4.6 Geology, Soils, and Paleontological Resources

This section identifies and describes the geology, soils, seismicity, and paleontological resources, and analyzes the effects of the proposed Project's impacts related to these resources. The section contains a description of the existing regional and local conditions, a summary of the pertinent regulations, and an analysis of the potential impacts related to geology, soils, and paleontological resources associated with construction and operation of the proposed Project. Issues related to effects on mineral resources are addressed in Section 4.17, *Effects Found Not to Be Significant*. This section relies in part on a *Preliminary Geotechnical Exploration Report* prepared by ENGEO, dated April 19, 2019, in support of the Project (see **Appendix GEO**), which was independently peer reviewed by ESA. This section also analyzes the Maritime Reservation Scenario, focused on environmental conditions, regulations, impacts and mitigation measures that are different from those identified for the proposed Project.

No comments pertaining to geology, soils or paleontological resources were received in response to the Notice of Preparation (NOP) for this EIR.

4.6.1 Environmental Setting

Regional Setting

The Project site lies within the geologically complex region of California referred to as the Coast Ranges geomorphic province.[1] The Project site is located at the northern most extent of the Southern Coast Ranges. The Project site is adjacent to the Oakland-Alameda Estuary (Estuary), part of San Francisco Bay, with Alameda Island to the south. The geologic map by R.W. Graymer (USGS, 2000), published by the United States Geological Survey, indicates the Project site is entirely on artificial fill of varying depths. Directly beneath the fill is Young Bay Mud, which is composed of mostly clayey material, and is described in more detail below.

Local Geology and Soils

The geologic unit descriptions described below come from the Preliminary Geotechnical Exploration Report (ENGEO, 2019). **Figure 4.6-1** depicts the Project site separated into zones, with **Table 4.6-1** listing the stratigraphic units,[2] and thicknesses of the units, that correspond to these zones. **Figure 4.6-2** presents a schematic geologic cross-section of the Project site, which depicts the units in their stratigraphic order from youngest at the top to oldest at the bottom. The units are described further below. The entire Project site is nearly level and paved with 4 to 20 inches of asphalt concrete and 6 to 24 inches of aggregate base, for a total thickness of approximately 1.2 to 4 feet of pavement (ENGEO, 2019).

[1] A geomorphic province is an area that possesses similar bedrock, structure, history, and age. California has 11 geomorphic provinces.

[2] A stratigraphic unit is a volume of rock of identifiable origin and a given age range.

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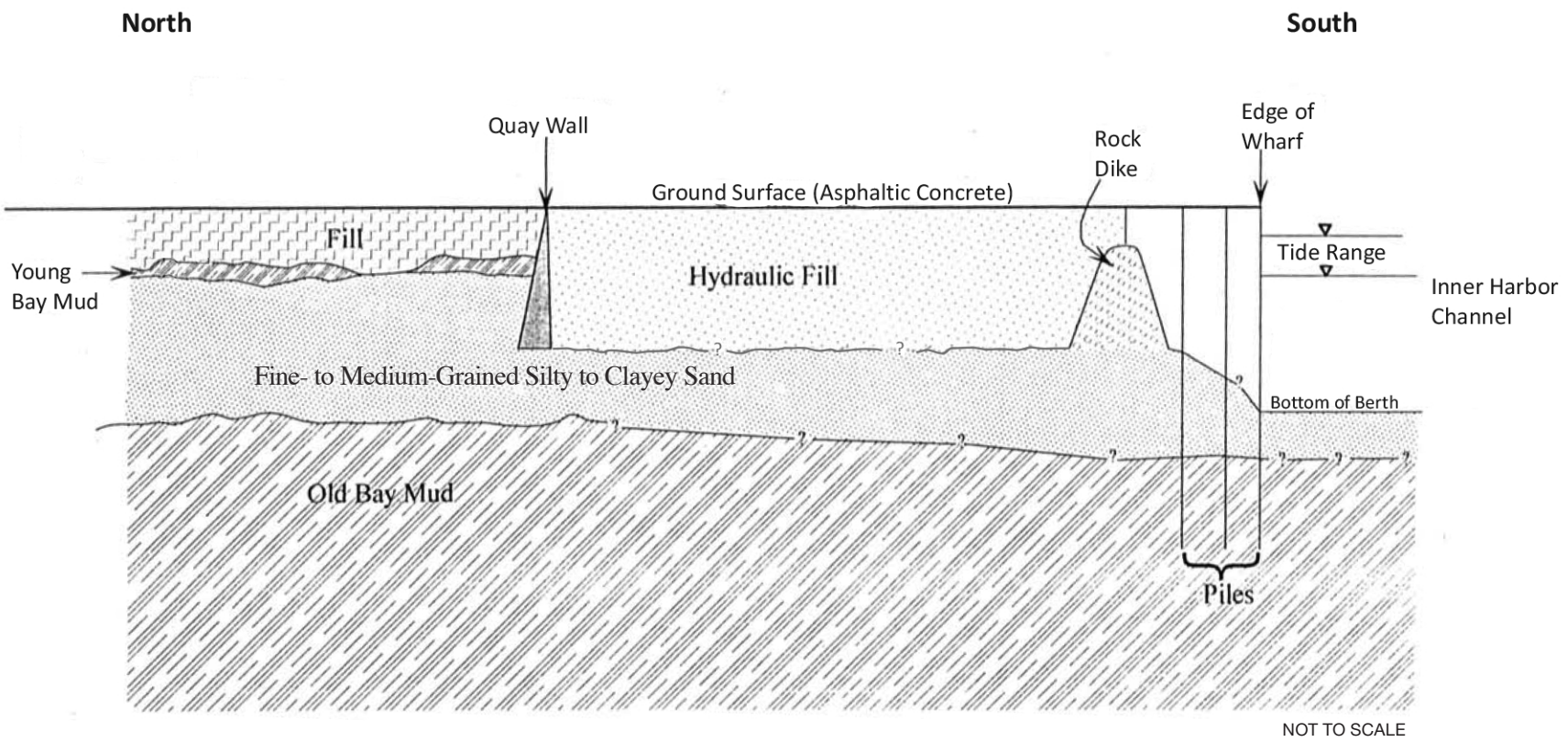
SOURCE: ENGEO, 2020

Oakland Waterfront Ballpark District Project

Figure 4.6-1
Geotechnical Zone Plan

ESA



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SOURCE: Adapted from Baseline, 2018; ENGEO, 2019

Oakland Waterfront Ballpark District Project

Figure 4.6-2
Schematic of Geologic Cross-Section of Project Site

ESA

TABLE 4.6-1
SUBSURFACE PROFILE

Material	Material Thickness (feet)			
	Zone 1A	Zone 1B	Zone 2A	Zone 2B
Non-Engineered Fill	—	about 25	5 to 10	about 25
Hydraulically Placed Fill	40 to 50	—	—	—
Bay Mud	0 to 8	about 20	2 to 5	0 to 5
Merritt Sand	up to 10	about 15	about 10	about 40
San Antonio Formation	Unknown thickness	Unknown thickness	Unknown thickness	Unknown thickness

NOTE: Please refer to corresponding Figure 4.6-1 for location of zones.

SOURCE: ENGEO, 2019

Artificial Fill

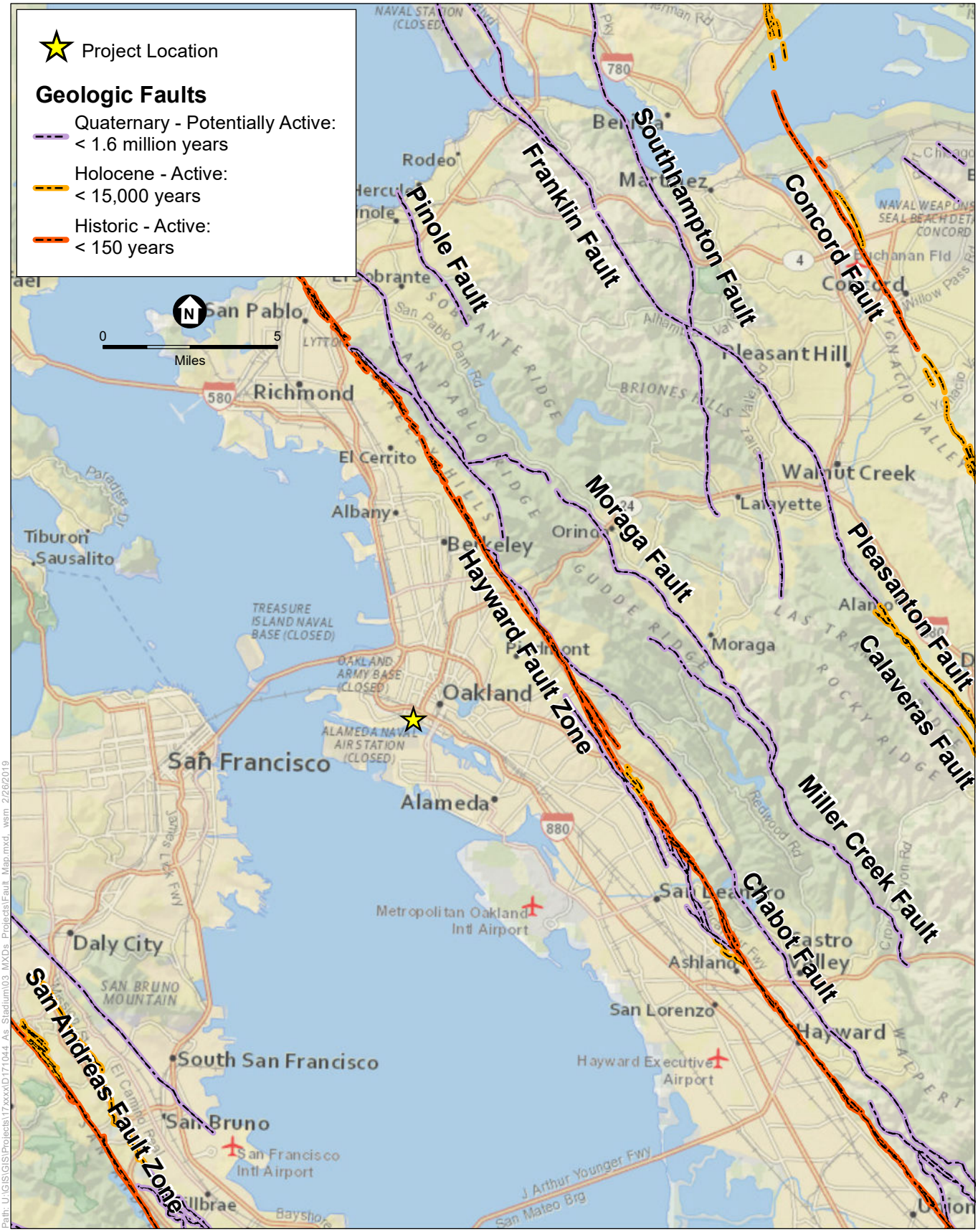
As a consequence of the land reclamation and prior construction activities at this area of Oakland, a highly heterogeneous surficial layer of fill material exists at the Project site. The fill material is composed of a mixture of sand, gravel, and clayey materials, much of which was dredged from the San Francisco Bay and placed on a pre-existing marshland. This layer can be characterized by abrupt and unpredictable changes in lithology,[3] both laterally and vertically, in the soil profile. The fill is highly variable and ranges from lean clay to a mixture of silts, sands and gravel, with scattered debris and organics. The density of the fill material also varies throughout the Project site from loose to medium dense.

Fill placement north of the 1877 historic shoreline happened through various events of construction using a variety of material in a non-engineered manner. The area between the historic shoreline and the quay wall structure on the Project site was reclaimed by placing non-engineered fill in conjunction with the construction of the quay wall in the early 1910s. During the Port of Oakland's extension during the 1980s, a rock dike was constructed and the fill was hydraulically placed in the southern part of the Project site. The triangular area in the southeast of the Project site, which corresponds to Sub Zone 1b in **Figure 4.6-3**, was later constructed by placing fill in 1995.

Young Bay Mud

On the Project site, soft sediment, locally known as Young Bay Mud lies directly underneath the existing fill. The Young Bay Mud deposits consist of greenish gray to blue gray, soft, silty clay that is highly compressible, existing in a soft state.

[3] The lithology of a rock or rock unit is the general description of the physical characteristics of that rock or rock unit in a particular area.



SOURCE: USGS, 2010

Oakland Waterfront Ballpark District Project

Figure 4.6-3
Regional Faults

ESA

Based on fill history and previous laboratory testing, the Young Bay Mud is normally consolidated to slightly overconsolidated. The Preliminary Geotechnical Exploration Report by ENGEO (2019) suggested that, based on prior experience near the Project location, the upper portion of the Young Bay Mud is likely moderately overconsolidated and stiffer because much of the Project site was a marsh prior to development and because of past industrial uses at the Project site. However, the previous exploration data does not appear to indicate the presence of a stiffer crust at the top of the layer.

Merritt Sand

Quaternary deposits known locally as Merritt Sand underlie the Young Bay Mud. This material is a beach or near-shore deposit of fine-grained clean to slightly clayey or silty sand.

San Antonio Formation

This formation is composed of alluvium deposited in environments ranging from alluvial fans and flood plains to lakes and beaches. The unit is generally moderately dense to very dense sand and stiff to hard silt and clay. At the Project site, the upper part of the San Antonio Formation consists of medium-grained sand containing varying amounts of silt and clay. The upper part of the formation consists of stiff to hard overconsolidated clay, locally known as Old Bay Mud (OBM), with varying amounts of dense to very dense sand (ENGEO, 2019). Below the San Antonio Formation is the upper and lower Alameda Formation, the initial unit deposited over Franciscan bedrock (Rogers & Figuers, 1991).

Geologic and Seismic Hazards

Fault Rupture

The Project site is located in a seismically active region of California that contains both active (Holocene age within the last 11,000 years; the USGS uses 15,000 years) and potentially active (Quaternary age or within the last 1.6 million years) faults (CGS, 2010). As shown in Figure 4.6-3 and discussed below, the Project site is not located on an active fault, but is located between two known active fault zones. Throughout the region, there is potential for damage resulting from movement along any one of a number of active faults, seismic shaking, and seismically induced ground failures (e.g., liquefaction).

The Working Group on California Earthquake Probabilities (WGCEP) is a collaboration between the United States Geological Survey (USGS), the California Geology Survey (CGS), and the Southern California Earthquake Center; the WGCEP evaluated the probability of one or more earthquakes of M_w[4] 6.7 or higher occurring in California over the next 30 years. The WGCEP estimated that the San Francisco Bay Area as a whole has a 72 percent chance of experiencing an earthquake of M_w 6.7 or higher over the next 30 years, with the Hayward and San Andreas Faults being the most likely to cause such an event (WGCEP, 2015a).

[4] Earthquake magnitudes are often measured by their Moment Magnitude (M_w) which is related to the physical characteristics of a fault including the rigidity of the rock, the size of fault rupture, and movement or displacement across a fault (CGS, 2002b).

San Andreas Fault Zone

The San Andreas Fault Zone is the major structural feature in the region and forms a boundary between the North American and Pacific tectonic plates. The San Andreas Fault is a major northwest-trending, right-lateral, strike-slip fault zone.[5] The fault zone extends for about 600 miles from the Gulf of California in the south to Cape Mendocino in the north. The San Andreas Fault Zone is not a single fault trace but rather a system of active faults that diverges from the main fault south of the city of San Jose, California. The San Andreas Fault Zone has produced numerous large earthquakes, including the 1906 San Francisco earthquake, and the 1989 Loma Prieta earthquake. The San Andreas Fault Zone has a 6.4 percent probability of generating an earthquake in the San Francisco Bay Area with a magnitude equal to or greater than M_w 6.7 over the next 30 years (WGCEP, 2015b). The closest distance of the San Andreas Fault Zone to the Project is about 13.5 miles to the west (ENGEO, 2019).

Hayward Fault Zone, Northern Hayward Section

The Hayward Fault Zone extends northwest approximately 55 miles from San Jose to Point Pinole. It is a right-lateral, strike-slip fault and is designated as an Alquist-Priolo Earthquake Fault Zone. The fault is active, producing large historic earthquakes, fault creep, and abundant geomorphic evidence of fault rupture. The Hayward Fault Zone has a 14.1 percent probability of generating an earthquake with a magnitude equal to or greater than M_w 6.7 over the next 30 years (WGCEP, 2015b). The last recorded large earthquake on the Hayward Fault occurred on October 21, 1868 and was a M_w 6.8 event. The closest distance of the Hayward Fault Zone to the Project is about 4.5 miles to the east (ENGEO, 2019).

Ground Shaking

The amplitude and frequency of ground shaking is related to the size of an earthquake, the distance from the causative fault, the type of fault (e.g., strike-slip), and the response of the geologic materials at the Project site. Ground shaking can be described in terms of acceleration, velocity, and displacement of the ground. As a rule, the greater the earthquake magnitude and the closer the fault rupture to a site, the greater the intensity of ground shaking. The analysis performed by ENGEO estimates the Cyclic Stress Ratio (CSR) for a Maximum Considered Earthquake (MCE) Peak Ground Acceleration (PGA_M) value of 0.593g, as outlined in the 2016 CBC with an earthquake magnitude of 7.33 (ENGEO, 2019). Based on the subsurface conditions encountered and the presence of liquefiable fill, ENGEO classified the site as Site Class F in accordance with the American Society of Civil Engineers (ASCE) 7-10 standard considering ground improvements. This site classification requires a site response analysis (ENGEO, 2019). Based on the Modified Mercalli Intensity Scale, this PGA would result in an Intensity Value of VIII, very strong shaking, at the Project site (Bolt, 1993).

Subsidence

Subsidence is the gradual lowering of the land surface due to compaction of underlying materials. Subsidence can occur as a result of the extraction of groundwater and oil, which can cause subsurface clay layers to compress and lower the overlying land surface. The subsidence occurs because the presence of water in the pore spaces in between grains helps to support the skeletal

[5] A strike-slip fault is a fault on which movement is parallel to the fault's strike or lateral expression at the surface.

structure of the geologic unit. If the water is removed, the structure becomes weaker and can subside. Long-term, post-construction dewatering is not anticipated at the site. Subsidence should be minimal and only occur during dewatering for construction.

Consolidation Settlement

Most of the site is underlain by highly compressible Young Bay Mud, which varies in thickness across the site (see Table 4.6-1). The Young Bay Mud deposits are considered highly susceptible to compression from loads imposed by new fill and structures. Structural loads from proposed buildings on shallow foundations bearing on the additional fill material will create further settlement (ENGEO, 2019). Based on the thickness of the Young Bay Mud encountered, the majority of the settlement should occur within approximately 3 months of loading (ENGEO, 2019). The most common approach to addressing long-term total and differential settlement in the San Francisco Bay Area is "preconsolidation" or "surcharge" (the compression or reduction of moisture content of soil to decrease soil volume) of the compressible Young Bay Mud layer prior to site development (ENGEO, 2019). Other approaches include designing improvements for anticipated settlement, waiting until settlement from new fill is nearly complete before constructing settlement sensitive improvements, and load compensation using light weight fill. The design-level, final geotechnical investigation will incorporate these methods into the analysis of the Project site.

Liquefaction

Liquefaction is the rapid loss of shear strength experienced in saturated, predominantly loose granular soils below the groundwater level during strong earthquake ground shaking and occurs due to an increase in pore water pressure (Rauch, 1997). The occurrence of this phenomenon is dependent on many complex factors, including the intensity and duration of ground shaking, particle-size distribution, and density of the soil. Liquefaction-induced lateral spreading is defined as the finite, lateral displacement of gently sloping ground as a result of pore-pressure buildup or liquefaction in a shallow underlying deposit during an earthquake. Liquefaction-induced lateral spreading requires the soil to have liquefied and for there to be a free face or sloping ground surface for the flow to occur.

The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling, and buckling of deep foundations due to ground settlement. Dynamic settlement (i.e., pronounced consolidation and settlement from seismic shaking) may also occur in loose, dry sands above the water table, resulting in settlement of and possible damage to overlying structures. In general, a relatively high potential for liquefaction exists in loose, sandy soils that are within 40 feet of the ground surface and are saturated (below the groundwater table). Lateral spreading can move blocks of soil, placing strain on buried pipelines that can lead to leaks or pipe failure.

Localities most susceptible to liquefaction-induced damage are underlain by loose, water-saturated, granular sediment within 40–50 feet of the ground surface (CGS, 2003a; 2006). As the Project site is underlain by potentially liquefiable materials, there is a very high potential for liquefaction at the Project site. in its current state. The CGS published a composite map of the Oakland West Quadrangle overlain with Alquist-Priolo Earthquake Fault Zones and Seismic

Hazard Zones (i.e., liquefaction and earthquake-induced landslides). The map indicates the Project site is within a Liquefaction Zone (CGS, 2003b).

The geotechnical exploration report also concluded that the entire Project site is susceptible to liquefaction (ENGEO, 2019). The hydraulically placed fill in Zone 1 (see Figure 4.6-1), much of the non-engineered fill in Zone 2, and some of the naturally deposited loose sand near the top of the Merritt Sand layer is estimated to likely liquefy during strong ground shaking in a major earthquake event associated with nearby active faults.

Paleontological Resources

Paleontological resources are the fossilized remains or impressions of plants and animals, including vertebrates (animals with backbones; mammals, birds, fish, etc.), invertebrates (animals without backbones; starfish, clams, coral, etc.), and microscopic plants and animals (microfossils). They are valuable, non-renewable, scientific resources used to document the existence of extinct life forms and to reconstruct the environments in which they lived. Fossils can be used to determine the relative ages of the depositional layers in which they occur and of the geologic events that created those deposits. The age, abundance, and distribution of fossils depend on the geologic formation in which they occur and the topography of the area in which they are exposed. The geologic environments within which the plants or animals became fossilized usually were quite different from the present environments in which the geologic formations now exist.

Geologic units beneath the artificial fill and Bay Mud (i.e., Merritt Sand and San Antonio Formation) on the Project site have the potential for containing paleontological resources.

4.6.2 Regulatory Setting

Federal

Federal regulations that apply directly to addressing the seismic and geotechnical aspects of the Project have been delegated to the State level.

State

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy (State of California Department of Conservation, California Geological Survey 2013). In accordance with the Alquist-Priolo Act, the State geologist established regulatory zones, called "Earthquake Fault Zones," around the surface traces of active faults and published maps showing the earthquake fault zones. Within the fault 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. California Code of Regulations (CCR) Title 14, Section 3601(e) defines buildings intended for human occupancy as those that would be inhabited for more than 2,000 hours per year. The Project site is not mapped

within an active earthquake fault zone per the Alquist-Priolo Special Studies Zone Act. Therefore, the Alquist-Priolo Act does not apply to the Project.

California Building Code

The most recent version of the California Building Code (CBC) was published by the California Building Standards Commission on July 1, 2019, and is based on the 2018 International Building Code (IBC) with the addition of more extensive structural seismic provisions. The CBC is included in Title 24 of the CCR, California Building Standards Code, and is a compilation of three types of building standards from three different origins:

- Building standards that have been adopted by state agencies without change from building standards contained in national model codes;
- Building standards that have been adopted and adapted from the national model code standards to meet California conditions; and
- Building standards authorized by the California legislature that constitute extensive additions not covered by the model codes that have been adopted to address particular California concerns.

Seismic sources and the procedures used to calculate seismic forces on structures are defined in Section 1613 of the CBC. The CBC requires that all structures and permanently attached nonstructural components be designed and built to resist the effects of earthquakes. The CBC also addresses grading and other geotechnical issues, building specifications, and non-building structures.

California Excavation Notification Requirements

California Code of Regulations Section 4216 requires that construction contractors report a project that involves excavation 48 hours prior to breaking ground. Section 4216 allows owners of buried installations to identify and mark the location of its facilities before any nearby excavation projects commence. Adherence to California Code of Regulations Section 4216 by contractors of projects reduces the potential of inadvertent pipeline and utility damage and leaks.

California Occupational Safety and Health Administration Regulations

Occupational safety standards exist in federal and State laws to minimize worker safety risks from both physical and chemical hazards in the workplace. 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.

NPDES Construction General Permit

The California Construction Storm Water Permit (Construction General Permit),[6] adopted by the State Water Resources Control Board, regulates construction activities involving clearing, grading, and excavation resulting in soil disturbance of more than one acre of total land area. The Construction General Permit authorizes the discharge of stormwater associated with construction activity to waters of the United States.

The Construction General Permit requires that construction sites be assigned a Risk Level of 1 (low), 2 (medium), or 3 (high), based both on the sediment transport risk at the site and the receiving waters risk during periods of soil exposure (e.g., grading and site stabilization). The sediment risk level reflects the relative amount of sediment that could potentially be discharged to receiving water bodies and is based on the nature of the construction activities and the location of the site relative to receiving water bodies. The receiving waters risk level reflects the risk to the receiving waters from the sediment discharge. Depending on the risk level, the construction projects could be subject to the following requirements:

- Effluent standards
- Good site management "housekeeping"
- Non-stormwater management
- Erosion and sediment controls
- Run-on and runoff controls
- Inspection, maintenance, and repair
- Monitoring and reporting requirements

The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) that includes specific best management practices (BMPs) designed to prevent sediment and pollutants from contacting stormwater from moving off site into receiving waters. The BMPs fall into several categories, including erosion control, sediment control, waste management and good housekeeping, and are intended to protect surface water quality by preventing the off-site migration of eroded soil and construction-related pollutants from the construction area. Routine inspection of all BMPs is required under the provisions of the Construction General Permit. In addition, the SWPPP is required to contain a visual monitoring program, a monitoring program for non-visible pollutants, effluent monitoring program, and potentially a receiving water monitoring program when a receiving water monitoring trigger or numeric effluent limitation is exceeded.

The SWPPP must be prepared before the construction begins. The SWPPP must contain a site map(s) that delineates the construction work area, existing and proposed buildings, parcel boundaries, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the Project site. The SWPPP must list BMPs and the placement of those BMPs that the Project sponsor would use to protect stormwater runoff. Examples of typical construction BMPs include scheduling or limiting certain activities to dry periods, installing sediment barriers such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction. Other construction BMPs include describing and

[6] *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order 2009-0009-DWQ, NPDES No. CAS000002, Construction General Permit; as amended by Orders 2010-0014-DWQ and 2012-006-DWQ).

installing BMPs for potential pollutant-generating activities, such as paving operations, and vehicle and equipment washing and fueling.

At the Project site, the Construction General Permit would be implemented and enforced by the San Francisco Bay Regional Water Quality Control Board (RWQCB), which administers the stormwater permitting program. Dischargers are required to electronically submit a notice of intent and Permit Registration Documents (PRD) in order to obtain coverage under this Construction General Permit. The PRD required by the Construction General Permit include the following:

- Notice of Intent (NOI)
- Risk assessment (Estimated tons per acre of sediment and estimated risk to nearby receiving waters)
- Site map showing extent of ground disturbance
- SWPPP
- Annual fee
- Certification by the Legally Responsible Person.

Dischargers are responsible for notifying the RWQCB of violations or incidents of non-compliance, as well as for submitting annual reports identifying deficiencies of the BMPs and how the deficiencies were corrected. The risk assessment and SWPPP must be prepared by a State Qualified SWPPP Developer and implementation of the SWPPP must be overseen by a State Qualified SWPPP Practitioner. A Legally Responsible Person, who is legally authorized to sign and certify permit registration documents, is responsible for obtaining coverage under the permit.

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 Seismic Hazards Mapping Act requires the State Geologist to delineate various seismic hazard zones, and cities, counties, and other local permitting agencies to regulate certain development projects within these zones. For projects that would locate structures for human occupancy within designated Zones of Required Investigation, the Seismic Hazards Mapping Act requires project applicants to perform a site-specific geotechnical investigation to identify the potential site-specific seismic hazards and corrective measures, as appropriate, prior to receiving building permits. The *CGS Guidelines for Evaluating and Mitigating Seismic Hazards* (Special Publication 117A) provides guidance for evaluating and mitigating seismic hazards (CGS, 2008). The CGS is in the process of producing official maps based on USGS topographic quadrangles, as required by the Act. The Project site lies within the Oakland West Quadrangle, and the CGS has identified the potential for seismic hazards at the Project site.

Local Plans, Ordinances and Policies

City of Oakland General Plan

Chapter 3, *Geologic Hazards*, of the *Safety Element* of the City of Oakland General Plan describes the following policies regarding geological resources, adopted for the purpose of avoiding or mitigating an environmental effect, and that apply to the Project.

> ***Policy GE-1*:** Develop and continue to enforce and carry out regulations and programs to reduce seismic hazards and hazards from seismically triggered phenomena.
>
> > *Action GE-1.2*: Enact regulations requiring the preparation of site-specific geologic or geotechnical reports for development proposals in areas subject to earthquake-induced liquefaction, settlement or severe ground shaking, and conditioning project approval on the incorporation of necessary mitigation measures.
>
> ***Policy GE-2:*** Continue to enforce ordinances and implement programs that seek specifically to reduce the landslide and erosion hazards.
>
> > *Action GE-2.1*: Continue to enforce provisions under the subdivision ordinance requiring that, under certain conditions, geotechnical reports be filed and soil-hazards investigations be made to prevent grading from creating unstable slopes, and that any necessary corrective actions be taken.

Oakland Municipal Code

Within the Oakland Municipal Code, Title 15 is known as the Oakland Amendments of the 2016 Editions of The California Building Standards Code, or the 2016 Oakland Building Construction Code. This chapter of the Municipal Code adopts the standards and requirements of the California Building Code and requires that they be applied to any new developments within the city.

City of Oakland Creek Ordinance

The City of Oakland Creek Protection Ordinance (OMC Chapter 13.16) provides a high level of protection for creeks within city limits. Aside from the Estuary, which is considered a waterway under the City's ordinance, no traditional creeks occur on the Project site or in the larger Project study area. The ordinance is intended to address potential water quality impacts from stormwater and other discharges into identified waterways, including preventing activities that would contribute significantly to erosion or sedimentation. This ordinance is not applicable to lands under Port permitting authority; however, the City and the Port are cooperating to establish a shared regulatory framework under which the Project will be subject to the Creek Protection Ordinance.

Society of Vertebrate Paleontology Guidelines

The SVP has established standard guidelines (SVP, 2010) that outline professional protocols and practices for conducting paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing professional vertebrate paleontologists adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically provided in its standard guidelines.

Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined by rock type, past history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological sensitivity is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey. In its "Standard Guidelines for the Assessment and Mitigation of Adverse Impacts to Non-renewable Paleontologic Resources," the SVP (2010) defines four categories of paleontological sensitivity (potential) for rock units: high, low, undetermined, and no potential.

While the artificial fill directly beneath the Project site has no potential for recovery of paleontological resources and the Holocene-age Young Bay Mud has a low potential, the geologic units below the fill and Bay Mud (i.e., Merritt Sand and San Antonio Formation) would be considered to have a high sensitivity for paleontological resources.

4.6.3 Significance Criteria

The City of Oakland has established thresholds of significance for CEQA impacts which incorporate those in Appendix G of the State CEQA Guidelines (City of Oakland, 2016). The Project would have a significant impact on the environment if it would expose people or structures to geologic hazards, soils, and/or seismic conditions so unfavorable that they could not be overcome by special design using reasonable construction and maintenance practices, specifically,

1. Expose people or structures to substantial risk of loss, injury, or death involving:
    a. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map or Seismic Hazards Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;[7]
    b. Strong seismic ground shaking;
    c. Seismic-related ground failure, including liquefaction, lateral spreading, subsidence, collapse; or
    d. Landslides;
2. Result in substantial soil erosion or loss of topsoil, creating substantial risks to life, property, or creeks/waterways;
3. Be located on expansive soil, as defined in Section 1803.5.3, Expansive Soil, of the California Building Code (2016 version, as it may be revised), or corrosive soil, creating substantial risks to life or property;
4. Be located above a well, pit, swamp, mound, tank vault, or unmarked sewer line, creating substantial risks to life or property;
5. Be located above landfills for which there is no approved closure and post-closure plan, or unknown fill soils, creating substantial risks to life or property; or

[7] Refer to California Geological Survey 42 and 117 and Public Resources Code Section 2690 et seq.

6. 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.

Additionally, the Project would have a significant impact on the environment if it would:

7. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
8. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state; or
9. Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

The changes to Appendix G of the State CEQA Guidelines effective in December 2018 were intended to reflect recent changes to the CEQA statutes and court decisions. These recent changes and decisions are already reflected in the City's adopted significance thresholds, which have been used to determine the significance of potential impacts. To the extent that the topics or questions in Appendix G are not reflected in the City's thresholds, these topics and questions have been taken into consideration in the impact analysis below. The 2018 revisions do not have modifications that significantly change geology, soils, or paleontological thresholds or analysis standards.

Approach to Analysis

The analysis in this section is based on the conditions described in the Preliminary Geotechnical Report prepared for the Project and included as Appendix GEO to this Draft EIR (ENGEO, 2019), as well as a review of literature research (geologic, seismic, and soils reports and maps), information from geologic and seismic databases, and the General Plan for the City of Oakland.

The Project would be regulated by the various laws, regulations, and policies summarized in Section 4.6.2, *Regulatory Framework*. Compliance by the Project with applicable federal, State, and local laws and regulations is assumed in this analysis, and local and State agencies would be expected to continue to enforce applicable requirements to the extent that they do so now. Note that compliance with many of the laws and regulations is a condition of permit approval.

For example, the Preliminary Geotechnical Exploration Report provides the preliminary geotechnical investigation results and recommendations to address the geotechnical conditions at the Project site. These results inform the ongoing Project design and this EIR section. Upon completion of the CEQA documentation, the Project would be required by the CBC, and the City of Oakland Building Code and Grading Regulations, to conduct a final geotechnical investigation that would inform the final Project design and provide recommendations to address all identified geotechnical issues.

Issues related to effects on mineral resources are addressed in Section 4.17, *Effects Found Not to Be Significant*.

Topics Considered and Determined to Have No Impact

The following topics are considered to have no impact to the Project based on the proposed Project characteristics, its geographical location, and underlying site conditions. Therefore, these topics are not addressed further in this document for the following reasons:

- ***Fault Rupture*** (Criterion 1.a). There are no active faults that cross the Project site, and the nearest active fault to the Project site is the Northern Hayward section of the Hayward Fault Zone, located approximately five miles east of the Project site. Therefore, the potential for fault rupture to affect the Project is very low and not discussed further.
- ***Landslides*** (Criterion 1.d). The Project site is not within areas designated by the State Geologist where previous landslide movement has occurred. The Project site is also not mapped within areas designated as having the potential for seismically-induced landslides. Therefore, no impact is associated with this hazard.
- ***Wastewater Disposal*** (Criteria 6). The Project site is located within an urban area where all development would connect with the existing wastewater sewer infrastructure. Therefore, the Project would not require the use of septic or other alternative disposal wastewater systems. Therefore, no impact is associated with this hazard.
- ***Mineral Resources*** (Criteria 8 and 9). See Section 4.17, *Effects Found Not to Be Significant*.

4.6.4 Impacts of the Project

Impact GEO-1: The Project could expose people or structures to seismic hazards such as ground shaking and seismic-related ground failure such as liquefaction, differential settlement, collapse, or lateral spreading. (Criteria 1.b and 1.c) (*Less than Significant with Mitigation*)

Construction Impacts

Phase 1 and Buildout – Construction

The Project site is located in a seismically active region that contains a number of active faults. The 2015 *Working Group on California Earthquake Probabilities* updated the 30-year earthquake forecast for California and it is estimated that the San Francisco Bay Area as a whole has a 72 percent chance of experiencing an earthquake of M_w 6.7 or higher over the next 30 years. Of the various active faults in the region, the Hayward Fault is a fault with a high likelihood to cause such an event (WGCEP, 2015a).

The Project would be required to comply with all standards, requirements, and conditions contained in construction related codes (e.g., the Oakland Building Code [which incorporates by reference the California Building Code] and the Oakland Grading Regulations), which would ensure structural integrity and safe construction. The continuation of design review and code enforcement to meet current seismic standards is the primary mitigation strategy to avoid or reduce damage from an earthquake. Per **Mitigation Measure GEO-1**, a final geotechnical report, to be approved by the City, would be required, and implementation of the recommendations contained in the approved geotechnical report during Project design and construction will be required.

The Preliminary Geotechnical Exploration Report by ENGEO (2019) is the Project's preliminary geotechnical investigation report which identifies potential geotechnical concerns and provides

recommendations to manage the potential impacts associated with consolidation and settlement of the Young Bay Mud unit, liquefaction-induced settlement in the existing fill, and strong ground shaking. The report also includes recommendations for ground improvement and deep foundations to address the potential for statically and seismically-induced settlement. There are multiple options (to be narrowed down during the final geotechnical investigation), and the recommendations are tailored to each of the zones within the Project site. Both Zone 1 and Zone 2 are recommended to have ground improvement and either shallow or deep foundations. Based on the results from the preliminary report, the planned development at the Project site is feasible from a geotechnical standpoint, provided the preliminary recommendations and guidelines provided are implemented. As required by Mitigation Measure GEO-1, the Project would be required to conduct a final geotechnical investigation that would inform the final Project design and provide recommendations that will be required to be implemented to address all identified geotechnical issues and mitigate any potential impacts.

In addition, as described in Chapter 3, *Project Description*, additional fill will be added to raise the elevation of the entire site to address sea level rise. This fill will be engineered specifically, following CBC requirements for acceptable fill, so as to not fail or liquefy if subjected to seismic ground shaking. Adherence to the fill engineering requirements described in the Preliminary Geotechnical Exploration Report by ENGEO and the forthcoming final geotechnical report, as required under Mitigation Measure GEO-1, would ensure that the impacts are mitigated to a less-than-significant level.

Compliance with existing laws and regulations, and Mitigation Measure GEO-1 requiring the development and implementation of geotechnical recommendations to be incorporated into the design plans and specifications, the impact would be less than significant.

Operational Impacts

Phase 1 and Buildout Operations

Upon completion of the construction activities, the Project would have complied with the CBC, the City of Oakland Building Code and Grading Regulations regarding seismic-related ground shaking and seismic induced ground failures (i.e., liquefaction, lateral spreading, and settlement), and Mitigation Measure GEO-1. Compliance with existing laws and regulations, and Mitigation Measure GEO-1, which requires adhering to the recommendations in the final geotechnical report approved by the City, would reduce the Project's potential impacts to less than significant.

> **Mitigation Measure GEO-1: Site-Specific Final Geotechnical Report.**
>
> The Project sponsor shall submit a site-specific final geotechnical report, consistent with the requirements of the CBC and California Geological Survey Special Publication 117 (as amended). The geotechnical investigation and report shall be prepared by a registered geotechnical engineer for City review and approval containing, at a minimum, a description of the geological and geotechnical conditions at the site, evaluation of site-specific seismic hazards based on geological and geotechnical conditions, and recommended measures to reduce potential impacts related to seismic shaking, liquefaction, corrosion, and all other ground stability hazards. The geotechnical investigation shall also include a report prepared by a corrosion consultant that evaluates whether specific corrosion recommendations are advised for the Project. The submittal and approval of the final geotechnical report shall be a condition of the grading and construction permits issued by the City's Bureau of

Building. The Project sponsor shall implement the recommendations contained in the approved report during Project design and construction.

Significance after Mitigation: Less than Significant.

Impact GEO-2: The Project could result in substantial soil erosion or loss of topsoil, creating substantial risks to life, property, or creeks/waterways. (Criterion 2) (*Less than Significant with Mitigation*)

The entire Project site is covered with hardscape, beneath which is fill material. There is no topsoil at the Project site, and consequently, effects on topsoil are not discussed further. The analysis below focuses on potential soil erosion impacts during construction and operation.

Construction Impacts

Phase 1 and Buildout – Construction

The Project would include ground-disturbing construction activities, including grading, removal of existing asphalt covering site, excavation for certain utilities, and installation of piles for building foundations, which could increase the risk of erosion or sediment transport. Construction would have the potential to result in soil erosion during excavation and grading.

Because the overall footprint of construction activities would exceed 1.0 acre, the Project would be required to comply with the Construction General Permit, described above in Section 4.6.2, *Regulatory Setting*. This State requirement was developed to ensure that stormwater is managed and erosion is controlled on construction sites. The Construction General Permit requires preparation and implementation of a SWPPP, which requires applications of BMPs to control run-on and runoff from construction work sites. The BMPs would include, but would not be limited to, physical barriers to prevent erosion and sedimentation, construction of sedimentation basins, limitations on work periods during storm events, use of infiltration swales, protection of stockpiled materials, and a variety of other measures that would substantially reduce or prevent erosion from occurring during construction. The Construction General Permit is under the jurisdiction of the State Water Resources Control Board (SWRCB) and the local RWQCB. Compliance with these independently enforceable existing requirements would reduce the Project's potential impacts associated with soil erosion during construction. Additionally, as discussed in Section 4.9, *Hydrology and Water Quality*, **Mitigation Measure HYD-1a** (Creek Protection Plan) would require the Project to comply with the provisions of the Creek Protection Ordinance, and prepare a Creek Protection Plan, which would require the Project to incorporate erosion, sedimentation, and debris control BMPs to protect the Estuary during construction, and would further reduce the Project's potential impacts associated with soil erosion during construction. Therefore, impacts during construction would be less than significant.

Operational Impacts

Phase 1 and Buildout Operations

Operations related to Phase 1 and the Buildout of the Project are not expected to contribute substantially to soil erosion at the Project site because the Project site would be constructed largely upon artificial fill and hardscape. The proposed Project would import some soil to the

Project site to support new areas of landscaping and open space areas, however, would not provide any large open areas of soil that would be subject to erosion from wind and rain. As discussed in Section 4.9, *Hydrology and Water Quality*, drainage at the Project site would be controlled with Project design features and BMPs to enter the City's stormwater system without causing erosion and sedimentation. **Mitigation Measure HYD-1b** (NPDES Stormwater Requirements) would ensure that the Project would comply with the requirements of the City's MRP Permit for post-construction stormwater management on the Project site. Therefore, with implementation of Mitigation Measure HYD-1b, potential impacts associated with soil erosion during operations would therefore be less than significant.

> **Mitigation Measure HYD-1a: Creek Protection Plan.** (See Section 4.9, *Hydrology and Water Quality*)
>
> **Mitigation Measure HYD-1b: NPDES Stormwater Requirements.** (See Section 4.9, *Hydrology and Water Quality*)
>
> **Significance after Mitigation:** Less than Significant.

Impact GEO-3: The Project could be located on expansive soil, as defined in Section 1803.5.3 of the California Building Code (2016, as it may be revised), or corrosive soil, creating substantial risks to life or property. (Criterion 3) (*Less than Significant with Mitigation*)

Construction Impacts

Phase 1 and Buildout – Construction

The existing artificial fill beneath the Project site has a thickness ranging from 5 to 40 feet, depending on location. The Bay Mud is stratigraphically below the artificial fill and ranges in thickness from 0 to 30 feet. As explained below, the artificial fill is not considered to be an expansive soil. The Bay Mud is mostly clay, which is known to have shrink-swell properties if subjected to changes in water content. Due to the sea-level rise that is predicted to occur at the Project site (see Section 4.9, *Hydrology and Water Quality*, for a detailed discussion on the predicted sea-level changes that are anticipated to affect the Project site), there are plans to raise the site by introducing specifically engineered fill (see Chapter 3, *Project Description*, for details). The Preliminary Geotechnical Exploration Report includes details on the requirements that the introduced fill must meet in order to be acceptable for use, which are based on the CBC and are engineered to specifically to reduce impacts from potential soil expansion. Because this unit is completely beneath sea-level and would not be exposed at the surface, there can be no substantial changes in the moisture content of the unit. Therefore, the risk of impacts related to soil expansion are less than significant.

Although there is a lack of expansive soils at the site, the potential for soil corrosion remains a potential impact. Two soils samples tested for corrosivity of the soil beneath the Project site indicated a "moderate" to "not applicable" classification for sulfate exposure. Additionally, the samples had a pH level of above 7.0, which does not present corrosion concerns for steel, iron, or concrete. However, based on the resistivity and redox measurements, both samples are classified

as "severely corrosive" to buried metal piping (ENGEO, 2019). The Preliminary Geotechnical Exploration Report provides some recommendations for foundation design and site improvements based on the CBC and the American Concrete Institute Manual that specify minimum thresholds for moderate sulfate exposure. While the report gives these recommendations, ENGEO recommended that a corrosion consultant be retained to evaluate whether specific corrosion recommendations are advised for the Project (ENGEO, 2019). The additional corrosion analysis is required to be included in the final geotechnical investigation as required by Mitigation Measure GEO-1, the CBC, and the City of Oakland codes.

As required by Mitigation Measure GEO-1, the CBC and City of Oakland codes, and adherence to the recommendations presented in the Preliminary Geotechnical Exploration Report, and the final geotechnical investigation would ensure that impacts related to soil expansion and soil corrosion are kept to less-than-significant level.

Operational Impacts

Phase 1 and Buildout Operations

Upon completion of construction, the potentially expansive Bay Mud beneath the fill would not be not exposed at the surface, would not undergo any drying sequences, and therefore would not be not subject to any changes in moisture content. Potential impacts associated with soil expansion during operations would be less than significant.

Potential impacts related to soil corrosion would be addressed during the construction phase, and with the adoption of the recommendations presented in the final geotechnical investigation per Mitigation Measure GEO-1, to protect against any potential soil corrosion, the operational impacts related to soil corrosion would be less than significant with mitigation incorporated.

> **Mitigation Measure GEO-1: Site-Specific Final Geotechnical Report.** (See Impact GEO-1)
>
> **Significance after Mitigation:** Less than Significant.

Impact GEO-4: The Project would not be located above a well, pit, swamp, mound, tank vault, or unmarked sewer line, creating substantial risks to life or property. (Criterion 4) (*Less than Significant*)

Construction Impacts

Phase 1 and Buildout – Construction

As discussed in Section 4.8, *Hazards and Hazardous Materials*, there is a monitoring well network in place to monitor the contamination conditions beneath the Project site; the network consists of seventeen wells at the locations shown on Figure 4.8-5. As a requirement of the Land Use Covenants (LUCs) currently placed in the site and the new LUCs anticipated to replace the existing LUCs described in Section 4.8, the entire Project site is overlain with a durable cover with a cap to prevent the public's exposure to contaminants and the monitoring well network verifies that the cap cover is effective in preventing contaminant contact and migration. Project

construction activities may disturb one or more wells of the groundwater monitoring well network and possibly require the relocation of one or more wells.

Both the existing and the anticipated new LUCs, with their associated Operations and Maintenance (O&M) Plans, require that any changes to the monitoring well network during construction must be approved by the regulatory agency enforcing the LUCs, which is the Department of Toxic Substances Control (DTSC). Any monitoring wells that may need to be removed would need to be replaced in other locations to maintain an effective monitoring well network. There are no known underground storage tanks (USTs), pits, swamps, mounds, tank vaults, or unmarked sewer lines present below the Project site; the Soil and Groundwater Management Plans (SGMPs) and Risk Management Plans (RMPs) specify protocols to be followed if any such currently unknown underground objects are discovered in the course of construction.

Compliance with the LUCs along with their associated O&M Plans, also described in Section 4.8, *Hazards and Hazardous Materials*, would be required as a condition of approval by DTSC to address any impacts related to the monitoring well network beneath the Project site, resulting in a less than significant impact.

Operational Impacts

Phase 1 Operations

As noted above, there are no USTs, pits, swamps, mounds, tank vaults, or unmarked sewer lines present beneath the Project site. As discussed above, the DTSC will require that the groundwater monitoring network be maintained. In the event that construction requires disturbing any monitoring well, that well would be replaced under the construction phase and access to all monitoring wells will be required by the DTSC as a condition of the LUCs and O&M Plans, resulting in a less than significant operational impact.

Mitigation: None required.

Impact GEO-5: The Project would not be located above landfills for which there is no approved closure and post-closure plan, or unknown fill soils, creating substantial risks to life or property. (Criterion 5) (*Less than Significant*)

Construction Impacts

Phase 1 and Buildout – Construction

The Project site is not located above a former landfill that accepted waste for disposal. However, as discussed above, the Project site is built on artificial fill, most of which consists of undocumented fill emplaced years ago with uncertain engineering placement procedures. As discussed in Section 4.8, *Hazards and Hazardous Materials*, subsurface fill, soils, and groundwater that were contaminated by former industrial uses at the Project site have been investigated and monitored for over 20 years, under the oversight of DTSC. As discussed above, the fill is capped by hardscape, which prevents the public's exposure to any contaminants present in the fill.

Project construction would remove some or all of the existing cap on the Project site as construction proceeds (an exception may be at a portion of the Peaker Power Plant property, where the existing cap would be retained in place, pending future plans; see Chapter 5, *Project Variants*). If proper engineering and institutional controls, and best management practices were not implemented during construction, such activities could expose construction workers and the environment to underlying contaminated fill, soil, soil vapor, and/or groundwater.

As discussed in detail in Section 4.8, *Hazards and Hazardous Materials*, the Project site is subject to three LUCs, and their associated plans, which are enforced by the DTSC. Those LUCs and associated plans will be replaced with new LUCs and associated plans before commencement of Project development activities. In particular, the LUCs and associated plans require that the Project site shall be used and developed in a way that preserves the integrity of the cap or engineered equivalents installed on the Project site. The cap or engineered equivalent shall not be disturbed without approval of the DTSC, which approval will be conditioned on requirements ensuring mitigation of any potential impacts of disturbance.

Portions of the cap may be replaced with a new hardscape (asphalt or concrete) cap, consistent with the existing cap. Concrete foundations of buildings and other structures could serve as hardscape cap with DTSC approval. In addition, the cap may be replaced with an engineered equivalent that maintains preventing exposure of the public or the environment to the underlying contaminated materials, again with DTSC approval. For example, in some areas, the cap could be replaced with a drainage system and fill. This engineered equivalent would prevent public exposure to the contaminated materials by adding fill, and also prevent rainfall and landscape water from infiltrating into the underlying materials and mobilizing contaminants through the installation of a drainage system. If areas are identified that have no underlying contaminated materials, the DTSC may approve not installing a cap or engineered equivalent in those areas. Note that all changes will require DTSC approval prior to the development of the site.

In addition, as described in Chapter 3, *Project Description*, additional fill will be added to raise the elevation of the entire site to address sea level rise. The addition of addition fill would further isolate the underlying contaminants from the public and the environment.

With compliance with the above-referenced LUCs, along with the associated O&M Plans, as approved and enforced by the DTSC, and the addition of additional fill to address sea level rise, the impacts would be less than significant.

Operational Impacts

Phase 1 Operations

Once constructed, the maintenance of the cap and alternate engineering controls would prevent the public and workers at the ballpark, commercial outlets, and residential users from encountering the hazardous materials beneath the cap and its engineered equivalents. As required by the previously-discussed LUCs and O&M Plans, the cap and engineered equivalents would be periodically inspected, maintenance conducted as needed, and disturbance of the cap cover and engineered equivalents prohibited without DTSC approval. The required compliance with

previously discussed LUCs and O&M Plans would prevent contact with the buried hazardous materials, and would result in a less than significant impact.

Mitigation: None required.

Impact GEO-6: The Project could directly or indirectly destroy a unique paleontological resource or site or unique geologic feature. (Criterion 7) (*Less than Significant with Mitigation*)

Construction Impacts

Phase 1 and Buildout – Construction

Geologic units beneath the artificial fill and Bay Mud (i.e., Merritt Sand and San Antonio Formation) on the Project site have the potential for containing paleontological resources. However, due to the nature of the ground disturbing activities (i.e., the addition of fill, utilities installation, and pile installation for building foundations), there would be limited potential for return of any undisturbed soil materials or intact deposits from the Merritt Sand and San Antonio Formation. There would not be large areas of exposure into those layers under the proposed Project during construction. For instance, any driven piles would be pneumatically hammered into the ground and no subsurface materials would be returned to the surface; and any drilled piles would be excavated into the subsurface with the returned materials highly disturbed and spatially confined. Given the limited exposure to the paleontologically sensitive geologic formations within the Project site, the potential for paleontological resources to be identified during Project construction is substantially lessened, and would be less than significant. However, **Mitigation Measure GEO-2** is recommended as an extra measure to protect against any possible inadvertent discovery of paleontological resources.

Mitigation Measure GEO-2: Inadvertent Discovery of Paleontological Resources During Construction.

Pursuant to State CEQA Guidelines Section 15064.5(f), in the event that any paleontological resources are discovered during ground disturbing activities, all work within 50 feet of the resources shall be halted and the Project sponsor shall notify the City and consult with a qualified paleontologist, as applicable, to assess the significance of the find. In the event of discovery of paleontological resources, the assessment shall be done in accordance with the Society of Vertebrate Paleontology standards. If any find is determined to be significant, appropriate avoidance measures recommended by the consultant and approved by the City must be followed unless avoidance is determined unnecessary or infeasible by the City. Feasibility of avoidance shall be determined with consideration of factors such as the nature of the find, Project design, costs, and other considerations. If avoidance is unnecessary or infeasible, other appropriate measures (e.g., data recovery, excavation) shall be instituted. Work may proceed on other parts of the Project site while measures for the paleontological resources are implemented.

In the event of excavation of paleontological resources, the Project sponsor shall submit an excavation plan prepared by a qualified paleontologist to the City for review and approval. All significant cultural materials recovered shall be subject to scientific analysis, professional museum curation, and/or a report prepared by a qualified

paleontologist, as appropriate, according to current professional standards and at the expense of the Project sponsor.

Significance after Mitigation: Less than Significant.

Operational Impacts

Operation of the proposed Project would result in no further disturbance of geologic units or paleontological resources, and accordingly, would have a less than significant impact.

Maritime Reservation Scenario

Under the Maritime Reservation Scenario, the Port of Oakland may retain up to approximately 10 acres at the southwest corner of the Project site to accommodate future expansion of a turning basin that is used to turn large vessels accessing berths in Oakland's Inner Harbor of the Estuary. If this option is exercised, that portion of the proposed Project site would not be developed, and the Project site boundary would change and the Project site area would become smaller. However, all site conditions relative to geology, soils, and paleontological resources would remain the same as described for the proposed Project but with a smaller Project area, and therefore the impacts and analysis for the Maritime Reservation Scenario would be the same as those discussed above for the proposed Project. Development of the Project, including grading improvements, may be phased, and are unlikely to occur on any part of the site affected by the Maritime Reservation Scenario until a decision is made regarding the need for and size of an expanded turning basin. The impacts from the construction of an expanded turning basin would be analyzed by the Port of Oakland under a separate CEQA document.

4.6.5 Cumulative Impacts

Impact GEO-1.CU: The Project, combined with cumulative development in the Project vicinity and citywide, could result in significant cumulative impacts to geology, soils, seismicity, or paleontology. ***(Less than Significant with Mitigation)***

Geographic Context

The geographic area affected by the proposed Project and its potential to contribute to cumulative impacts varies based on the environmental resource under consideration. The geographic scope of analysis for cumulative geologic impacts encompasses and is limited to the Project site and its immediately adjacent area. This is because impacts relative to geologic hazards are generally site-specific. For example, the effect of erosion would tend to be limited to the localized area of a project and could only be cumulative if erosion occurred as the result of two or more adjacent projects that spatially overlapped.

The time frame during which proposed Project could contribute to cumulative geologic hazards includes the construction and operations phases. For the proposed Project, the operations phase is permanent. However, similar to the geographic limitations discussed above, it should be noted that impacts relative to geologic hazards are generally time-specific. Geologic hazards could only

be cumulative if two or more geologic hazards occurred at the same time, as well as overlapping at the same location.

Cumulative Impact – Construction

Other cumulative projects that would be near or adjacent to the Project that could be constructed at the same time, could result in cumulative erosion effects. However, as with the proposed Project, the State Construction General Permit would require cumulative projects to prepare and implement a SWPPP. The SWPPPs would describe BMPs to control runoff and prevent erosion for each project. Through compliance with this requirement, the potential for erosion impacts would be controlled. The Construction General Permit has been developed to address cumulative conditions arising from construction throughout the state, and is intended to maintain cumulative effects of projects subject to this requirement to less-than-significant levels. For example, two adjacent construction sites would be required to implement BMPs to reduce and control the release of sediment and/or other pollutants in any runoff leaving their respective sites. The runoff water from both sites would be required to achieve the same action levels, measured as a maximum amount of sediment or pollutant allowed per unit volume of runoff water. Thus, even if the runoff waters were to combine after leaving the sites, the sediments and/or pollutants in the combined runoff would still be at concentrations (amount of sediment or pollutants per volume of runoff water) below action levels and would not be cumulatively considerable. Additionally, as discussed under Impact GEO-2, Mitigation Measure HYD-1a (Creek Protection Plan) would require the Project to comply with the provisions of the Creek Protection Ordinance, and prepare a Creek Protection Plan, which would further reduce the Project's potential impacts associated with soil erosion during construction. Similar to the proposed Project, cumulative projects subject to the Creek Protection Ordinance would also be required to comply with the ordinance and incorporate applicable erosion, sedimentation, and debris control BMPs to protect qualifying waterbodies, including the Estuary, during construction, and the proposed Project's contribution to cumulative effects would not be cumulatively considerable.

Seismically induced groundshaking, liquefaction and lateral spreading, and expansive and corrosive soils could cause structural damage or ruptures during construction of cumulative projects. However, as discussed for the Project, the CBC and City of Oakland building regulations and standards have been established to address and reduce the potential for such impacts to occur. The cumulative projects would be required to comply with the same applicable provisions of these laws and regulations. Through compliance with these requirements, the potential for impacts would be reduced to less than significant. The purpose of the CBC and City of Oakland building regulations and standards is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction; by design, it is intended to reduce the cumulative risks from buildings and structures. Based on compliance with these requirements, such as that specified in project-level Mitigation Measure GEO-1 for the proposed Project, the incremental impacts of the Project, combined with impacts of other projects in the area would not combine to cause a significant cumulative impact related to seismically-induced ground shaking, liquefaction, and lateral spreading, or expansive soils.

Federal, State, and local laws can generally protect paleontological resources in most instances. Similar to the proposed Project, any cumulative development would be required to comply with the same provisions of CEQA and implement CEQA mitigations measures, such as project-level Mitigation Measure GEO-2 identified for the proposed Project, to mitigate any potential impacts. These measures would require protocols for responding in the event of inadvertent discovery of paleontological resources. Through compliance with applicable regulations and implementation of associated avoidance and minimization measures, the Project would not combine with other cumulative development to have considerable adverse cumulative effects on paleontological resources of the region. This cumulative impact would be less than significant.

Cumulative Impact – Operations

Seismically induced groundshaking, liquefaction and lateral spreading, and expansive soils could cause structural damage or pipeline leaks or ruptures. However, State and local building regulations and standards, described in the *Regulatory Setting*, have been established to address and reduce the potential for such impacts to occur. Upon completion of construction, the proposed Project and cumulative projects would have been constructed in compliance with the applicable construction and design laws and regulations. Through compliance with these requirements, the potential for impacts would be reduced. As explained in Section 4.6.2, *Regulatory Setting*, the purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction; by design, it is intended to reduce the cumulative risks from buildings and structures. Therefore, based on compliance with these requirements, the incremental impacts of the proposed Project combined with impacts of other projects in the area would not cause a significant cumulative impact related to seismically induced groundshaking, liquefaction and lateral spreading, or expansive soils and the proposed Project's contribution to cumulative effects would not be cumulatively considerable.

The Project would be required to comply with applicable NPDES Permit requirements, as referenced previously in Impact GEO-2 and Mitigation Measure HYD-1b (NPDES Stormwater Requirements). These requirements and the design of the Project to capture all onsite stormwater within a new onsite stormwater system meeting stormwater quality design specifications would reduce the Project's incremental contribution to a cumulative impact related to erosion to a less-than-considerable level.

As previously discussed in this section under *Topics Considered and Determined to Have No Impact*, the Project would have no impact with respect to being located on an active fault, landslides, or wastewater disposal. Accordingly, the Project could not contribute to cumulative impacts related to these topics and are not discussed further. Also, Project operations do not include any activities that would pose a threat to any paleontological resources. As stated above, the proposed Project and cumulative projects would have been constructed in compliance with applicable laws and regulations, and therefore the potential for impacts would be reduced, and would not cause a significant cumulative impact related to paleontological resources.

Conclusion

Potential exposure to geological and soils hazards, and impacts to paleontological resources, resulting from construction and operation of development of the Project would not have a

cumulatively considerable contribution to a cumulative impact. No significant cumulative impact is identified.

Mitigation Measure GEO-1: Site-Specific Final Geotechnical Report. (See Impact GEO-1)

Mitigation Measure GEO-2: Inadvertent Discovery of Paleontological Resources During Construction. (See Impact GEO-6)

Mitigation Measure HYD-1a: Creek Protection Plan. (See Section 4.9, *Hydrology and Water Quality*)

Mitigation Measure HYD-1b: NPDES Stormwater Requirements. (See Section 4.9, *Hydrology and Water Quality*)

Significance after Mitigation: Less than Significant.

Maritime Reservation Scenario – Cumulative

As described above, under the Maritime Reservation Scenario, approximately 10 acres of the proposed Project site would not be developed, and the reconfigured Project site boundary would change and the Project site area would become smaller. However, all site conditions relative to geology, soils and paleontological resources would remain the same as described for the proposed Project, and therefore the cumulative impacts and analysis for the Maritime Reservation Scenario would be the same as those discussed above for the proposed Project.

As discussed above, the proposed Project and other cumulative developments will comply with State and local building regulations and standards, in particular the CBC, and all applicable construction and design laws and regulations. Therefore, based on compliance with these requirements, the incremental impacts of the proposed Project combined with impacts of other projects in the area would not cause a significant cumulative impact related to seismically induced groundshaking, liquefaction and lateral spreading, expansive soils, or paleontological resources. If the Port was to proceed with the expanded turning basin, the impacts from the construction of an expanded turning basin would be analyzed by the Port of Oakland under a separate CEQA document, and that project would be subject to the same regulatory requirements as the Project, and would not combine to cause a significant cumulative impact.

4.6.6 References – Geology, Soils, and Paleontological Resources

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