presidio National Park in late 2009.
San Bruno Mountain manzanita *Arctostaphylos imbricada*	--	CE	1B.1	Chaparral and coastal scrub, usually on sandstone outcrops. February – May	**Low.** Regional occurrences are restricted to San Bruno Mountain and the Santa Cruz Mountains. .
Presidio manzanita *Arctostaphylos montana* ssp. *ravenii*	FE	CE	1B.1	Open, rocky, serpentine slopes in chaparral, coastal scrub, and coastal prairie. February – March	**Low.** No suitable habitat present.
Pacific manzanita *Arctostaphylos pacifica*	--	CE	1B.2	Coastal scrub and chaparral. February – April	**Low.** Regional occurrences are restricted to San Bruno Mountain
Marsh sandwort *Arenaria paludicola*	FE	CE	1B.1	Freshwater or brackish marshes and swamps. May – August	**Low.** Potentially suitable habitat present at Lake Merced, but species not observed there (May and Associates, 2009; Nomad Ecology, 2011; SFPD, 2011); species presumed extirpated in San Francisco.
Robust spineflower *Chorizanthe robusta* var. *robusta*	FE	--	1B.1	Sandy or gravelly coastal dunes, coastal scrub, cismontane woodland and maritime chaparral. April – September	**Low.** Potentially suitable habitat present at Lake Merced but species not observed there (SFPD, 2011; May and Associates, 2009; Nomad Ecology, 2011); species presumed extirpated in San Francisco. Potentially suitable habitat present at Avalon Canyon access road site though only regional occurrences are historical.
Presidio clarkia *Clarkia franciscana*	FE	CE	1B.1	Serpentine outcrops in coastal scrub, and valley and foothill grassland. May – July	**Low.** No suitable habitat present.
Marin western flax *Hesperolinon congestum*	FT	CT	1B.1	Chaparral and grassland, usually on serpentine barrens. April – July	**Low.** No suitable habitat present.
Beach layia *Layia carnosa*	FE	CE	1B.1	Sand dunes. March – July	**Low**. Potentially suitable habitat present at Fort Funston. Recorded generally from sand dunes in San Francisco in 1904; may be present in the seed bank.

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**CRPR Ranking**	**Habitat Description / Blooming Period**	**Potential to Occur in the Study Area**
PLANT SPECIES LISTED OR PROPOSED FOR LISTING (cont.)					
San Francisco lessingia *Lessingia germanorum*	FE	CE	1B.1	Coastal scrub, sandy soils free of competing species. July – November	**Low.** Historically known to Lake Merced but not recently observed; may be present in the seed bank. Documented at Fort Funston in 2002 (GGNRA, 2013); Fort Funston is identified as an important recovery site for this species (USFWS, 2003). Potentially suitable habitat is present in the lower portion of Avalon Canyon access road.
White rayed pentachaeta *Pentachaeta bellidiflora*	FE	CE	1B.1	Open, dry, rocky slopes and grassy areas, usually on serpentine. March – May	**Low.** No suitable habitat present.
San Francisco popcornflower *Plagiobothrys diffusus*	--	CE	1B.1	Coastal prairie, and valley and foothill grasslands. March – June	**Low.** No suitable habitat present.
Adobe sanicle *Sanicula maritima*	--	Rare	1B.1	Moist clay or ultramafic soil in chaparral, coastal prairie, meadows, seeps, and valley and foothill grassland. February – May	**Low.** No suitable habitat present.
Showy Indian clover *Trifolium amoenum*	FE	--	1B.1	Valley grassland and wetland and riparian areas. Affinity to serpentine soils. April – June	**Low.** No suitable habitat present.
CNPS CALIFORNIA RARE PLANT RANKED SPECIES					
Franciscan onion *Allium peninsulare* var. *franciscanum*	--	--	1B.2	Clay, volcanic, or serpentine substrate in valley and foothill grassland and cismontane woodland. May - June	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site.
Bent-flowered fiddleneck *Amsinckia lunaris*	--	--	1B.2	Coastal bluff scrub, cismontane woodland, and valley and foothill grassland. March – June	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site.
coast rockress *Arabis blepharophylla*	--	--	4.3	Rocky soils in broadleaf upland forest, coastal bluff scrub, coastal prairie, and coastal scrub. February - May	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site.
Montara manzanita *Arctostaphylos montaraensis*	--	--	1B.2	Slopes and ridges in chaparral and coastal scrub. January – March	**Low.** Regional occurrences are restricted to San Bruno Mountain and mountains west of San Mateo.
Carlotta Hall's lace fern *Aspidotis carlotta-halliae*	--	--	4.2	Crevices, outcrops and slopes in chaparral and cismontane woodland, generally in serpentine soils. January - December	**Low.** No suitable habitat present.

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**CRPR Ranking**	**Habitat Description / Blooming Period**	**Potential to Occur in the Study Area**
CNPS CALIFORNIA RARE PLANT RANKED SPECIES (cont.)					
Nuttall's milkvetch *Astragalus nuttallii* var. *nuttallii*	--	--	4.2	Coastal bluff scrub and coastal dunes, January - November	**Low.** Documented at Fort Funston (GGNRA, 2013) though not previously found in areas considered for use under the proposed project. Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Lake Merced.
Alkali milk-vetch *Astragualus tener* var. *tener*	--	--	1B.2	Alkali flats, flooded grassland, playas and vernal pools. March – June	**Low.** No suitable habitat present; species presumed extirpated in San Francisco.
Bristly sedge *Carex comosa*	--	--	2B.1	Lake margins, marshes, swamps, coastal prairie, and valley and foothill grasslands. May – September	**Low.** Potentially suitable habitat present at Lake Merced but species not observed there (SFPD, 2011; May and Associates, 2009; Nomad, 2011)
Johnny-nip *Castilleja ambigua* var. *ambigua*	--	--	4.2	Wet sites in coastal bluff scrub, coastal prairie, marshes and swamps, valley and foothill grassland, and at the margins of vernal pools. March - August	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011).
Pappose tarplant *Centromadia parryi* ssp. *parryi*	--	--	1B.2	Chaparral, coastal prairie, meadows, seeps, coastal salt marshes and swamps, and vernally mesic, often alkaline, valley and foothill grasslands. May – November	**Low.** No suitable habitat present.
Point Reyes bird's-beak *Chloropyron maritimum* ssp. *palustre*	--	--	1B.2	Coastal salt marshes and swamps. June – October	**Low.** No suitable habitat present.
San Francisco spineflower *Chorizanthe cuspidata* var. *cuspidata*	--	--	1B.2	Sandy terraces and slopes of coastal bluff scrub, coastal dunes, coastal prairie and coastal scrub. April – July	**Moderate.** Robust populations documented at Fort Funston near the proposed staging areas during ESA's June 2015 reconnaissance survey. Two populations documented in 1992 and 2011 within half a mile of the project site along the west side of John Muir Drive west of Impound Lake (CNDDB, 2015 and Nomad, 2011). Documented on the north shore of South Lake Merced (May and Associates, 2009). Potentially suitable habitat present at Avalon Canyon access road site.
Franciscan thistle *Cirsium andrewsii*	--	--	1B.2	Coastal bluff scrub, coastal prairie, coastal mesic scrub, and broadleaf upland forest; sometimes on serpentine soils; often associated with seeps. March – July	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Lake Merced but species not observed there (SFPD, 2011; May and Associates, 2009; Nomad, 2011)

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**CRPR Ranking**	**Habitat Description / Blooming Period**	**Potential to Occur in the Study Area**
CNPS CALIFORNIA RARE PLANT RANKED SPECIES (cont.)					
Compact cobwebby thistle *Cirsium occidentale* var. *compactum*	--	--	1B.2	Coastal scrub, grassland, and dunes; often associated with seeps. April – June	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Formerly known from Lake Merced in the same gully as San Francisco gumplant, but not recently observed; may be present in the seedbank. Potentially suitable habitat present at Fort Funston.
Round-headed Chinese-houses *Collinsia corymbosa*	--	--	1B.2	Coastal dunes and coastal prairie. April – June	**Low.** No suitable habitat present; species has not been seen in San Francisco for more than 100 years. Potentially suitable habitat present at Fort Funston.
San Francisco collinsia *Collinsia multicolor*	--	--	1B.2	On humus-covered soil derived from mudstone in closed-cone coniferous forest and coastal scrub. March – May	**Low.** Potentially suitable habitat present in coastal scrub at Lake Merced but species not documented to occur there (May and Associates, 2009; Nomad, 2011).
slender cottongrass *Eriophorum gracile*	--	--	4.3	Acidic soils in bogs, and fens, meadows and seeps, and upper montane coniferous forest. May - September	**Low.** No suitable habitat present.
San Francisco wallflower *Erysimum franciscanum*	--	--	4.2, LS	Coastal scrub and grassland, often on serpentine soils. March – June	**Moderate.** Documented at Fort Funston within areas to the south of the staging area during ESA's June 2015 reconnaissance survey. Occurs on northeastern slope of Impound Lake and suitable habitat is present at the project site (Nomad, 2011). Potentially suitable habitat present at Avalon Canyon access road site.
Fragrant fritillary *Fritillaria liliacea*	--	--	1B.2	On clay, often serpentine derived soils in coastal scrub, grassland, and coastal prairie. February – April	**Low.** No suitable habitat present.
Blue coast gilia *Gilia capitata* spp. *chamissonis*	--	--	1B.1	Coastal dunes and scrub. April – July	**Moderate.** Historically present in suitable habitat around Lake Merced. Present on the northeastern shore of Impound Lake (Nomad, 2011). Potentially suitable habitat present at Avalon Canyon access road site. Present at Fort Funston (GGNRA, 2013) though not previously documented in areas considered for use under the proposed project.
Dark-eyed gilia *Gilia millefoliata*	--	--	1B.2	Coastal dunes. April – July	**Low.** Potentially suitable habitat present at Fort Funston.

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name *Scientific Name*	Federal Status	State Status	CRPR Ranking	Habitat Description / Blooming Period	Potential to Occur in the Study Area
CNPS CALIFORNIA RARE PLANT RANKED SPECIES (cont.)					
San Francisco gumplant *Grindelia hirsutula* var. *maritima*	--	--	3.2	Coastal scrub and grasslands. June – September	**Moderate.** Documented at Fort Funston in 2011 (GGNRA, 2013) though not previously found in areas considered for use under the proposed project. Potentially suitable habitat present at Avalon Canyon access road site. Formerly known from Lake Merced but not recently observed and not easily overlooked; may be present in the seedbank.
Diablo helianthella *Helianthella castanea*	--	--	1B.2	On rocky soils in broadleaf upland forest, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. March – June	**Low.** No suitable habitat present.
White seaside tarplant *Hemizonia congesta* ssp. *congesta*	--	--	1B.2	Grassy valleys and hills, often on fallow fields in coastal scrub. April – November	**Low.** No suitable habitat present.
Short-leaved evax *Hesperevax sparsiflora* var. *brevifolia*	--	--	1B.2	Sandy bluffs and flats in coastal scrub and coastal dunes. March – June	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site and central dune scrub at Fort Funston. Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011).
Kellogg's horkelia *Horkelia cuneata* ssp. *sericea*	--	--	1B.1	Coastal scrub, dunes, and openings of closed-cone coniferous forests. February – July	**Moderate.** Suitable habitat present; not historically known to Lake Merced (May and Associates, 2009). Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Fort Funston.
coast iris *Iris longipetala*	--	--	4.2	Coastal prairie, lower montane coniferous forest, meadows and seeps, mesic sites. March - May	**Low.** No suitable habitat present.
Rose leptosiphon *Leptosiphon rosaceus*	--	--	1B.1	Coastal bluff scrub. April – July	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site.
Arcuate bush mallow *Malacothamnus arcuatus*	--	--	1B.2	Gravelly alluvium in chaparral and cismontane woodland. April – September	**Low.** No suitable habitat present.
Marsh microseris *Microseris paludosa*	--	--	1B.2	Closed-cone coniferous forest, cismontane woodland, coastal scrub, and valley and foothill grassland. August – June	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011).

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name *Scientific Name*	Federal Status	State Status	CRPR Ranking	Habitat Description / Blooming Period	Potential to Occur in the Study Area
CNPS CALIFORNIA RARE PLANT RANKED SPECIES (cont.)					
Northern curly-leaved Monardella *Monardella sinuata* ssp. *nigrescens*	--	--	1B.2	Coastal dunes and scrub, chaparral, lower montane coniferous forest. April - September	**Low.** Suitable habitat present at Fort Funston through species is presumed extirpated from San Francisco.
Choris's popcorn-flower *Plagiobothrys chorisianus* var. *chorisianus*	--	--	1B.2	Mesic sites in chaparral, coastal scrub, and coastal prairie. March – June	**Low.** Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011).
Hairless popcornflower *Plagiobothrys glaber*	--	--	1A	Coastal salt marshes and alkaline meadows. March – May	**Low.** No suitable habitat present.
Oregon polemonium *Polemonium carneum*	--	--	2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest. April – September	**Moderate.** Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011). Potentially suitable habitat present at Avalon Canyon access road site and in coastal scrub at Fort Funston.
San Francisco campion *Silene verecunda*	--	--	1B.2	Mudstone, shale, or serpentine substrates in coastal scrub, coastal prairie, chaparral and valley and foothill grassland. March – June	**Moderate.** Documented at Fort Funston in 2009 (GGNRA, 2013) though not previously found in areas considered for use under the proposed project. Potentially suitable habitat is found along the Avalon Canyon access road.
Santa Cruz microseris *Stebbinsoseris decipiens*	--	--	1B.2	On sandstone, shale or serpentine derived seaward facing slopes in broadleaf upland forest, closed-cone coniferous forest, chaparral, coastal prairie, and coastal scrub. April – May	**Low.** No suitable habitat present.
Coastal triquetrella *Triquetrella californica*	--	--	1B.2	On soil in coastal bluff and coastal scrub.	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Potentially suitable habitat present at Lake Merced but species not observed there (May and Associates, 2009; Nomad, 2011; SFPD, 2011).
San Francisco owl's clover *Triphysaria floribunda*	--	--	1B.2	Grasslands. April – June	**Low.** Though historically known from Lake Merced, this species has not been observed since 1907; may be present in the seed bank.
LOCALLY SIGNIFICANT SPECIES					
California pipevine *Aristolochia californica*	--	--	LS	Chaparral and mixed evergreen forests on streambanks. January – April	**Low.** Occurs on the north side of East Lake (Nomad, 2011).

TABLE 1 (Continued)
SPECIAL-STATUS PLANT SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name *Scientific Name*	Federal Status	State Status	CRPR Ranking	Habitat Description / Blooming Period	Potential to Occur in the Study Area
LOCALLY SIGNIFICANT SPECIES (cont.)					
Wight's paintbrush *Castilleja wightii*	--	--	LS	Northern coastal scrub. March – August	**Moderate.** Potentially suitable habitat present at Avalon Canyon access road site. Occurs on the east side of Impound Lake (Nomad, 2011).
Vancouver wild rye *Eleymus x vancouverensis*	--	--	LS	Coastal strand.	**Low.** Occurs on the north side of East Lake (Nomad, 2011).
Wild cucumber *Marah oreganus*	--	--	LS	Mixed evergreen forest. March – June	**Low.** Occurs on the northwest side of the Mesa in California blackberry scrub (SFRPD, 2006).
Dune tansy *Tanacetum bipinnatum*	--	--	LS	Coastal dunes and clearings in dune scrub. July – October	**Moderate.** Occurs on the southwestern shore of South Lake and suitable habitat is present at the project site (Nomad, 2011). Occurs at Fort Funston outside of the Project site (Forrestel, 2015). Potentially suitable habitat is present at Avalon Canyon access road.
Canyon live oak *Quercus chrysolepis*	--	--	LS	Chaparral and valley grasslands. May – June	**Low.** Occurs on the south side of East Lake; not known to South Lake (Nomad, 2011).
Coastal black gooseberry *Ribes divaricatum*	--	--	LS	Moist coastal understories; streamside thickets. March – May	**Low.** Occurs along southeastern slopes of Impound Lake; suitable habitat is present at the project site (Nomad, 2011).
Thimbleberry *Rubus parviflorus*	--	--	LS	Closed cone pine forest and riparian wetlands. March – May	**Low.** Occurs on the south shore of East Lake (Nomad, 2011).

NOTES:

The "Potential for Effect" category is defined as follows:
High = Species is expected to occur and habitat meets species requirements.
Moderate = Habitat is only marginally suitable or is suitable but not within species geographic range.
Low = Habitat does not meet species requirements as currently understood in the scientific community.

STATUS CODES:
Federal:
FE = Listed as "endangered" under the federal Endangered Species Act
FT = Listed as "threatened" under the federal Endangered Species Act
FPD = Proposed delisted
FD = Delisted

State:
CE = Listed as "endangered" under the California Endangered Species Act
CT = Listed as "threatened" under the California Endangered Species Act
CSC = CDFW designated "species of special concern"
CFP = CDFW designated "fully protected"
SC = CDFW designated "candidate threatened"
WL = CDFW designated "watch list"

California Rare Plant Rank (CRPR):
Rank 1A = Plants presumed extirpated in California and either rare or extinct elsewhere.
Rank 1B = Plants rare, threatened, or endangered in California and elsewhere.
Rank 2A = Plants presumed extirpated in California, but more common elsewhere.
Rank 2B = Plants rare, threatened, or endangered in California, but more common elsewhere.
Rank 3 = Plants about which we need more information – a review list
Rank 4 = Plants of limited distribution – a watch list

An extension reflecting the level of threat to each species is appended to each rarity category as follows:
.1 – Seriously endangered in California.
.2 – Fairly endangered in California.
.3 – Not very endangered in California.

LS = Locally Significant Plant Species for San Francisco County as designated by the CNPS Yerba Buena Chapter

SOURCE: CDFW, 2015b; CNDDB, 2015; CNPS, 2015a; CNPS, 2015b; Forrestel, 2015; GGNRA, 2013; May and Associates, 2009; Nomad, 2011; SFPD, 2011; SFRPD, 2006; USFWS, 2003; USFWS, 2015.

TABLE 2
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
SPECIES LISTED OR PROPOSED FOR LISTING				
Invertebrates				
San Bruno elfin butterfly *Callophrys mossii bayensis*	FE	--	Coastal scrub on rocky outcrops with broadleaf stonecrop (*Sedum spathulifolium*)	**Low.** No suitable habitat present in the study area. Three known populations at San Bruno Mountain, Montara, and Pacifica.
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT	--	Serpentine grasslands.	**Low.** No suitable habitat present in the study area.
Mission blue butterfly *Plebejus icarioides missionensis*	FE	--	Grassland with *Lupinus albifrons, L. Formosa*, and *L. varicolor.*	**Low.** No suitable habitat present in the study area.
Callippe silverspot butterfly *Speyeria callippe callippe*	FE	--	Found in native grasslands with *Viola pedunculata* as larval food plant.	**Low.** No suitable habitat present in the study area.
Myrtle's silverspot butterfly *Speyeria zerene myrtleae*	FE	*	Host plants include *Grindelia hirsutula, Abronia latifolia, Mondardella, Cirsium vulgare, Erigeron glaucus* where found on the San Francisco and Marin peninsulas.	**Low.** Host plants present in the study area. Historically widespread on the San Francisco and Marin Peninsulas, though presently known only to few sites in northern Marin County.
Fish				
Steelhead *Oncorhynchus (=Salmo) mykiss*	FT	--	Spawns and rears in coastal streams between the Russian River and Aptos Creek, as well as drainages tributary to San Francisco Bay, where gravelly substrate and shaded riparian habitat occurs.	**Low.** No suitable habitat present in the study area.
Tidewater goby *Eucyclogobius newberryi*	FE	CSC	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego Co. to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	**Absent.** No suitable habitat present in the study area.
Reptiles				
San Francisco garter snake *Thamnophis sirtalis tetrataenia*	FE	CE, CFP	Densely vegetated ponds near open hillsides with abundant small mammal burrows.	**Absent.** No record of this species occurring at Lake Merced and is considered likely extirpated from San Francisco. No suitable habitat occurs elsewhere in the study area.
Amphibians				
California red-legged frog *Rana draytonii*	FT	CSC	Freshwater ponds and slow streams with emergent vegetation for egg attachment.	**Low.** Historically present where habitat exists in the study area including several recent CNDDB records in Golden Gate Park; however this species is considered extirpated from Lake Merced

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
SPECIES LISTED OR PROPOSED FOR LISTING (cont.)				
				(Jones and Stokes, 2007). No suitable habitat occurs elsewhere in the study area.
Birds				
Marbled murrelet *Brachyramphus marmoratus*	FT	CE	Breeds in coniferous forests near the coast with an affinity to old growth, mature stands. Nests on large horizontal branches high in the trees. Winters at sea.	**No nesting potential.** May occur offshore of the study area in winter months.
Western snowy plover *Charadrius alexandrinus nivosus*	FT	CSC	Sandy beaches, salt pond levels and shores of alkali lakes. Needs sandy, gravelly or friable soils for nesting.	**Moderate.** Species may occur on beaches north of the study area from July 1 through May 15 (NPS, 2012). Species may appear in the study area on a transient basis during this timeframe; no records of this species nesting on study area beaches.
American peregrine falcon *Falco peregrines anatum*	FD	CFP	Woodlands, coastal habitats, riparian areas, coastal and inland waters, human made structures that may be used as nest or temporary perch sites.	**Moderate.** Suitable nesting habitat is present on the bluffs above study area beaches; no documented nests in the bluffs within the study area. May hunt shorebirds on the beach.
Bald eagle *Haliaeetus leucocephalus* (nesting and wintering)	FD	CE, CFP	Nests and forages on inland lakes, reservoirs, and rivers	**Low.** Nested at Crystal Springs Reservoir, south of the study area, in recent years. Unlikely to nest at Lake Merced or elsewhere in the study area.
California black rail *Laterallus jamaicensis coturniculus*	--	CT	Salt and brackish marshes; also in freshwater marshes at low elevations.	**Low.** Historically known to Lake Merced but not recently observed.
Short-tailed albatross *Phoebastria (=Diomedea) albatrus*	FE	CSC	A pelagic species that spends most of its time at sea and returns to land only for breeding purposes.	**No nesting potential.** Breeds only at one or two sites off the coast of Japan, occasional visitor to California coast and could appear on a transient basis offshore of the study area.
Ridgway's rail *Rallus obsoletus obsoletus*	FE	CE, CFP	Salt marsh wetlands along the San Francisco Bay.	**Absent.** No suitable habitat present in the study area.
Bank swallow *Riparia riparia* (nesting)	--	CT	Vertical banks and cliffs with sandy soil, near water. Nests in holes dug in cliffs and river banks.	**Present.** Nests in bluffs at Fort Funston and forages over Lake Merced.
California least tern *Sterna antillarum browni*	FE	CE	Open beaches free of vegetation along the California coast.	**Low.** May appear in the project area on a transient basis. Nearest breeding colonies are located at the former Alameda Naval Air Station.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
SPECIES LISTED OR PROPOSED FOR LISTING (cont.)				
Mammals (cont.)				
Southern sea otter *Enhydra lutris nereis*	FT	FP	Shallow coastal areas with kelp between Half Moon Bay and Morro Bay in California.	**Low.** Study area is outside of current known range.
OTHER SPECIAL-STATUS SPECIES				
Invertebrates				
Monarch butterfly *Danaus plexippus*	--	*	Eucalyptus groves (wintering sites).	**Low.** Several records of this species in Golden Gate Park but no wintering sites have been identified within the study area.
Tomales isopod *Caecuditea tomalensis*	--	--	Still-to slow-moving water in vegetated ponds, preferably spring-fed.	**Absent.** Collected in 1984 from the waters of Lake Merced, but SFSU information indicates this species is no longer present (Holzman, 2005).
Reptiles				
Western pond turtle *Emys marmorata*	--	CSC	Ponds, marshes, rivers, streams, and irrigation ditches with aquatic vegetation. Requires basking sites and suitable upland habitat for egg-laying. Nest sites most often characterized as having gentle slopes (<15%) with little vegetation or sandy banks.	**Present.** This species is known to East Lake Merced. Basking habitat is present in riprap, matted bulrush, abandoned piers, and wood debris; limited upland breeding habitat has been noted.
Birds				
Cooper's hawk *Accipiter cooperii*	--	§3503.5	Nests in riparian areas and oak woodlands, forages at woodland edges.	**Present.** Foraging is known at Lake Merced, though breeding remains undocumented. Large trees in the study area, including eucalyptus and Monterey cypress, could support nests for this species.
Sharp-shinned hawk *Accipiter striatus*	--	§3503.5	Nests in riparian areas and oak woodlands, forages in open areas	**Present.** Large trees in the study area, including eucalyptus and Monterey cypress, could support nests for this species.
Clark's grebe *Aechmophorus clarkii*	--	§3503	Marine subtidal and estuarine waters; large lakes near coast and inland at low elevations.	**Present.** Breeds at Lake Merced.
Tricolored blackbird *Agelaius tricolor* (nesting colony)	--	CSC	Nests in dense colonies within sloughs, swamps, and marshes where tall aquatic vegetation is present. Nests can extend into upland scrub habitat on colony fringes. Nests are constructed of leaves and stems woven tightly into a cup, suspended between two upright vegetative stems.	**Present. I**ndividuals appear in flocks of red-winged blackbirds during annual fall dispersal. Nesting colony is not present at Lake Merced.
Gadwall *Anas strepera*	--	§3503	Interior valleys, wetlands, ponds and streams.	**Present.** Historically bred within San Francisco; now a winter resident at Lake Merced.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
OTHER SPECIAL-STATUS SPECIES (cont.)				
Birds (cont.)				
Great blue heron *Ardea herodias*	--	§3503	Shallow estuaries and fresh and saline emergent wetlands.	**Present.** Breeds at Lake Merced.
Short-eared owl *Asio flammeus*	BCC	CSC	Open, flat, treeless terrain. Marshes, grasslands, or fields.	**Low.** Marginal habitat is present at Fort Funston in coastal scrub areas.
Western burrowing owl *Athene cunicularia*	BCC	CSC	Open grasslands and shrublands where perches and existing rodent burrows are available.	**Low.** No suitable habitat present in the study area.
Oak titmouse *Baeolophus inornatus*	BCC	§3503	Open, dry oak woodlands.	**Low.** Marginal habitat occurs in the study area though could be present around Lake Merced.
Great horned owl *Bubo virginianus*	--	§3503.5	Riparian, coniferous, chaparral and desert habitats.	**Present.** Large trees in the study area, including eucalyptus and Monterey cypress, could support nests for this species.
Red-tailed hawk *Buteo jamaicensis*	--	§3503.5	Found in nearly all habitats and elevations.	**Present.** Large trees in the study area, including eucalyptus and Monterey cypress, could support nests for this species.
Red-shouldered hawk *Buteo lineatus*	--	§3503.5	Riparian woodlands with swamps and emergent wetlands.	**Present.** Large trees in the study area, including eucalyptus and Monterey cypress, could support nests for this species.
Green heron *Butorides striatus*	--	§3503	Valley foothill and desert riparian habitats; freshwater emergent wetlands, lacustrine and riverine areas.	**Present.** Occurs at Lake Merced.
Red knot *Calidris canutus* ssp. *roselaari*	BCC	§3503	Shoreline mudflats and beaches.	**No nesting potential.** Uncommon winter migrant that could occur on beaches and mudflats of the study area.
California quail *Callipepla californica*	--	§3503	Shrub, scrub, brush, grasslands, open coniferous and deciduous habitats.	**Low.** Reintroduced to Harding Park in 2009. May occur within the study area.
Wilson's warbler *Cardellina pusilla*	--	§3503	Foothill riparian areas, thickets.	**Present.** Breeds in riparian areas surrounding Lake Merced.
Marsh wren *Cistothorus palustris*	--	§3503	Creates a domed nest of grasses and sedges suspended in dense tulle vegetation. Forages in shrubs near marshes.	**Present.** Breeds at Lake Merced.
Olive-sided flycatcher *Contopus cooperi*	BCC	CSC	Forest and woodland habitats.	**Present.** Breeds at Lake Merced.
American kestrel *Falco sparverius*	--	§3503.5	Frequents generally open grasslands, pastures, and fields; primarily a cavity nester.	**Present.** Large trees in the study area, including eucalyptus and Monterey cypress, and excavations in telephone poles could support nests for this species.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
OTHER SPECIAL-STATUS SPECIES (cont.)				
Birds (cont.)				
San Francisco common yellowthroat *Geothlypis trichas sinuous*	BCC	CSC	Forages in various marsh, riparian and upland habitats. Nests on or near the ground in concealed locations.	**Present.** This species is known to breed in the freshwater bulrush marshes at Lake Merced.
Purple finch *Haemorhous purpureus*	--	§3503	Coastal foothills and lowlands; riparian and coniferous habitats.	**Present.** Breeds at Lake Merced.
Hooded oriole *Icterus cucullatus*	--	§3503	Lower elevation riparian areas, palm oases, urban and cropland areas.	**Present.** Breeds at Lake Merced.
short-billed dowitcher *Limnodromus griseus*	BCC	§3503	Saltwater tidal flats, beaches, and salt marshes during migration.	**No nesting potential.** Common winter migrant that could occur on beaches and mudflats of the study area.
Marbled godwit *Limosa fedoa*	BCC	§3503	Shoreline mudflats and beaches.	**No nesting potential.** Common winter migrant that could occur on beaches and mudflats of the study area.
Alameda song sparrow *Melospiza melodia pusillula*	--	CSC	Salt marshes of eastern and south San Francisco Bay.	**Low.** No suitable habitat present in the study area. Study area is outside of current known range.
San Pablo song sparrow *Melospiza melodia samuelis*	--	CSC	Salt marshes of eastern and north San Francisco Bay.	**Low.** No suitable habitat present in the study area. Study area is outside of current known range.
Long-billed curlew *Numenius americanus*	BCC	WL, §3503	Breeds in upland shortgrass prairies and wet meadows in northeastern California in gravelly soils.	**No nesting potential.** Uncommon winter visitor to sandy beaches and mudflats of the study area.
Whimbrel *Numenius phaeopus*	BCC	§3503	Saltwater tidal flats, beaches, and salt marshes during migration.	**No nesting potential.** Common winter migrant that could occur on beaches and mudflats of the study area.
Black-crowned night heron *Nycticorax nycticorax*	--	§3503	Lowland and foothill areas. Nests in dense emergent wetlands and dense-foliaged trees.	**Moderate.** Locally uncommon; may breed at Lake Merced.
Orange-crowned warbler *Oreothlypis celata*	--	§3503	Chaparral, coastal scrub, foothill riparian.	**Present.** Occurs at Lake Merced; suspected to breed here also.
Osprey *Pandion haliaetus*	--	WL, §3503.5	Habitat varies greatly and usually includes adequate supply of accessible fish, shallow waters, open and elevated nest sites (10-60 feet in height), and artificial structures such as towers. Builds large platform stick nests near or in open waters such as lakes, estuaries, bays, reservoirs, and within the surf zone.	**Present.** Occurs at Lake Merced.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
OTHER SPECIAL-STATUS SPECIES (cont.)				
Birds (cont.)				
Cliff swallow *Petrochelidon pyrrhonota*	--	§3503	Traditionally build nests on vertical cliff faces however have adapted to man-made structures in urban environments including buildings, bridges, culverts, and overpasses where swallows build their mud nests on vertical walls in groups or colonies.	**Present.** Colonies have been known to nest under bridge between South Lake and Impound Lake within the study area
Double-crested cormorant *Phalacrocorax auritus*	--	WL, §3503	Rookery breeder in coastal areas and inland lakes in fresh, saline, and estuarine waters.	**Present.** Large nesting colonies are present at Lake Merced. Known to nest on the west side of South Lake near the San Francisco Police Department Firing Range which is located northwest of the Project alignment.
Nuttall's woodpecker *Picoides nuttallii*	BCC	§3503	Oak and riparian woodlands.	**Present.** Frequently observed around Lake Merced.
Sora *Porzana carolina*	--	§3503	Fresh and saline emergent wetlands.	**Present.** Occurs at Lake Merced.
Pied-billed grebe *Podilymbus podiceps*	--	§3503	Lacustrine habitats and freshwater emergent wetlands.	**Present.** Breeds at Lake Merced.
Virginia rail *Rallus limicola*	--	§3503	Fresh and saline emergent wetlands.	**Present.** Occurs at Lake Merced.
Allen's hummingbird *Selasphorus sasin*	BCC	§3503	Brush and woodlands.	**Present.** Breeds in the study area.
Yellow warbler *Setophaga petechia*	BCC	CSC	Nests in dense riparian cover and montane chaparral. Breeding distribution includes the coast ranges and western slopes of the Sierra Nevada. Rare to uncommon in lowland areas.	**Present.** Breeds at Lake Merced.
Pygmy nuthatch Sitta pygmaea	--	§3503	Coniferous forests and pinyon-juniper habitats.	**Present.** Breeds in the coniferous forest of the Olympic Club within the study area.
Lawrence's goldfinch *Spinus lawrencei*	BCC	§3503	Open woodlands, chaparral near fields for foraging seeds.	**Low.** Marginal habitat is present in the study area.
American goldfinch *Spinus tristis*	--	§3503	Cismontane foothills; riparian and cropland habitats.	**Present.** Breeds at Lake Merced.
Bewick's wren *Thryomanes bewickii*	--	§3503	Chaparral; also pinyon-juniper woodlands.	**Present.** Breeds at Lake Merced.
Barn owl *Tyto alba*	--	§3503.5	Open areas including chaparral, grassland, riparian, wetlands.	**Present.** Occurs at Lake Merced.
Barn swallow *Hirundo rustica*	--	§3503	Open areas from coastal grassland and shrubland to mixed coniferous forests.	**Present.** Breeds at Lake Merced.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name ***Scientific Name***	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
OTHER SPECIAL-STATUS SPECIES (cont.)				
Mammals				
Pallid bat *Antrozous pallidus*	--	CSC	Prefers caves, crevices, hollow trees, or buildings in areas adjacent to open space for foraging. Associated with lower elevations in California.	**Low.** Suitable roosting habitat is available in buildings around Lake Merced. This species was not detected during 2009 surveys in San Francisco parks (Krauel, 2009). Not expected to breed here but may be present on a transient basis.
Townsend's big-eared bat *Corynorhinus townsendii*	--	CSC, SC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings of rocky areas with caves or tunnels. Roosting sites limited. Extremely sensitive to human disturbance.	**Low.** Suitable roosting habitat is available in buildings around Lake Merced. This species was not detected during 2009 surveys in San Francisco parks (Krauel, 2009).
Steller [northern] sea lion *Eumetopias jubatus*	DL	--	This species forages in the open ocean but can also occur in near shore waters and haul out on local beaches to rest, molt, mate, and raise young during breeding season.	**Low.** The closest active rookeries for this species are located at Año Nuevo and the South Farallon Islands. Individuals may occur off shore of the study area or on study area beaches during rare stranding events.(NOAA, 2014)
western red bat *Lasiurus blossevillii*	--	CSC	Roosts primarily in trees, 2-40 feet above ground, from sea level up through mixed conifer forests. Prefers habitat edges and mosaics with trees that are protected from above and open below with open areas for foraging.	**Moderate.** Roosting habitat is available in tree/shrub foliage at Lake Merced and Fort Funston. Documented at Fort Funston during 2004-2005 surveys (Fellers, 2005). In 2009 surveys, this species was found in some San Francisco parks containing water bodies (Krauel, 2009).
hoary bat *Lasiurus cinereus*	--	*	Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths; requires water.	**Low.** Roosting habitat is available in large-diameter trees at Lake Merced and Fort Funston. Documented at Fort Funston during 2004-2005 surveys (Fellers, 2005); however, not detected during 2009 surveys in San Francisco parks (Krauel, 2009). May be present on a transient basis.
Yuma myotis *Myotis yumanensis*	--	*	Optimal habitats are open forests and woodlands with water sources to feed over. Roosts in buildings, trees, mines, caves, bridges, and rock crevices. Maternity colonies active May through July.	**Moderate.** Roosting habitat is available in tree/shrub foliage at Lake Merced and Fort Funston. Documented at Fort Funston during 2004-2005 surveys (Fellers, 2005). In 2009 surveys, this species was found in some San Francisco parks containing water bodies (Krauel, 2009).
American badger *Taxidea taxus*	--	CSC	Open grasslands with loose, friable soils.	**Absent.** No suitable habitat present.

TABLE 2 (Continued)
SPECIAL-STATUS ANIMAL SPECIES THAT MAY OCCUR IN THE STUDY AREA

Common Name *Scientific Name*	**Federal Status**	**State Status**	**Habitat Description**	**Potential to Occur in the Study Area**
OTHER SPECIAL-STATUS SPECIES (cont.)				
Mammals (cont.)				
Point Reyes jumping mouse *Zapus trinotatus orarius*	--	CSC	Upland areas of bunch grass in marshes in Point Reyes.	**Absent.** Study area is south of the known range for this species.

NOTES:
The "Potential for Effect" category is defined as follows:
High = Species is expected to occur and habitat meets species requirements.
Moderate = Habitat is only marginally suitable or is suitable but not within species geographic range.
Low = Habitat does not meet species requirements as currently understood in the scientific community.

STATUS CODES:
Federal:
FE = Listed as "endangered" under the federal Endangered Species Act
FT = Listed as "threatened" under the federal Endangered Species Act
FSC = NOAA Fisheries designated "species of concern"
FPD = Proposed delisted
FD = Delisted
BCC = Bird of Conservation Concern

State:
CE = Listed as "endangered" under the California Endangered Species Act
CT = Listed as "threatened" under the California Endangered Species Act
CSC = California Department of Fish and Wildlife designated "species of special concern"
CFP = California Department of Fish and Wildlife designated "fully protected"
SC = California Department of Fish and Wildlife designated "candidate threatened"
WL = California Department of Fish and Wildlife designated "watch list"
§3503 = Eggs, Nests, and Nestlings Protected under Section 3503 of the California Fish and Game Code
§3503.5 = Eggs, Nests, and Nestlings of Falconiformes and Strigiformes Protected under Section 3503.5 of the CDFG Code
* = California special animal

Other:
Western Bat Working Group (WBWG):
Low = Stable population
Medium = Need more information about the species, possible threats, and protective actions to implement.
High = Imperiled or at high risk of imperilment.

SOURCE: CDFW, 2015a; CNDDB, 2015; eBird, 2015a; eBird, 2015b; Fellers, 2005; Holzman, 2005; Jones and Stokes, 2007; Krauel, 2009; NOAA, 2013; NPS, 2012; SFFO, 2003; USFWS, 2015.

Vegetation Change Analysis Methodology Associated with Lake Merced Water Level Changes

Appendix D summarizes the Lake Merced vegetation change analysis conducted by ESA for Vista Grande Drainage Basin Improvement Project which addresses the effects of water level increases on shoreline vegetation.[1] Building upon prior studies, ESA updated a GIS vegetation layer created by Nomad Ecology in 2010[2]. Using ArcGIS, ESA overlaid the 2010 vegetation data on a high resolution 2011 aerial photograph and then ground-truthed the resulting imagery in the field in May 2012. In general, the 2010 data correlated well with aerial signatures of the various vegetation types on the 2010 aerial photo and conditions on the ground. All discrepancies were mapped in the field and the 2010 vegetation layer was updated using the annotated field maps and aerial interpretation comparing the 2008 and 2011 aerials. To reduce the complexity of modeling vegetation change in response to water level management, many of the distinct vegetation types mapped by Nomad Ecology (2011) were combined with similar types. Table 3.4-5 in the Approach to Analysis: Operational Impacts – Lake Level Management subsection of the Biological Resources Operational Impacts section presents the results of the vegetation mapping update, along with results from 2002, and 2010, for comparative purposes. See Figure 3.4-6 in the same subsection for the updated Lake Merced vegetation map.

A GIS database was constructed using Light Detection and Ranging (LIDAR) (Foxgrover and Barnard, 2012) surface topographic data, and bathymetric data supplied by the San Francisco Public Utilities Commission (SFPUC) (Sea Survey/Entrix, 1987; Talavera & Richardson, 2001). The two data sets differ substantially in precision and vertical control, such that the bathymetric data were adjusted by hand to conform more closely with the greater vertical precision of the LIDAR data[3] as well as current aerial photos (USGS, 2011). For example, in many cases, overlays of vegetation mapping and the bathymetric data resulted in the appearance of certain species or vegetation types occurring in much deeper water than field observations would support.

A set action of "action rules" was developed to predict the response of different vegetation types to changing inundation levels. Action rules were drawn from previous modeling efforts specific to Lake Merced (Stillwater Sciences, 2009; EDAW, 2004) and Lower Crystal Springs Reservoir (ESA, 2009), available literature on vegetation tolerance to inundation, and field observations. The action rules (see Table 3) are based on the following general principles:

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1 The same vegetation change analysis methodology for Lake Merced has previously been applied to the San Francisco Groundwater Supply Project and the Groundwater Storage and Recovery Project EIRs, both of which have the potential to result in lake level decreases and the Groundwater Storage and Recovery Project has the potential to result in lake level increases. The analysis supporting these EIRs assessed effects of both lake level increases and decreases on shoreline vegetation.

2 The 2010 GIS vegetation layer was created by Nomad (2011) using heads up digitizing on a 2008 aerial photo base and then verifying the results in the field.

3 The original bathymetric data created by Sea Survey and Entrix in 1987 was digitized from a scanned image and adjusted to "fit" a 2001 orthophoto background by Talavera & Richardson in 2001. Upon comparing the bathymetric data with April, 2011 aerial imagery it was clear that the data did not fit within the confines of lake as shown in the current aerial imagery. ESA adjusted the bathymetry again to fit the current imagery. The accuracy of the bathymetric data affects the amount of vegetation impacted with decreasing water surface elevation, which may be overestimated or underestimated.

TABLE 3
VEGETATION MODEL ACTION RULES

Class/Vegetation Type	Remove:	Add:	Replacer Status	Conflict Rule for Adding:
Class1[a]				
Bulrush wetland	<-5	0 to -5	Primary Replacer	In areas of replacement overlap, the adjacent replacer wins. In areas where both replacers are adjacent, bulrush wins. In areas of no replacer adjacency, bulrush wins.
Cattail	<-3	0 to -3	Secondary Replacer	
Knotweed wetland	<-2	0 to -2	Secondary Replacer	
Class 2[a]				
Arroyo willow	<0	1 to 0	Primary Replacer	In areas of replacement overlap, the adjacent replacer wins. In areas where both replacers are adjacent, willow wins. In areas where no adjacency, willow wins.
Rush meadow	<-1	1 to 0	Secondary Replacer	
Giant vetch	<-1	na	na	
Class 3[a,b]				
Coastal scrub	<1	na	na	
Dune scrub	<1	na	na	
Oak woodland	<1	na	na	
Non-native forest	<1	na	na	
Non-native herbaceous	<1	na	na	
Annual grassland	<1	na	na	
Perennial grassland	<1	na	na	

NOTES: Seasonal variation is 1 foot higher than average in wet season and 1 foot less than average in dry season.
Elevations are relative to modeled water surface elevation.

[a] **Class 1 - Tolerant:** Can survive permanent inundation at depths equal to or less than 5 feet below average annual WSE.
Class 2 - Moderately Intolerant: Survives inundation up to 3 months during dormant season.
Class 3 - Intolerant: This class is generally unable to survive inundation for more than two consecutive weeks.

[b] Upland vegetation types would not replace others as WSE rises.

SOURCE: ESA, 2012

The lower limit of both woody and herbaceous upland vegetation is determined by the maximum water surface elevation (WSE). The lower limit of upland vegetation is determined by inundation frequency and duration, a principal that also is applied in the federal method for determining the boundary between wetlands and non-wetlands for jurisdictional purposes. Observations of current conditions at Lake Merced, coupled with previous mapping and descriptions (SFRPD, 2006; May and Associates, 2009; Nomad Ecology, 2011) indicate that the lower limit of upland woody vegetation is above the maximum WSE, which restricts upland plant species lacking adaptation to prolonged inundation or soil saturation. Upland woody vegetation will occur, but not persist, at the mean water level, and will be replaced by opportunistic wetland vegetation dominated by bulrush and knotweed. The lower limits of upland herbaceous communities also extend down to the maximum WSE, and would be replaced by wetlands if the water level rises.

The upper and lower limits of wetland vegetation depend on depth of inundation and inundation tolerance. For example, most herbaceous wetlands fringing Lake Merced occur no higher than one foot above the projected existing conditions mean WSE of 5.7 feet and at assumed depths no greater than two feet below WSE. The wetland species that make up these communities do not require year-round inundation. In contrast, bulrush wetlands require at least nine months inundation or soil saturation, readily tolerate permanent inundation, and are found at elevations no more than one foot above the seasonal high water elevation, and no greater than five feet lower than mean WSE.

Vegetation was categorized into three classes associated with water inundation tolerance. Inundation tolerance is largely a function of seasonal fluctuations in lake levels. Monthly water levels increase up to one foot above the annual average during winter (February through May), declining to one foot below average annual water level towards the end of the growing season (August through November) (Stillwater, 2009). Class 1 includes vegetation types that are extremely tolerant and can survive permanent inundation. Class 2 vegetation is somewhat tolerant and can survive partial inundation due to seasonal variations. Class 3 vegetation is intolerant and cannot survive seasonal inundation. ESA developed action rules based on this classification that determined how vegetation would die or establish as WSE rises.

Replacement criteria not only took elevation relative to WSE into account but also adjacency of vegetation types. Overlapping depth tolerance among different wetland types requires complex rules for resolving conflicts when two wetland types have the potential to occupy the same elevation zone. For the purposes of the analysis, therefore, these conflicts were resolved by creating action rules that restrict the amount of overlap. The action rules also govern interactions between vegetation types for projected WSE that would cause the loss of one type and its replacement by one or more other type. For example, bulrush and knotweed have a somewhat overlapping tolerance to inundation. Priority rules for replacement instruct the GIS-based analysis to replace a “drowned” vegetation type with bulrush or knotweed (the most aggressive “replacer” types) based on the elevation of the replaced vegetation and its proximity to the nearest replacer type.

The GIS-based analysis was conducted to estimate vegetation response to changes in lake levels over time using the newly updated vegetation data, topography, bathymetry, slope, output from the water level models (Kennedy/Jenks, 2012), and the action rules for vegetation change. For the purposes of the vegetation change analysis, the initial baseline estimates for existing vegetation acreage are those which would occur at a mean annual water surface elevation of 6 feet City Datum. This is slightly higher than the baseline water surface elevation of 5.7 feet used for the Kennedy Jenks hydrologic modeling but was necessary in order to correspond to the topographic data, which was created at one foot elevation intervals. The 2012 vegetation mapping update was based on an April 2011 aerial photograph, at which time, according to historic water surface elevation data (SFPUC, 2011), Lake Merced water surface elevation was at about 7 feet City Datum, and field observations made in May, 2012. The acreages given for the 6-foot WSE were obtained by running the receding WSE model on the 2012 vegetation data. In addition, the analysis only included vegetation at or below 13 feet City Datum, since this is the maximum possible lake water level due to the existing spillway height and therefore, elevation, at which vegetation change would be expected due to changes in WSE. Therefore, for the upland vegetation types and for arroyo willow riparian scrub, acreage located above the 13 foot elevation, as mapped in Figure 3.4-6 in the Biological Resources Operational Impacts section, Approach to Analysis: Operational Impacts – Lake Level Management subsection, would remain unchanged.

To determine impacts to vegetation associated with water surface elevation change it is necessary to have an accurate topographical representation of the area. For elevation above the surface of Lake Merced, ESA obtained a high resolution LIDAR derived digital elevation model (DEM) to provide accurate elevation data. Past Lake Merced inundation studies used 1 foot photogrametically created elevation contour data derived from flights of the area in 1996. The LIDAR derived elevation data were used in place of the photogrammetry data because they are considerably more current (2010) and determined to be a better representation of current conditions[4]. From the DEM, ESA created 1 foot elevation contour polygons so that areas could be calculated for each elevation range. For bathymetric topography ESA used contour data provided by the SFPUC. These contours were originally created from depth soundings of the lakes in 1987; the data was subsequently adjusted in 2001 to fit current aerial photos of that time. Visual analysis of the contour data compared to current aerial photos (2011) revealed inconsistencies along the shoreline. It was therefore necessary to modify the bathymetric data to match the aerial photos and surface DEM to create an accurate topographical representation. The adjusted bathymetric data was converted to a Triangular Irregular Network (TIN) which in turn was used to produce 1 foot contour polygons by interpolating elevation gaps in the original contour data. The 1 foot bathymetric elevation contours and the 1 foot DEM derived surface elevation contours were then combined to create a complete elevation dataset of the area. This finished elevation dataset was intersected with the vegetation data to determine distribution of vegetation by elevation ranges.

Two different approaches were used in this methodology to determine impacts to vegetation associated with increasing and decreasing water surface elevation at Lake Merced. As the Vista Grande Drainage Basin Improvement Project would contribute to lake level increases over time, only the approach for determining impacts to vegetation from increasing WSE are discussed. A GIS approach similar to past inundation studies was used to asses impacts associated with an increase in water surface elevation. As described above, action rules were established for each vegetation type dictating how vegetation would respond to increasing water surface elevation. Once the action rules were established for a relative water surface elevation, they were applied to every 1 foot contour up to the 13 foot spillway elevation. The resulting vegetation statistics were used to determine impacts to vegetation types due to increase in water surface elevation.

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4 LIDAR tends to be superior when there is dense vegetative cover. ESA compared aerial photos where the historic WSE was known with the LIDAR and the photogrammetry derived elevation data and the LIDAR was a better match relative to the shoreline, which represents the WSE.

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