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).

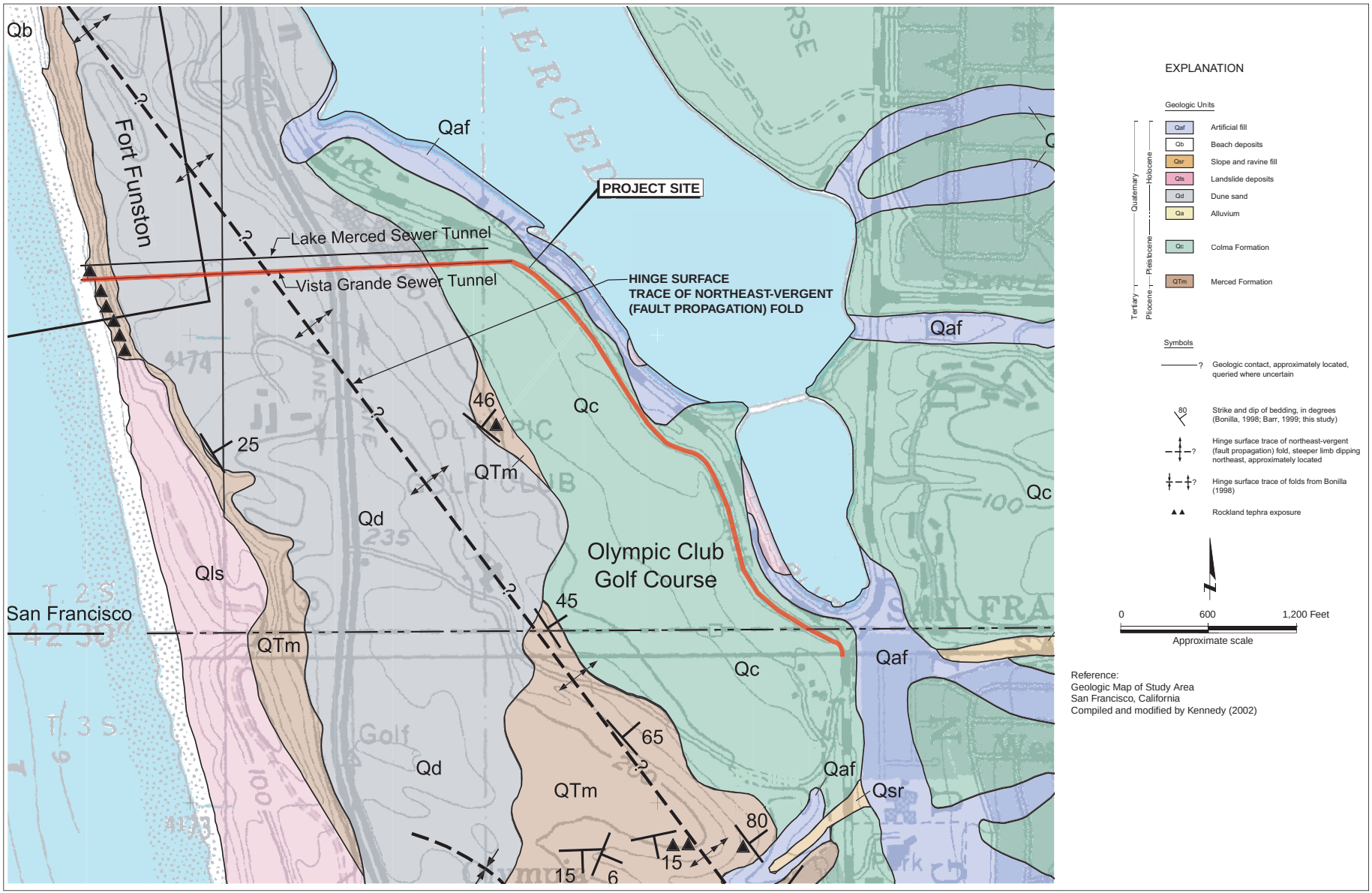
3.6.1.2 Geology

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

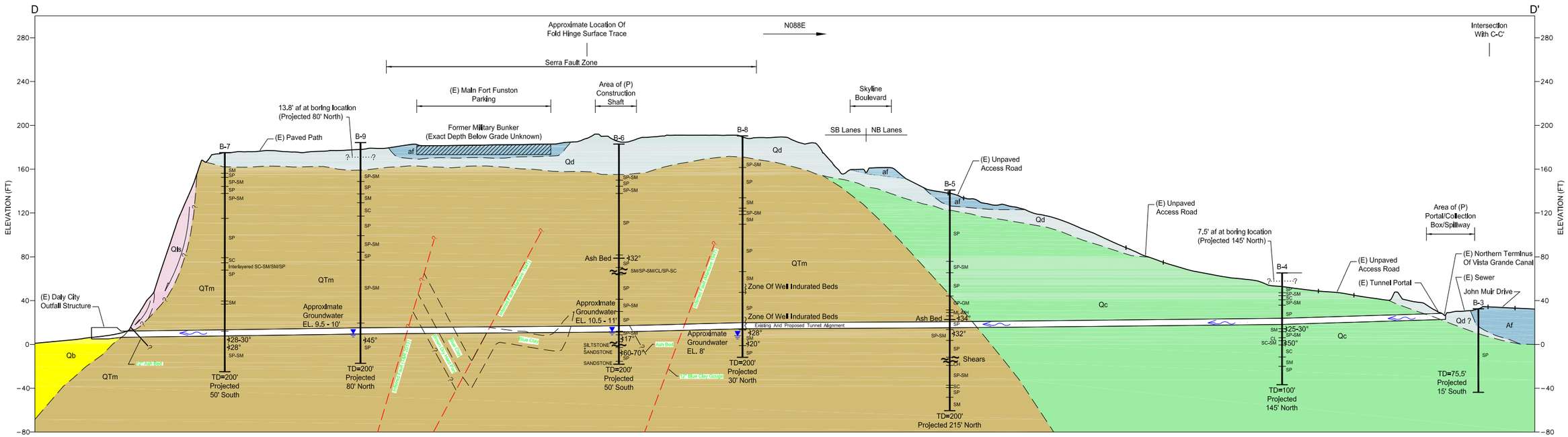
The geotechnical investigation describes the tunnel portal area as underlain by approximately 18 feet of fill, consisting of loose to medium dense sand. The fill is underlain by approximately 5 feet of Dune Sand, characterized by yellow-brown, medium dense sand and sand with silt. Based on geomorphic 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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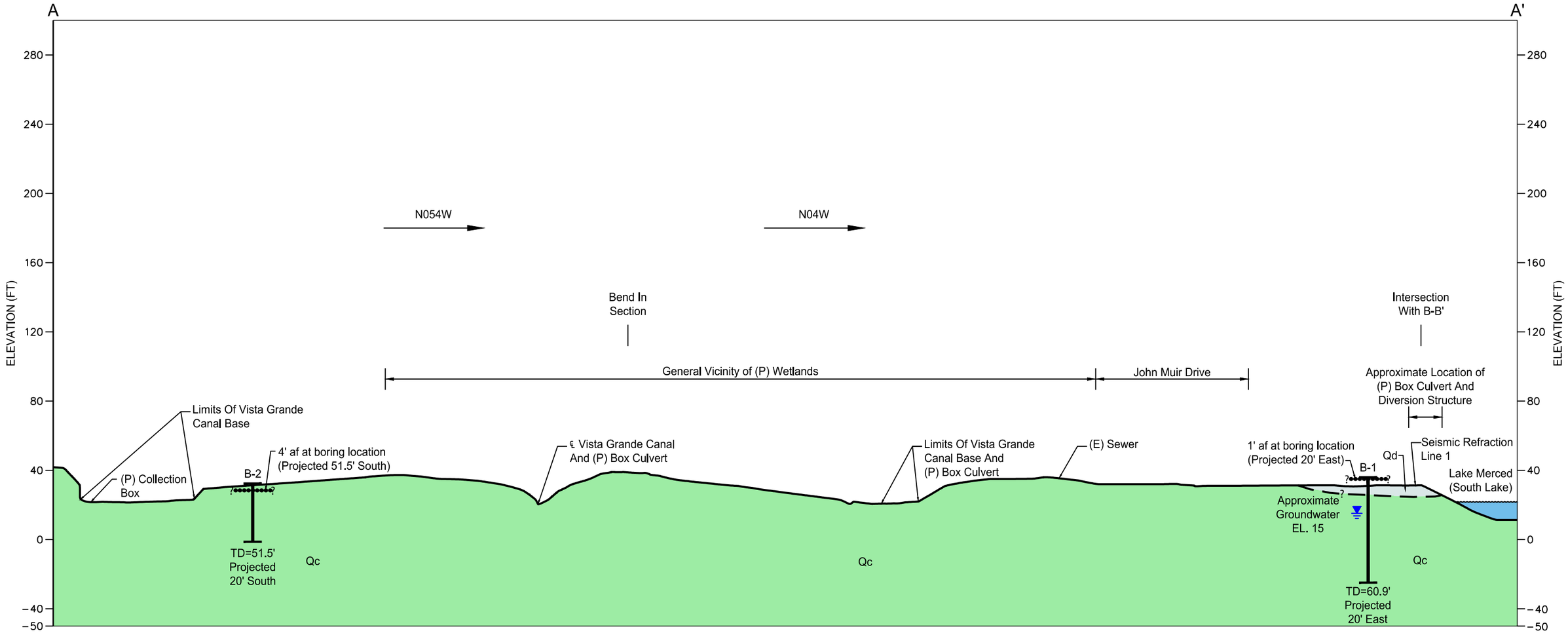
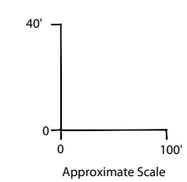
Figure 3.6-2

Geologic Cross-Section D-D'



EXPLANATION

af	Artificial fill	—— • • • ?	Geologic contact; dashed where inferred, dotted where concealed, queried where uncertain
Qls	Landslide deposits	℄	Center line
Qb	Beach sand	N04W →	Orientation of cross-section
Qd	Dune sand	(E)	Existing
Qc	Colma Formation	(P)	Proposed
QTm	Merced Formation	I	Treadwell & Rollo Exploratory Boring Locations



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

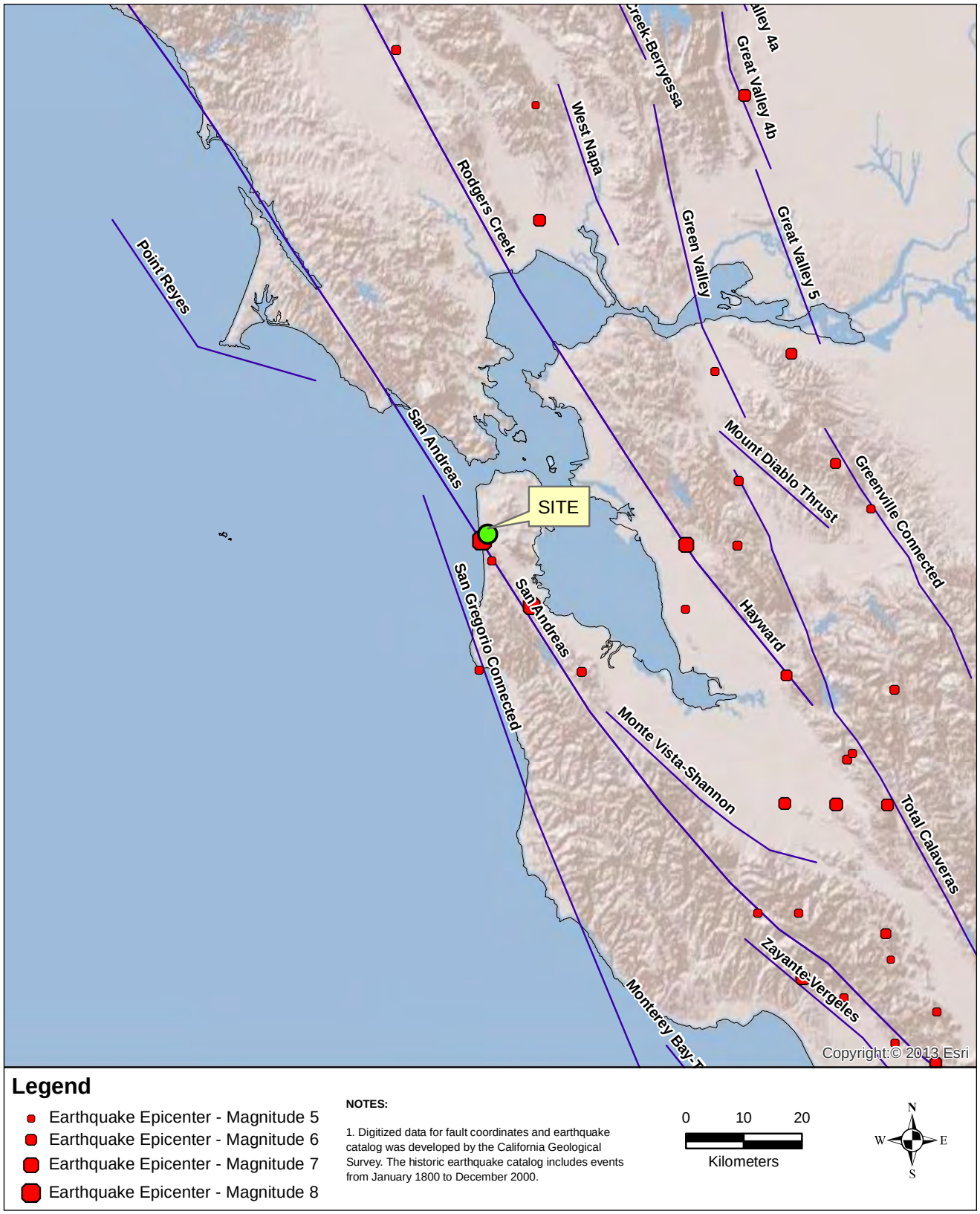
Fault Segment	Approx. Distance from fault (Miles)	Direction from Site	Mean Characteristic Moment Magnitude
N. San Andreas – Peninsula	0.7	West	7.23
N. San Andreas (1906 event)	0.7	West	8.05
San Gregorio Connected	5.0	West	7.50
N. San Andreas – North Coast	6.2	Northwest	7.51
Total Hayward	17	Northeast	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).



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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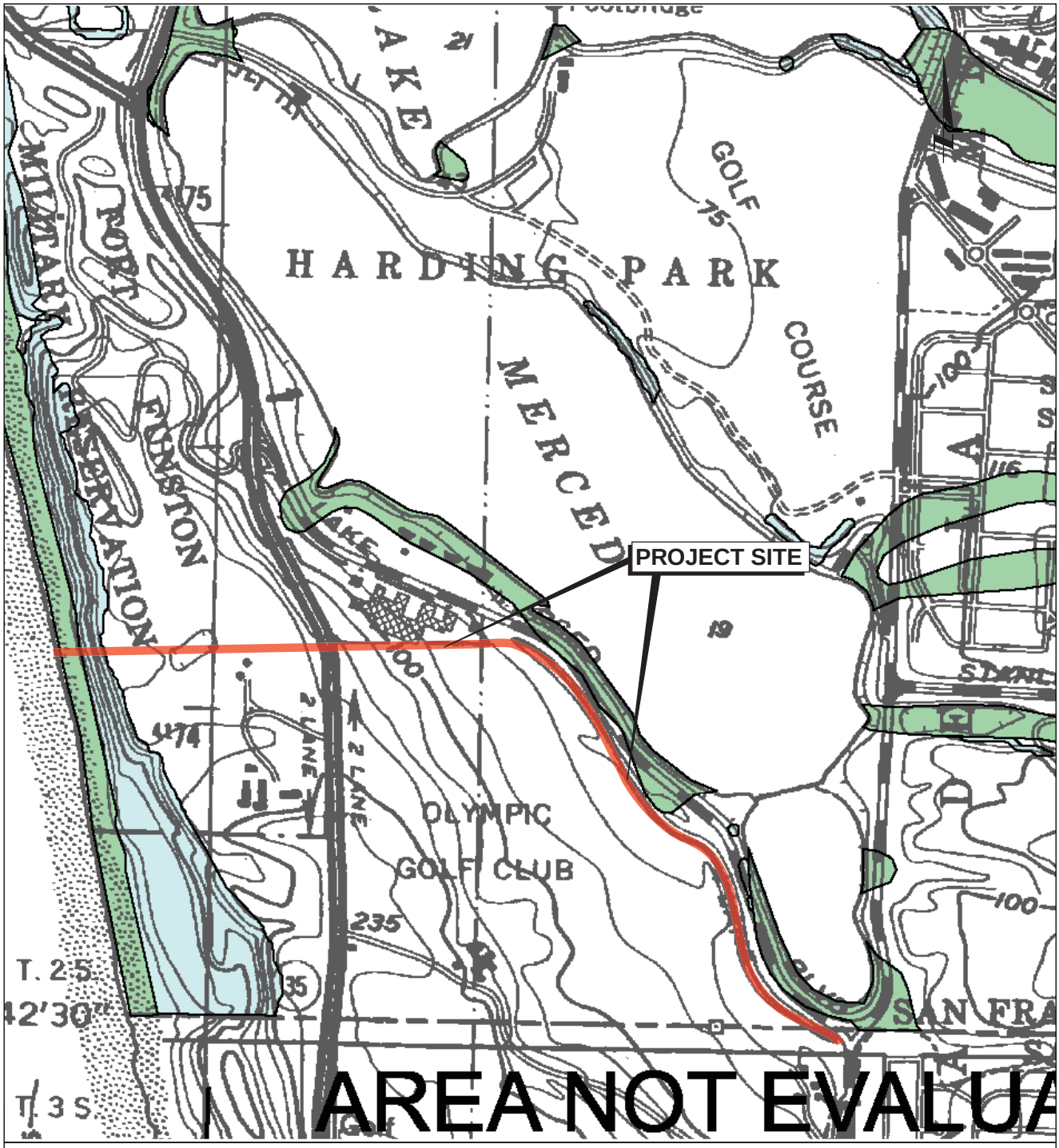
8 Cyclic densification (also referred to as differential compaction) is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground surface settlement.

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

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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

EXPLANATION

- Creeks, watershed area ≥ 0.2 km²
- Minor creek, watershed area < 0.2 km²
- Underground storm drains ≥ 24"
- Engineered channels, minor and major
- Underground drains for combined sewage and storm flows ≥ 24"
- Tunnel for combined sewage and storm flows
- Transport/storage structure for combined sewage and storm flows
- Transport/storage tunnel for combined sewage and storm flows
- Wet weather overflow point
- Direction of flow
- Wastewater treatment plant
- Force main, takes combined flows to treatment plant
- Outfall from treatment plant
- Bay, ocean or natural lakes
- Artificial bodies of water
- Bay fill
- Piers, docks, and other large structures
- Present watersheds
- Present watersheds draining into the ground

Historical Features, circa 1850

- Creeks, buried or drained dashed where location uncertain
- Ephemeral creek
- Water spread over the ground
- Lakes and lagoons
- Beach sand
- Tidal marsh
- Sloughs
- Now fill land

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.

[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

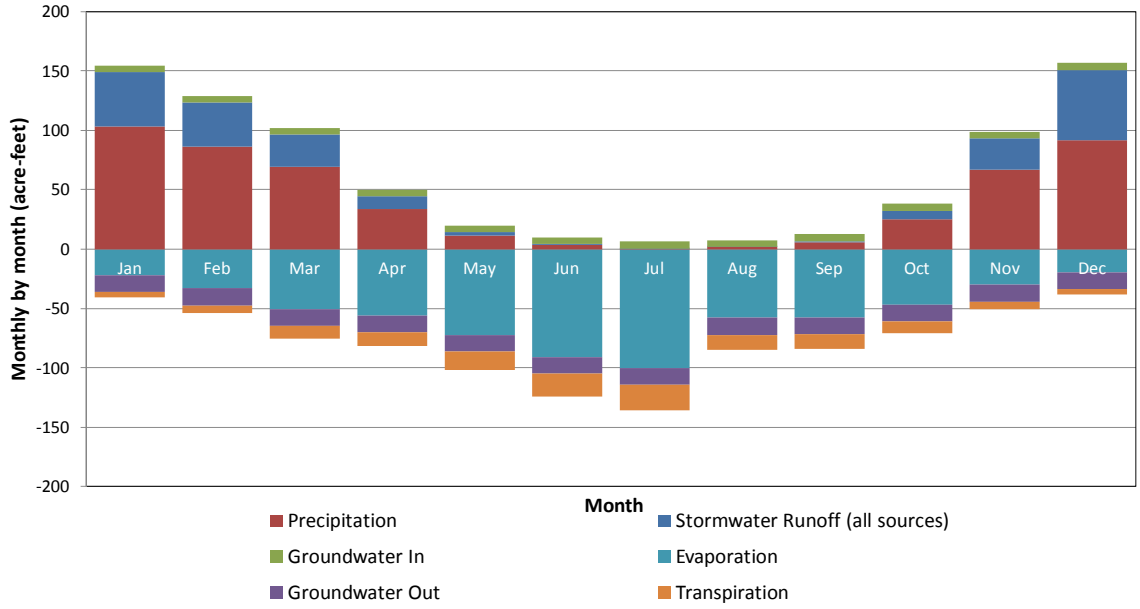
Lake Merced supports recreational activities that involve some water contact; including boating and fishing, as well as other non-contact uses such as pedestrian use of perimeter paved paths, and trails managed by the San Francisco Recreation and Park Department. The SFPUC also maintains Lake Merced 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



Vista Grande Drainage Basin Improvement Project ▪ 207036.01

SOURCE: ESA

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

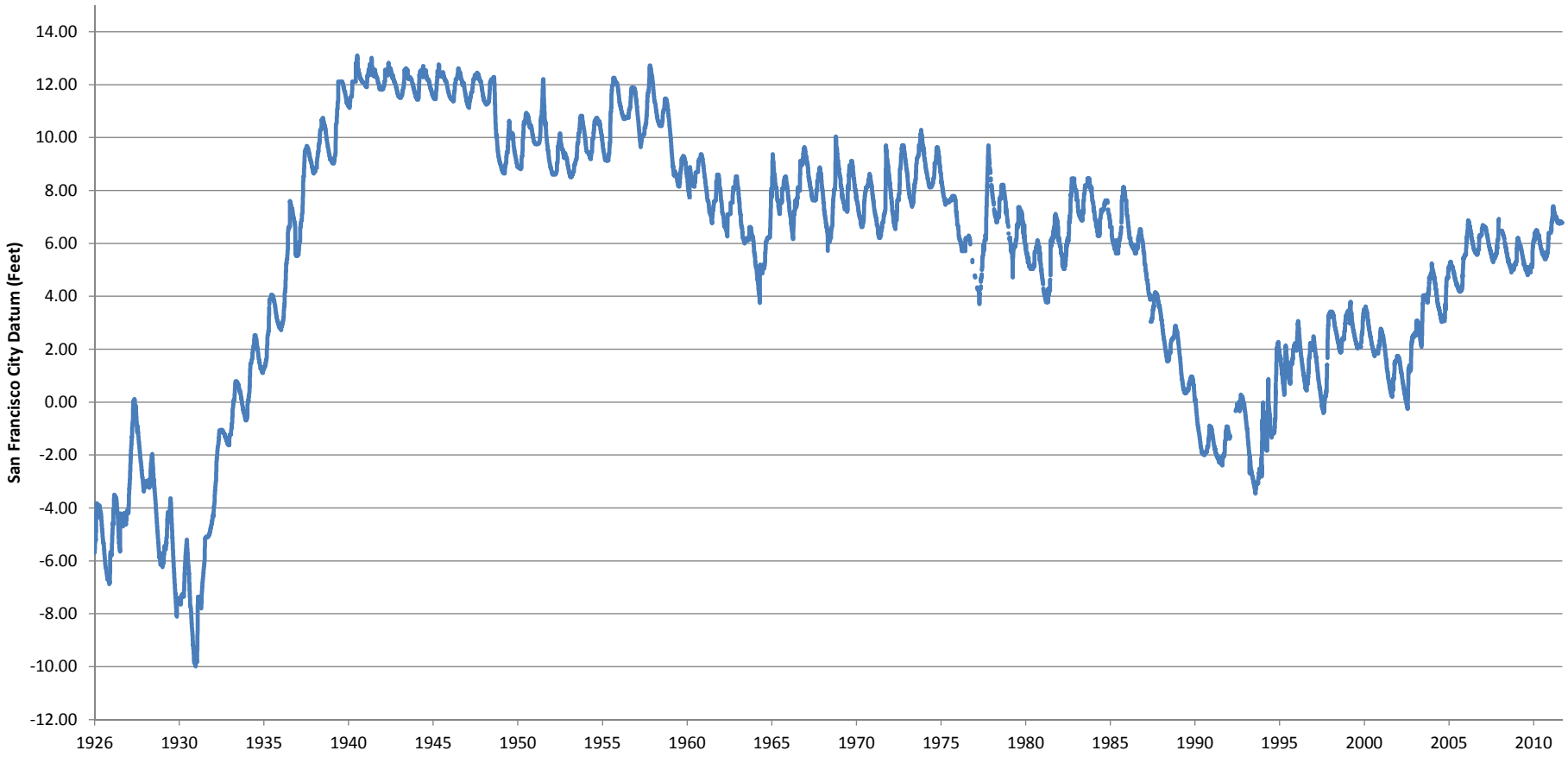
Stormwater relevant to the study area is associated with the Vista Grande Canal and Tunnel storm drain system and the SFPUC combined sewer system.

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.

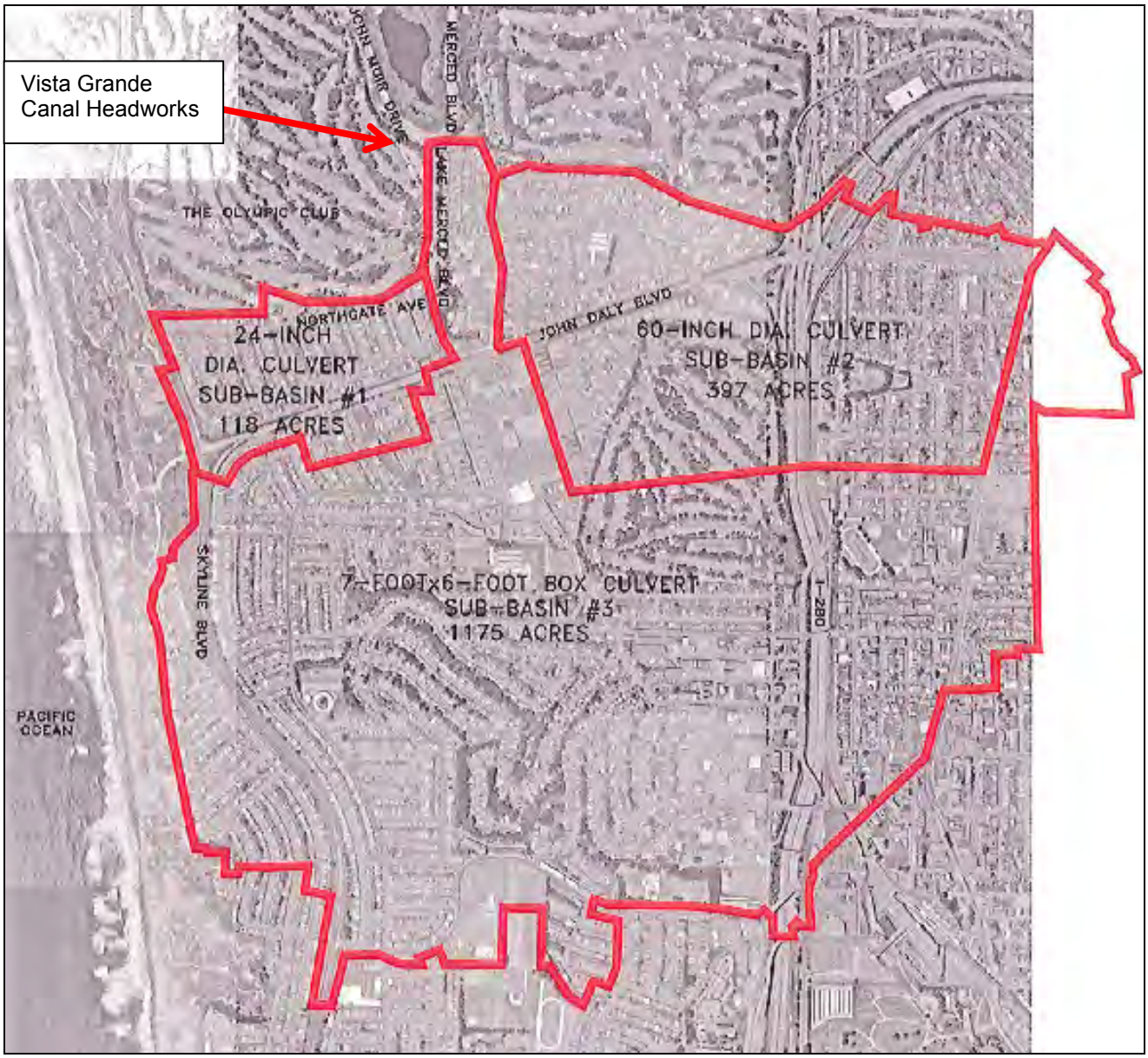
Vista Grande Canal and Tunnel

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]

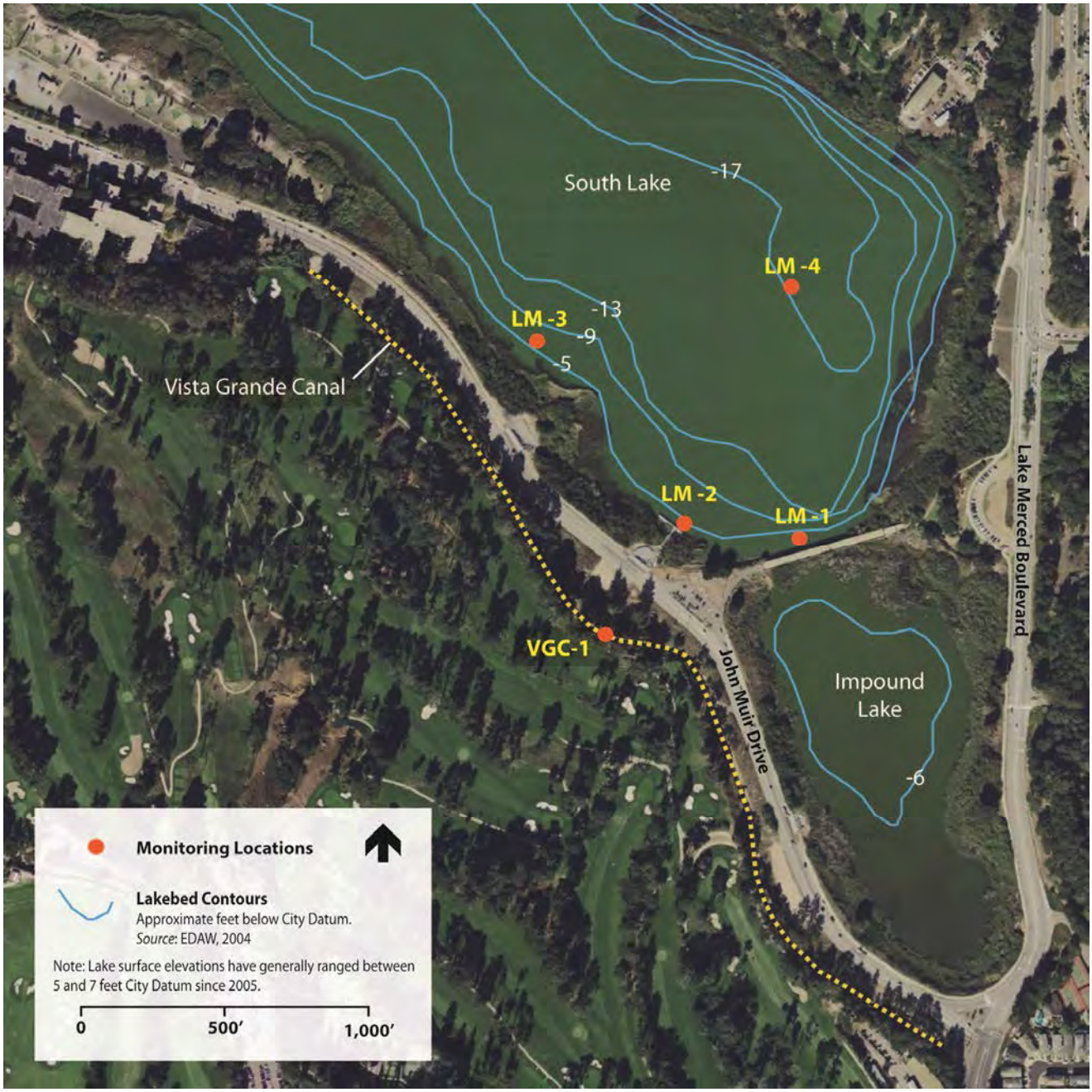
Typical dry and wet season base flow ((authorized non-stormwater runoff) that results from urban or suburban land-uses, such as irrigation runoff, car washing, foundation drains, and planned and unplanned potable water system discharges) within the Vista Grande Canal averages approximately 0.25 cubic 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

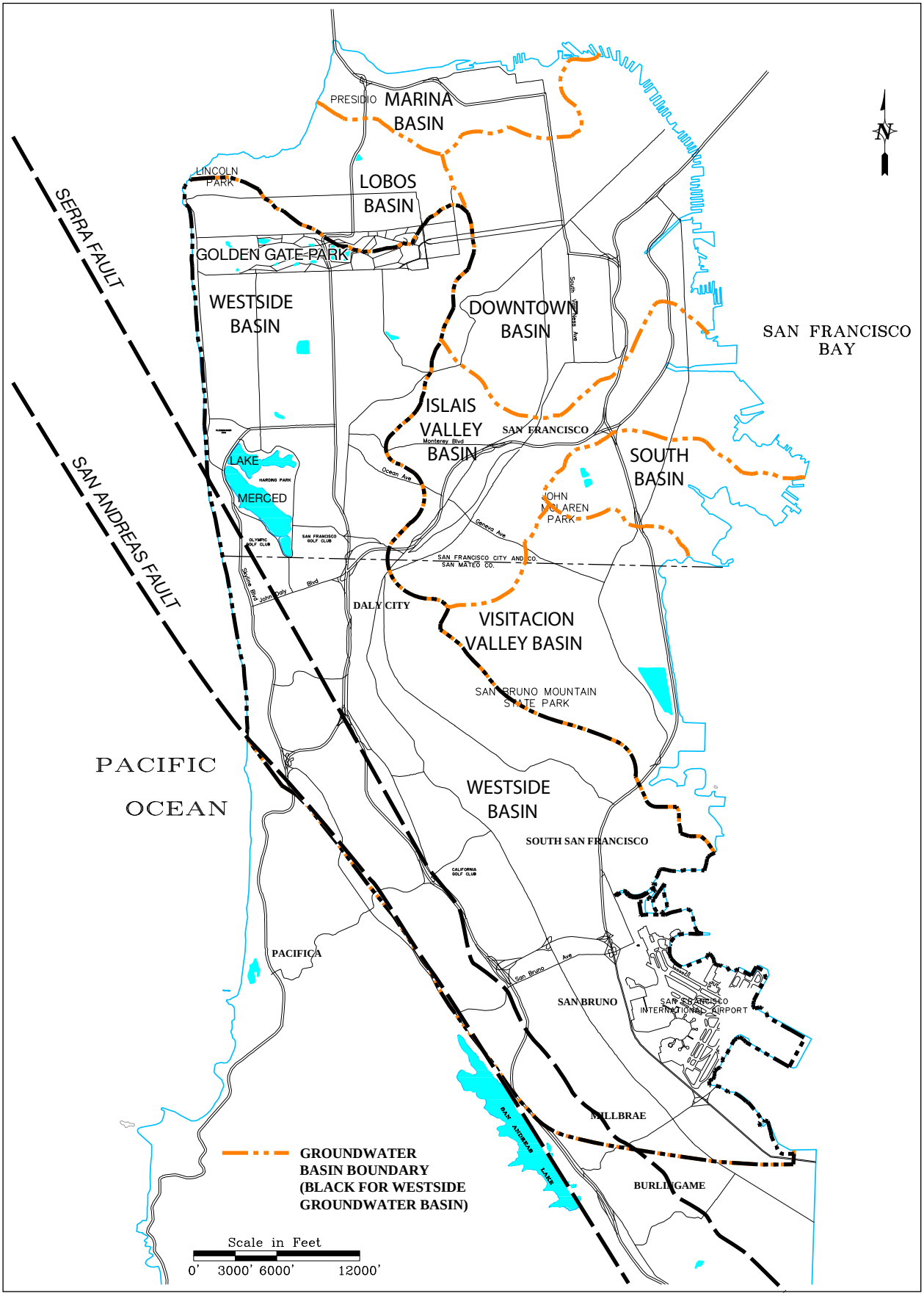
While it is important to understand historic rates of erosion, future erosion rates are of particular importance to consideration of engineering design. In general, erosion rates of coastal cliffs and beaches will increase with rising sea level (California Coastal Commission, 2015). With higher sea levels, 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).

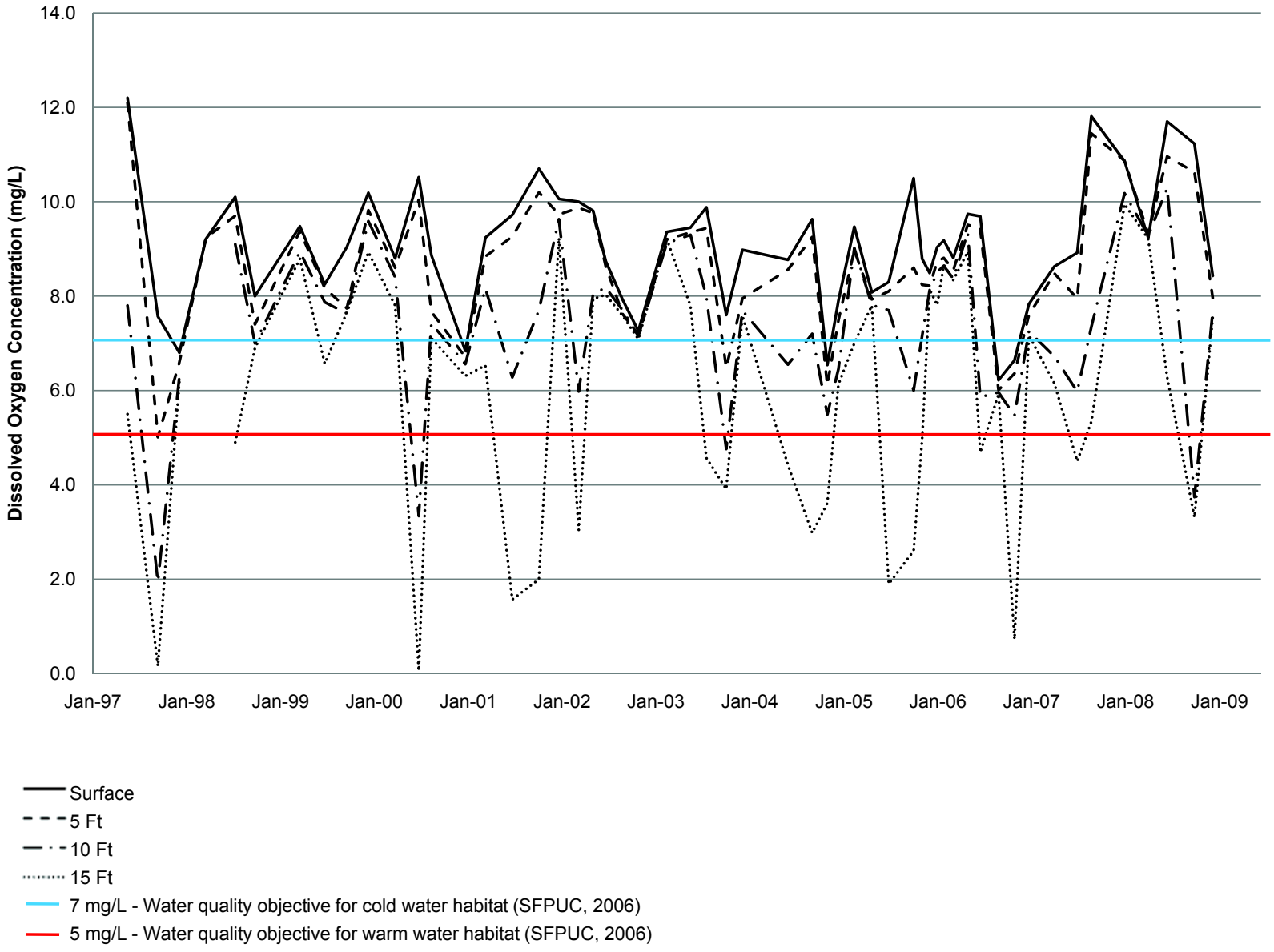
Dissolved Oxygen

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.

[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”).

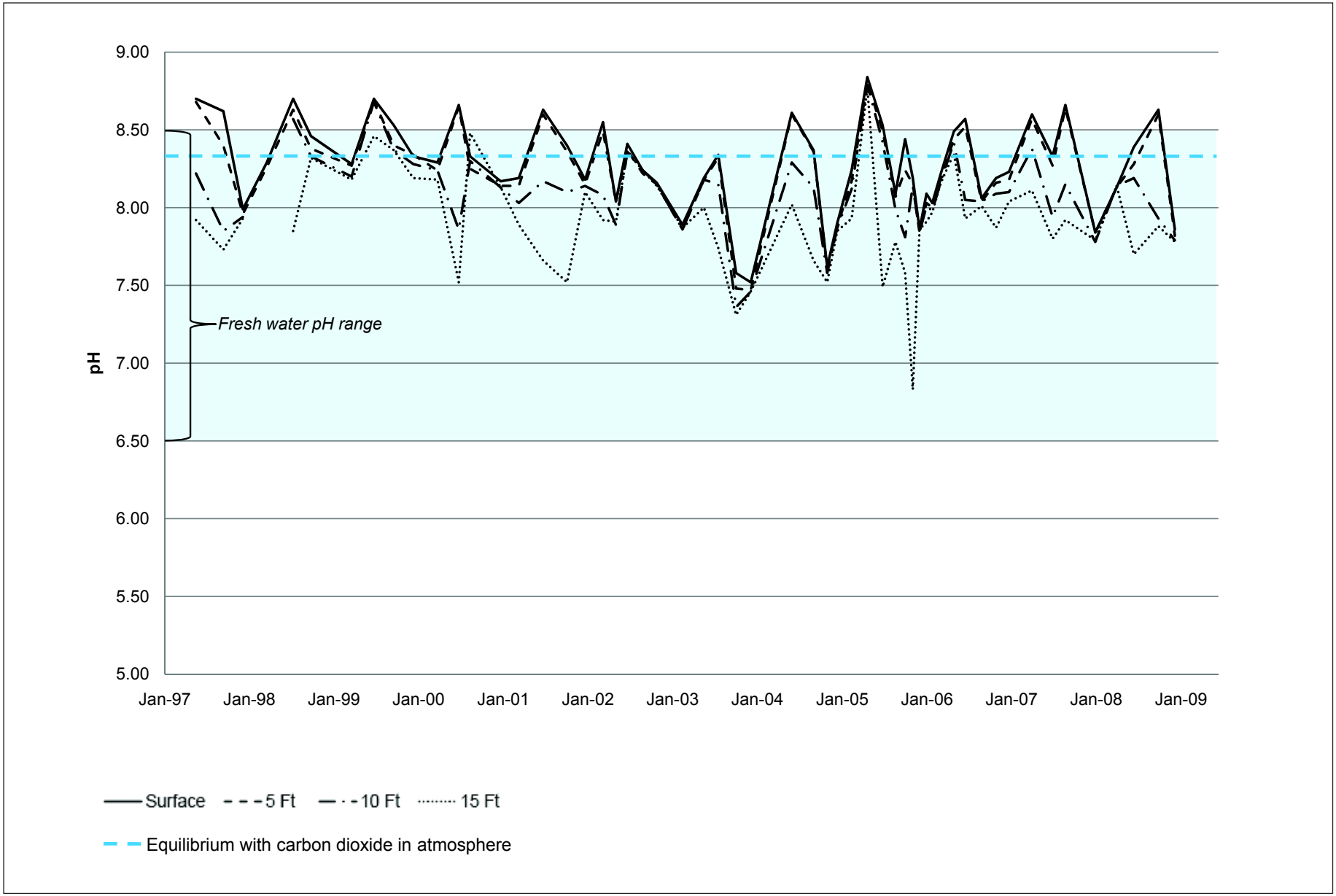


SOURCE: Kennedy/Jenks Consultatns

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-8

Dissolved Oxygen, South Lake Pump Station



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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

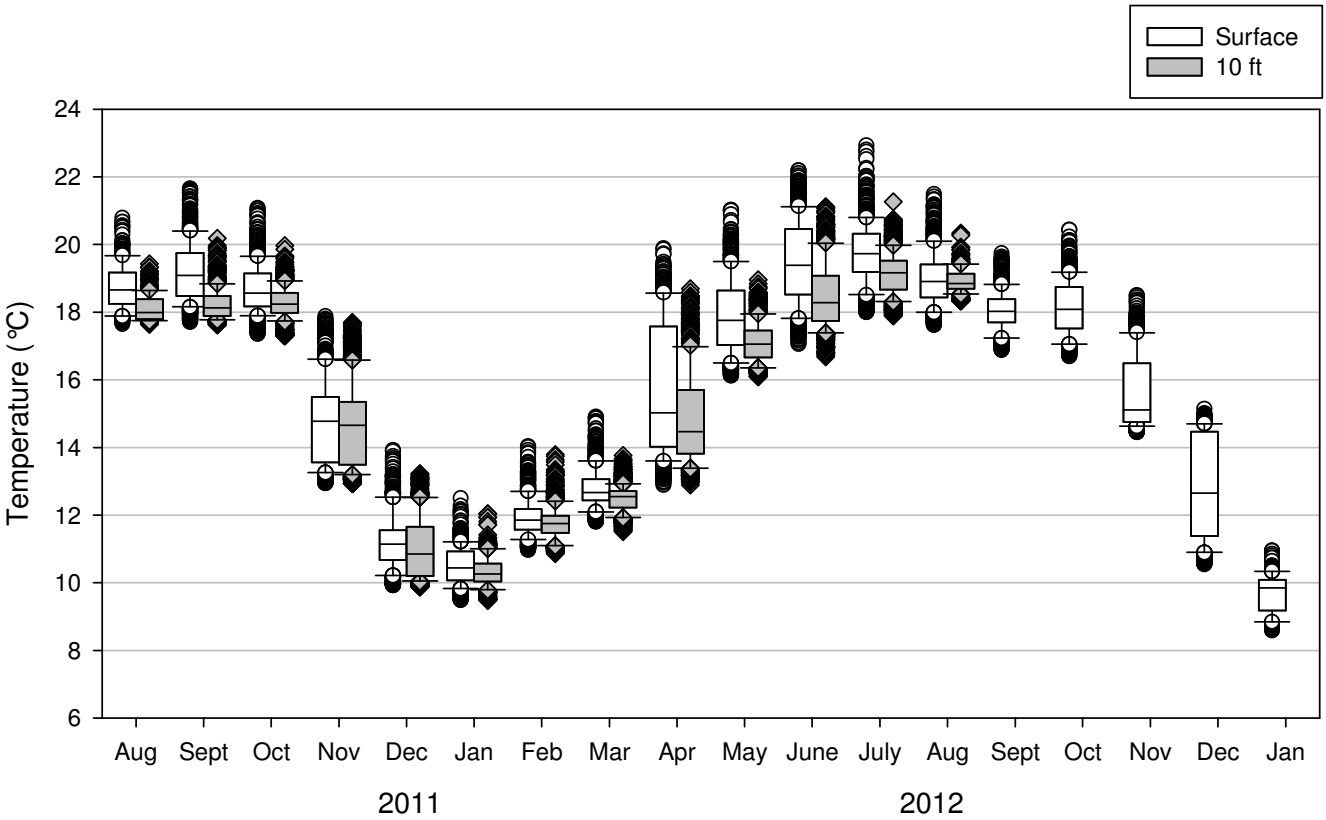
Continuous (hourly) temperature data (**Figure 3.9-10**) indicate that from approximately mid-October through mid-April, the Lake is well mixed with a relatively uniform temperature profile throughout the water column. Water temperatures during that period range from about 10 °C to 18 °C. From late spring 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.

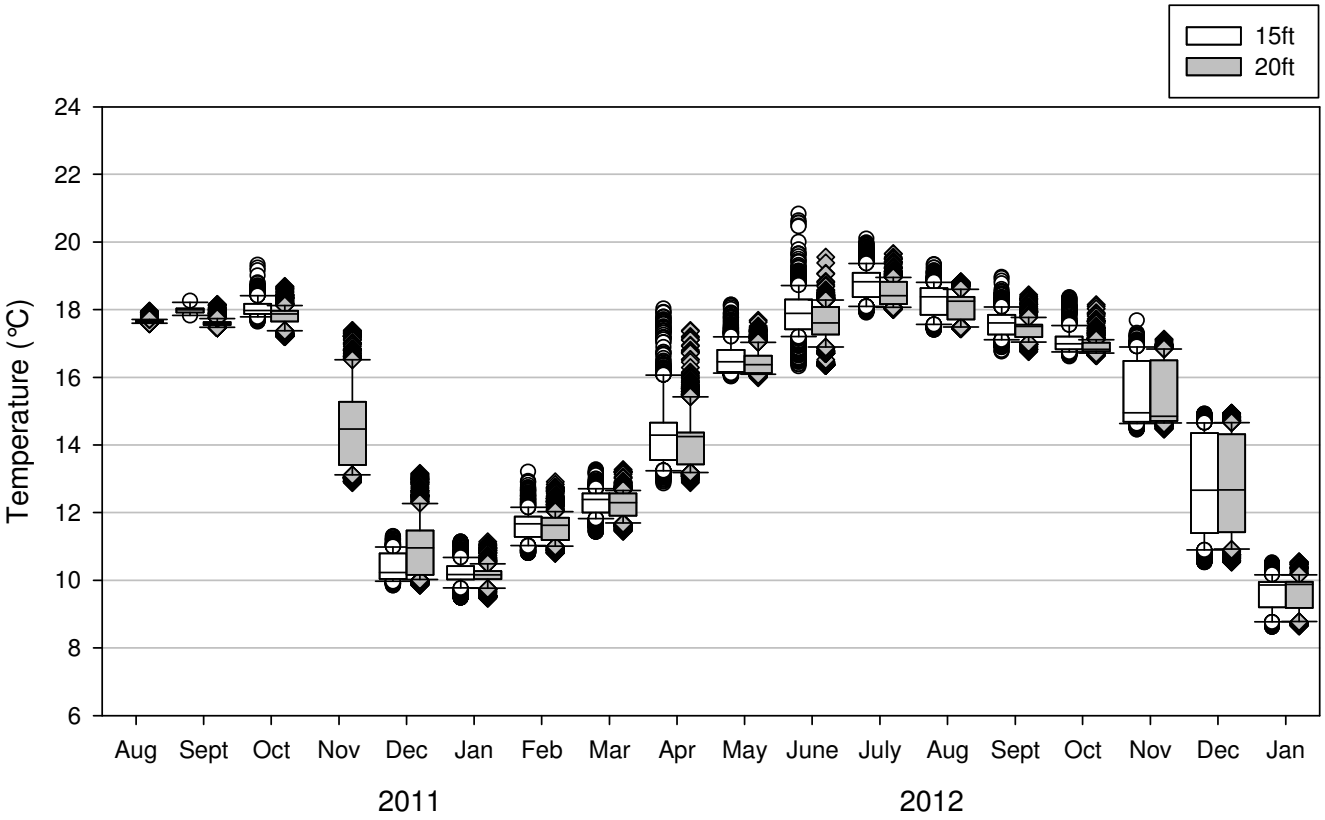
Dissolved Oxygen

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



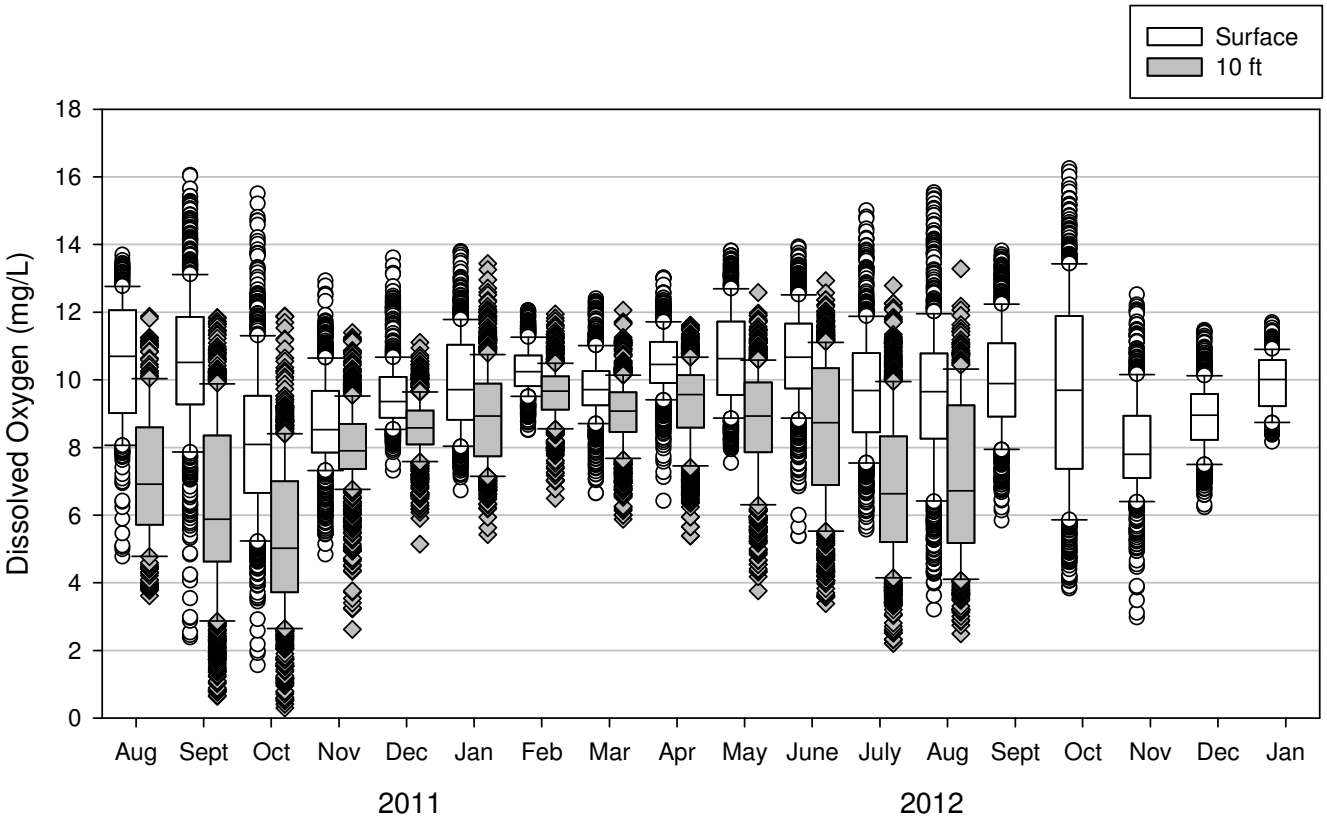


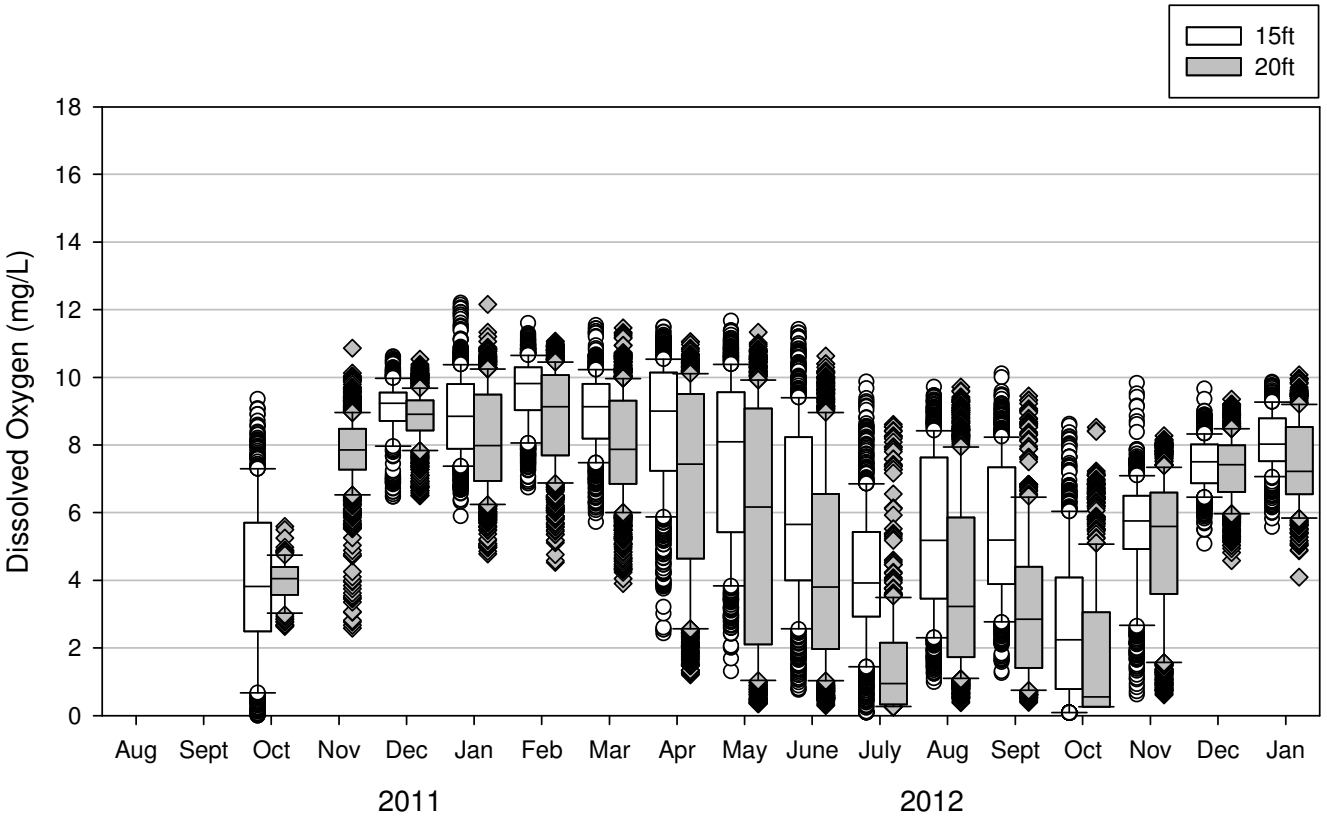
SOURCE: ESA, 2013

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**).

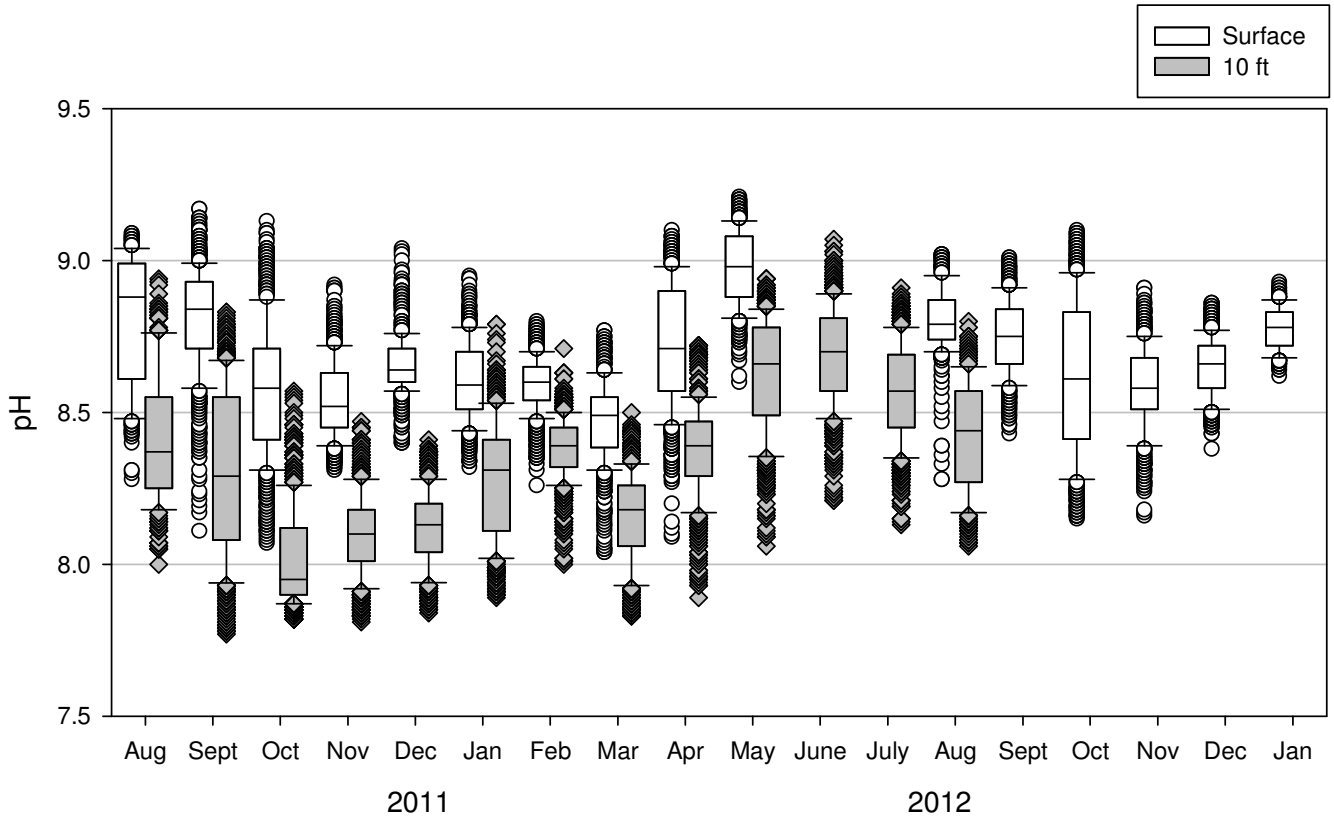
The higher pH values in Lake Merced are not typical for a system such as Lake Merced, given the sandy (acidic) nature of the Lake's drainage soils which should produce a more acid runoff water. Rain is acidic (pH equilibrium 5.7) and should not be easily neutralized passing though sandy soil. Due to 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.

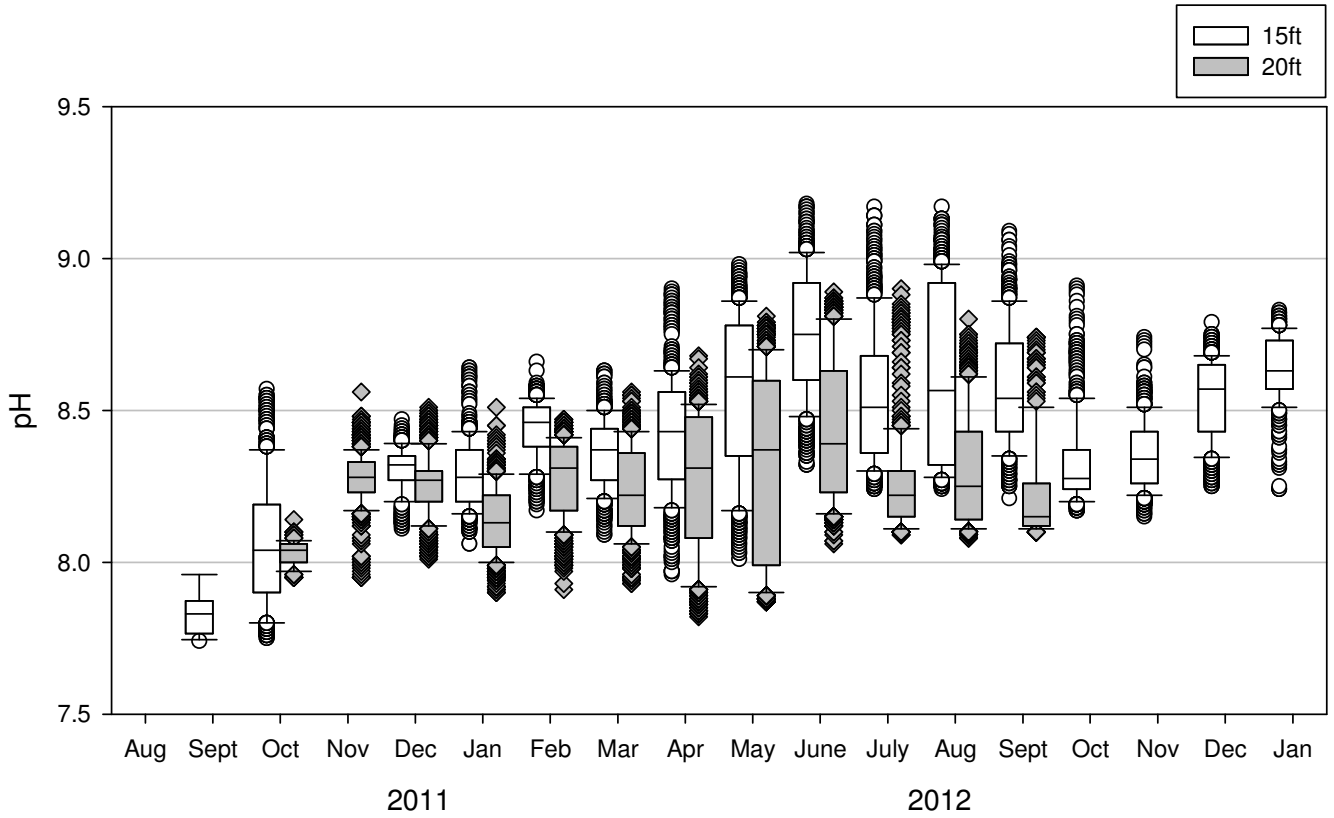
The best explanation for the observed cycle of the highest pH occurring in the day and lowest at night is algal photosynthesis (see "Acidity and alkalinity (pH) in Lake Merced" in the WQA [ESA, 2015]). The cycles of high pH in Lake Merced are due to algal photosynthesis in the day and respiration by 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

Vista Grande Drainage Basin Improvement Project. 207036.01

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

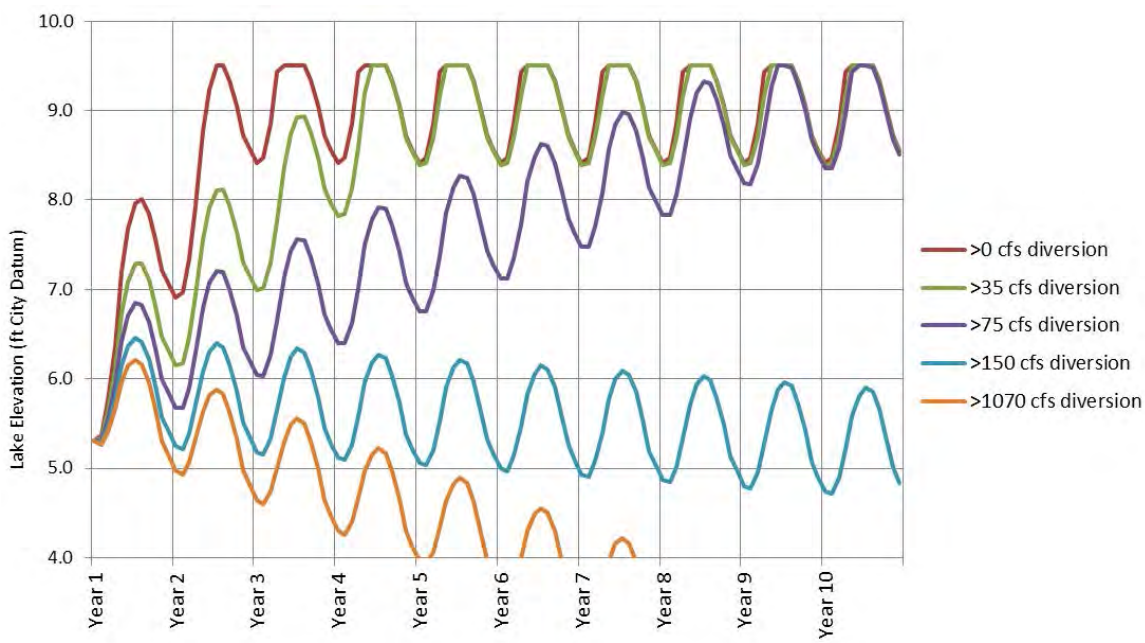
Five diversion thresholds were analyzed to estimate the potential contribution of stormwater flows diverted to Lake Merced. These diversion thresholds were developed to analyze a range of potential diversions. The diversion thresholds are structured such that all flows over a certain flow threshold would 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

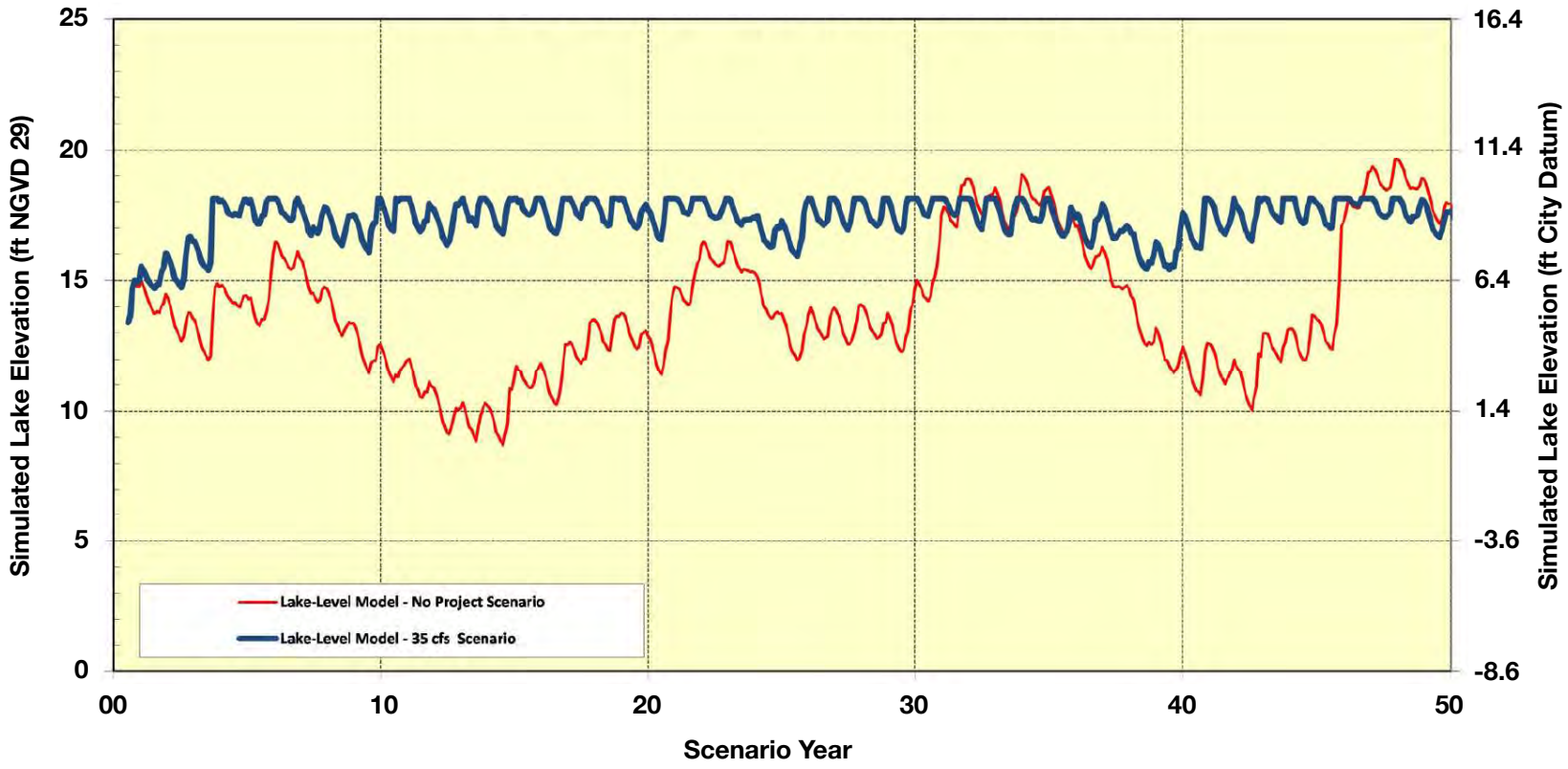
The simulated lake levels for the Project Scenario are shown on Figure 3.9-14 and **Figure 3.9-15**. The results show that, in general, lake levels vary within a narrow range of about 1 foot during the year and would regularly include flow over the Lake Merced overflow, and that the lake levels are generally 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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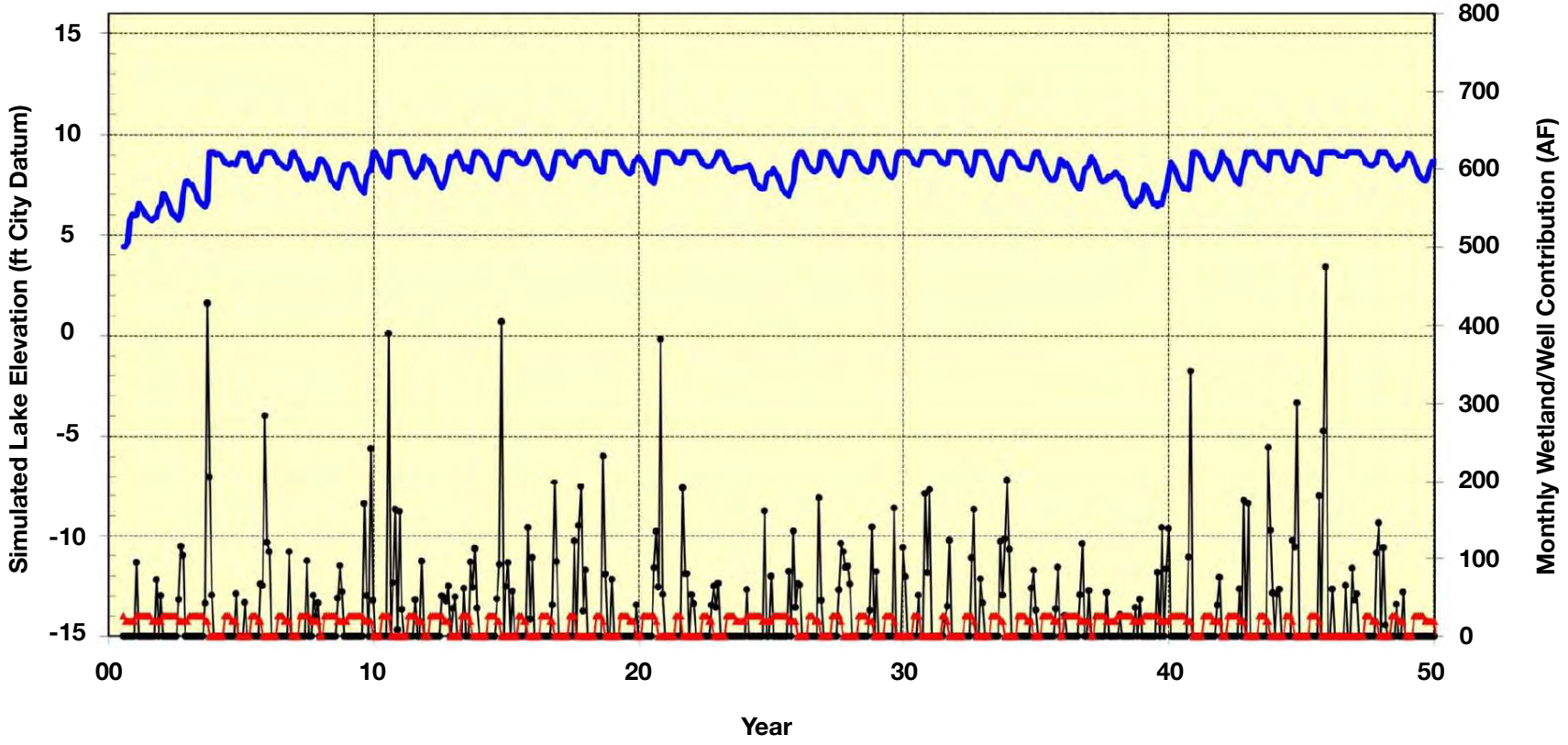
Figure 3.9-14

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

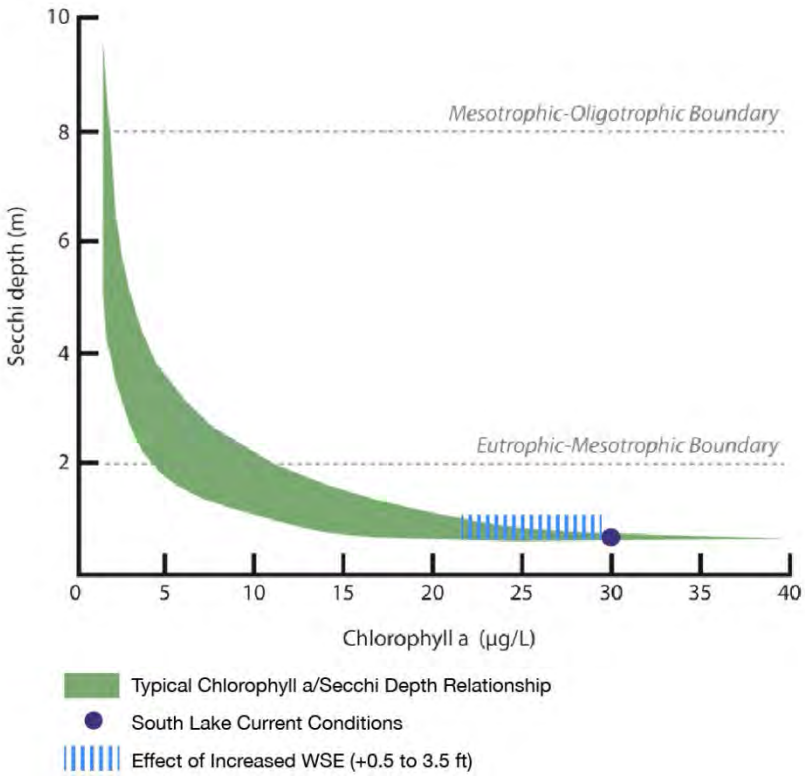
A simple lake model based on mixing depth and the chlorophyll-water transparency relationship was used to estimate the water quality changes that could occur at the range of proposed depth increases. Based on the model results, increased thermal stratification duration due to increased depth is expected 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

			Winter Nitrate or TIN (µg/L)						
Max WSE (ft)	**Flow Diversion Threshold (cfs)**	**Average Filling Time (Months)**	**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

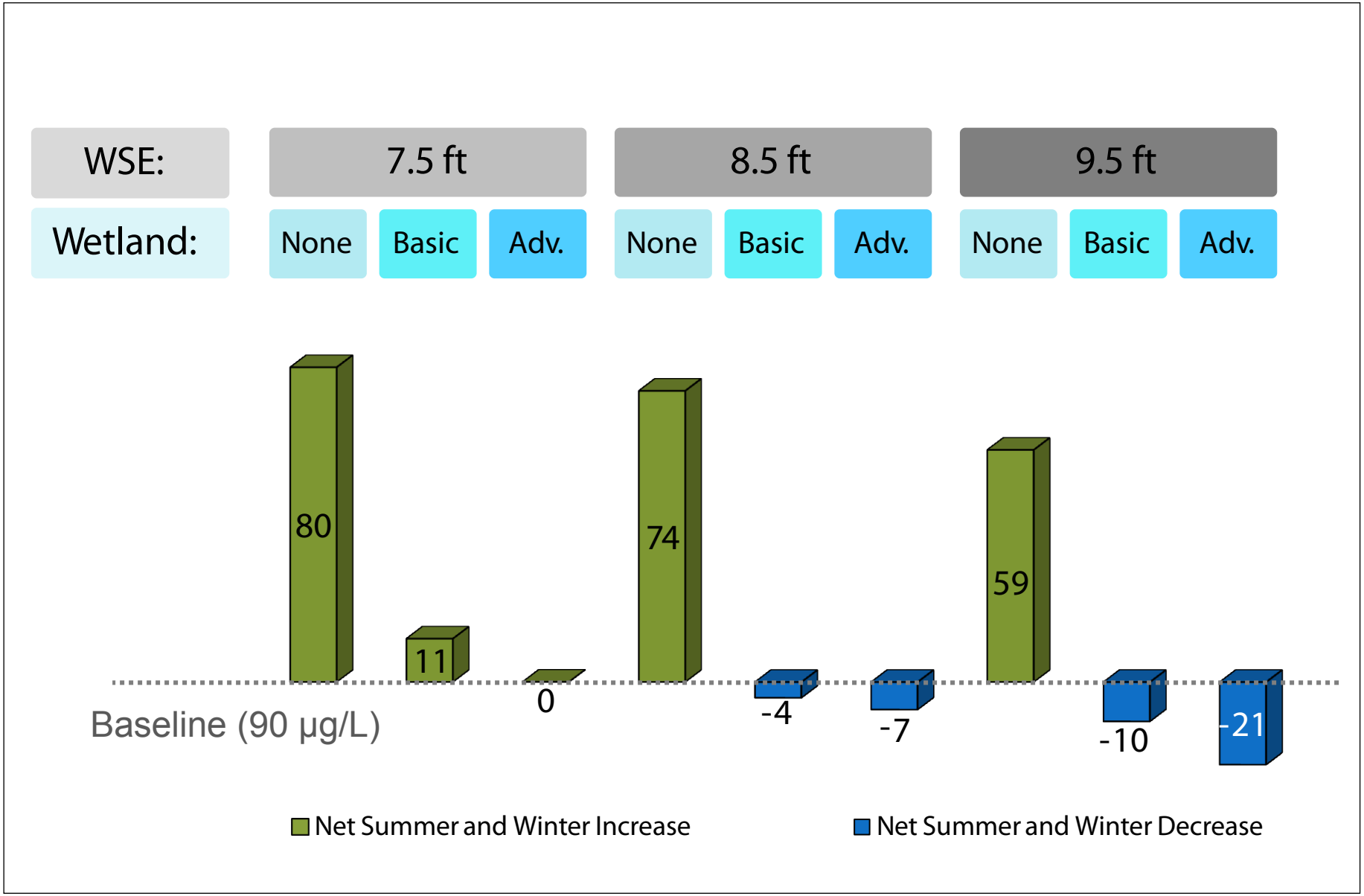
TABLE 3.9-14
ESTIMATED NET EFFECTS ON SUMMER TIN, COMBINED SUMMER AND WINTER TIN, AND ALGAL CONCENTRATIONS DURING FILLING PERIOD

	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

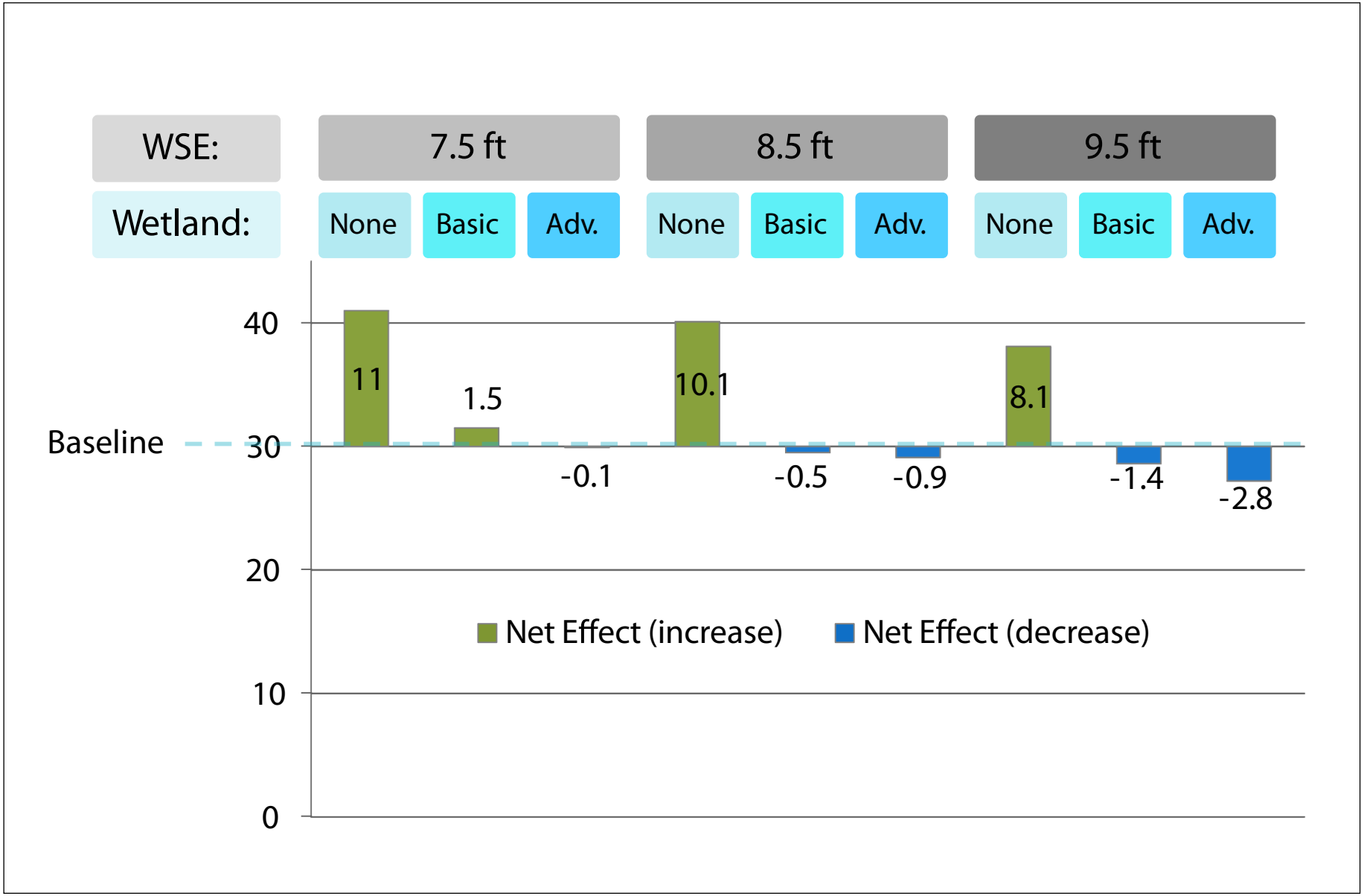
Temperature Model: Thermal Stratification

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

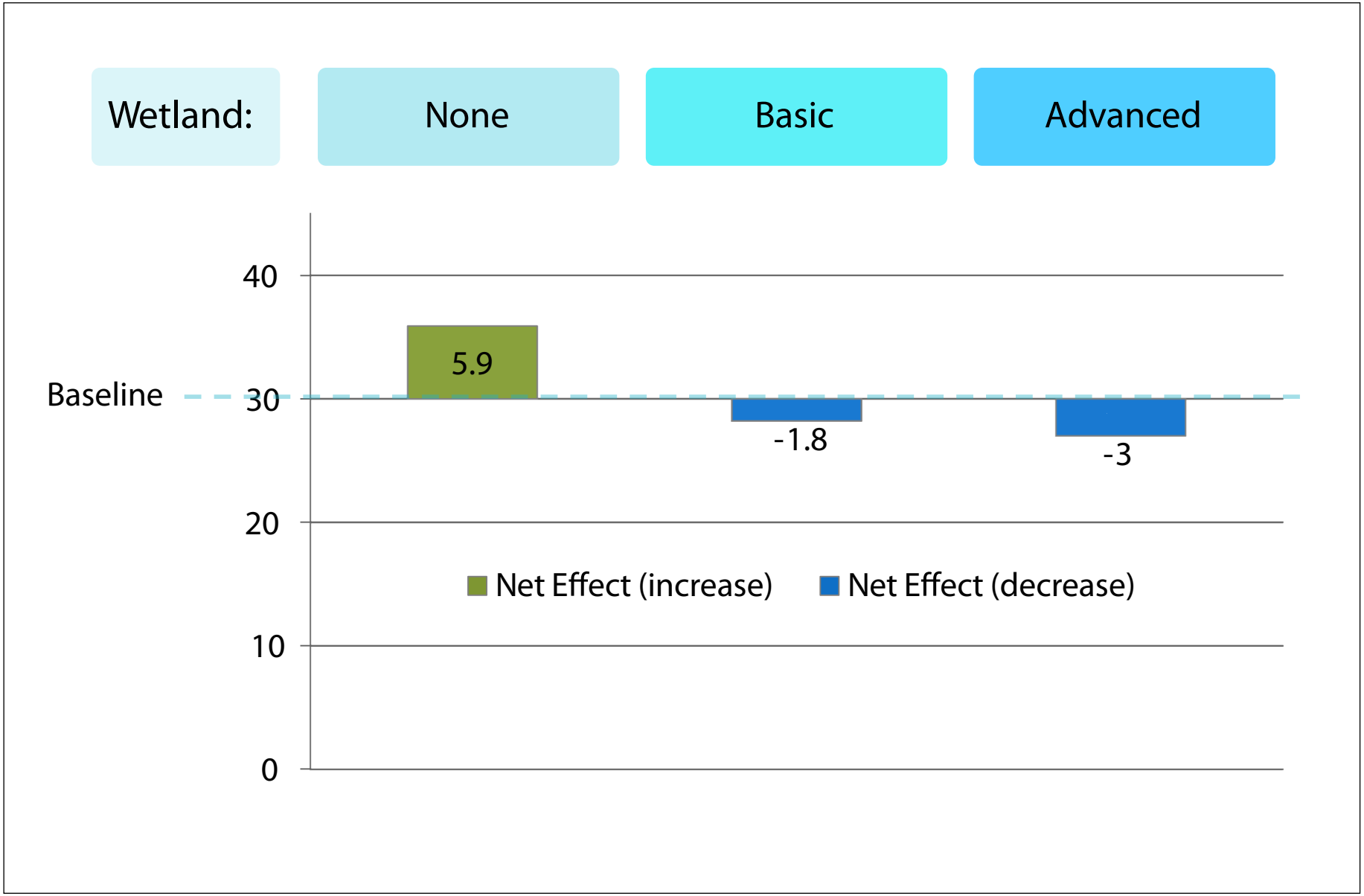


SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

Figure 3.9-18

Filling Period Algae (µg Chl/L)

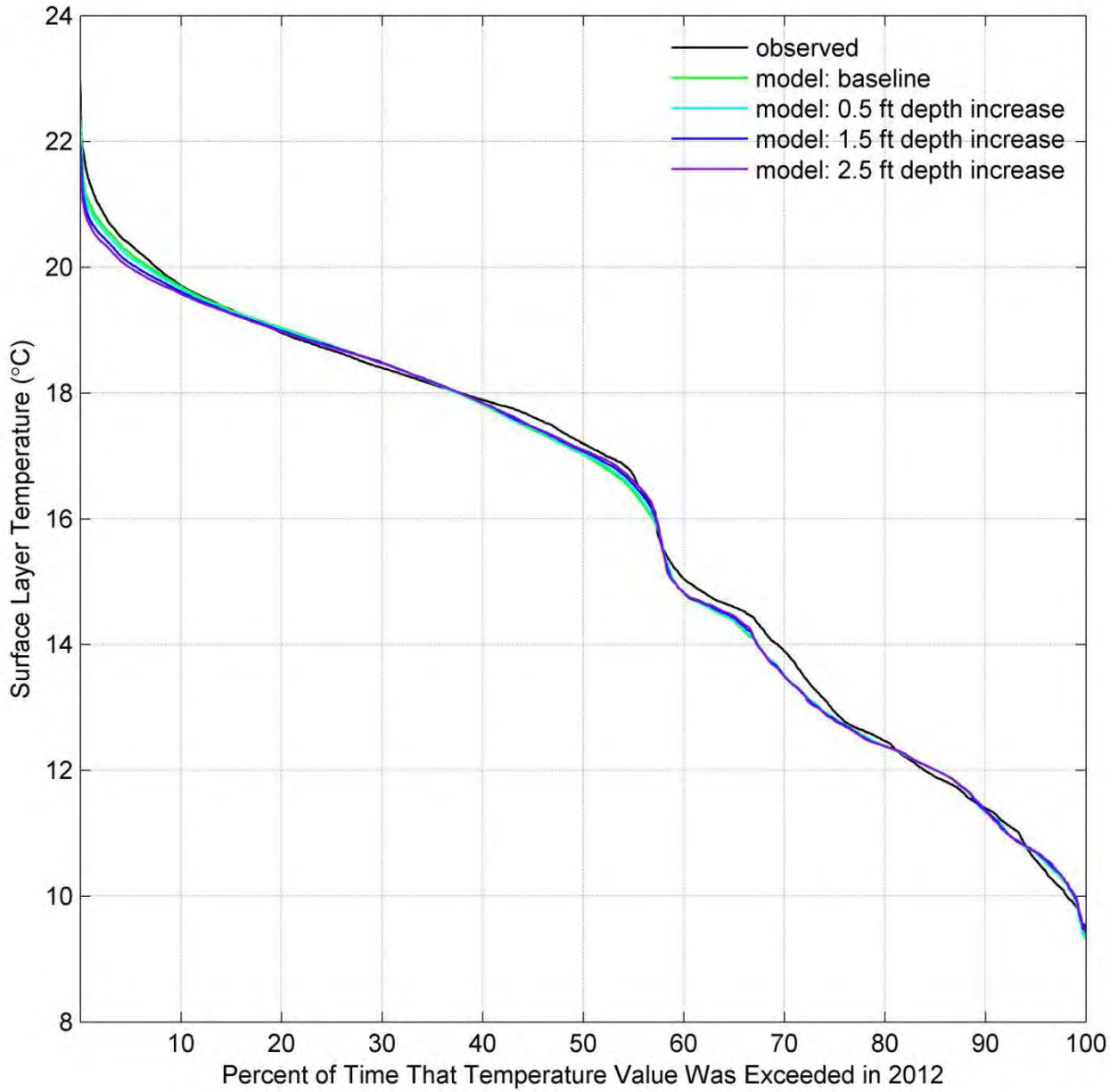


SOURCE: ESA

Vista Grande Drainage Basin Improvement Project. 207036.01

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.

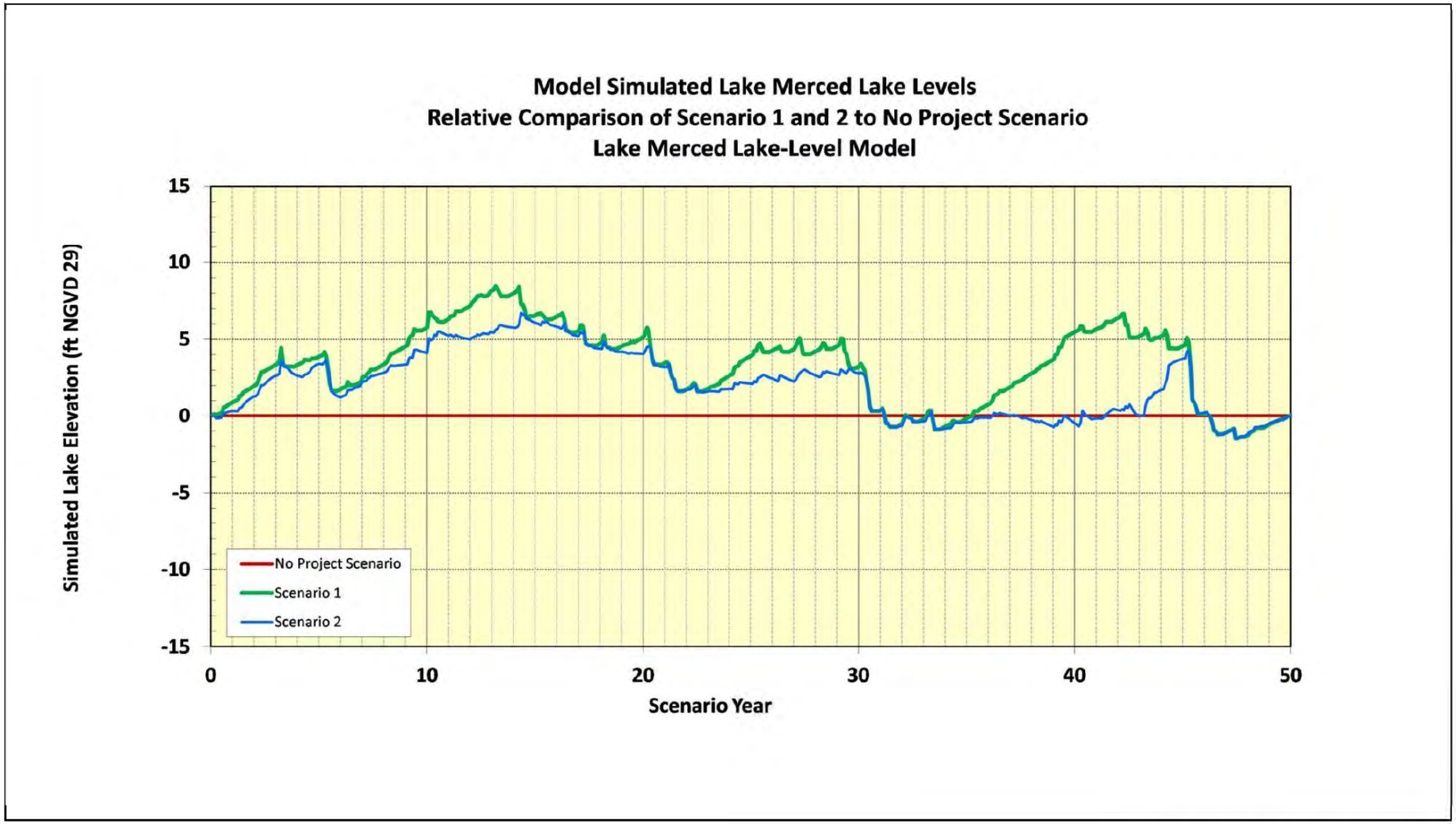
As described in detail under Impact HYD-8, above, Kennedy/Jenks (2014) assessed Lake Merced lake levels to support technical analyses and provide detailed hydrologic context for Project operation. The Model, constructed to analyze the effects of the >35 cfs flow diversion from the Canal on Lake Merced 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	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	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

	Construction Maximum Vibration to the Nearest Residential Receiver Located 200 feet Away	
Equipment	**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, F*ort 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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