3.6 GEOLOGY AND SOILS

GEOLOGY AND SOILS – Would the Project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) 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 Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) 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 on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

3.6.1 Environmental Setting

Regional Setting

The Project site lies within the Coast Range Geomorphic Province of California, a region with independent and discontinuous northwest-trending mountain ranges, ridges, and intervening valleys (California Geological Survey [CGS] 2002). The Coast Range province is the largest of the state's geomorphic provinces and rises abruptly from the shore in northern Humboldt County extending 400 miles south to the Santa Ynez River

in Santa Barbara County. In general, the Coast Range province is composed of marine sedimentary bedrock, occasional volcanic rocks, and alluvial deposits (CGS 2002).

Historically active faults in the region include the Concord, Hayward, Greenville-Marsh Creek-Clayton, Calaveras, and San Andreas Faults (Figure 3.6-1). Of the major fault zones, the San Andreas Fault is capable of generating the largest maximum credible earthquake (MCE), estimated at a magnitude of 8.3 on the Richter scale (Borcherdt 1975). The Hayward and Calaveras Faults can generate an MCE of magnitude 7.5, the Greenville-Marsh Creek-Clayton Fault can generate an MCE of magnitude 7.2, and the Concord Fault can generate an MCE of magnitude 7.0 (Table 3.6-1). Earthquakes of this magnitude are sufficient to create severe ground accelerations in bedrock and unconsolidated deposits that could potentially cause major damage to structures and foundations (Greensfelder 1974).

Project Setting

Geology

The Project site is located in northern Contra Costa County along the southeast shore of the Carquinez Strait near the town of Port Costa, Contra Costa County. The East Bay Hills region is primarily composed of Cretaceous and Tertiary age sedimentary and volcanic rock with Quaternary alluvium in the valleys, and Quaternary colluviums on hillslopes. The onshore portion of the Project area is within undivided surficial deposits of Holocene and Pleistocene age (Graymer et al. 1994). A map of the Project site geology is presented as Figure 3.6-2. Quaternary geologic maps of the East Bay Hills region characterize the onshore portions of the Project area as predominantly Holocene alluvial fan deposits (Helley and Graymer 1997).

Faults and Seismicity

The East Bay Hills region is characterized by northwest to southeast trending ridges. The structural trend of this region is controlled primarily by the active faulting and folding related to the movement within the San Andreas Fault system. This portion of the East Bay Hills lays between two major active structures within the fault system, the active Concord Fault approximately 4 miles to the east, and the active Hayward Fault approximately 10 miles to the west (Figure 3.6-1, Table 3.6-1). Faults zoned as active by the CGS are those that have undergone seismic activity within the past 11,000 years (Holocene epoch). While the Project site is generally between the Concord and Hayward Faults, a search of the Alquist-Priolo Earthquake Fault Zone Maps indicates that the Project does not lie within an Alquist-Priolo Earthquake zone (CGS 2010). No known active faults cross the Project site. Two faults in the Project vicinity are considered inactive by the CGS (Hart 1990): the Southampton Fault, located near the site, and the Franklin Fault, located about 1.5 miles west of the site (Figure 3.6-1).

Figure 3.6-1. Regional Fault Map

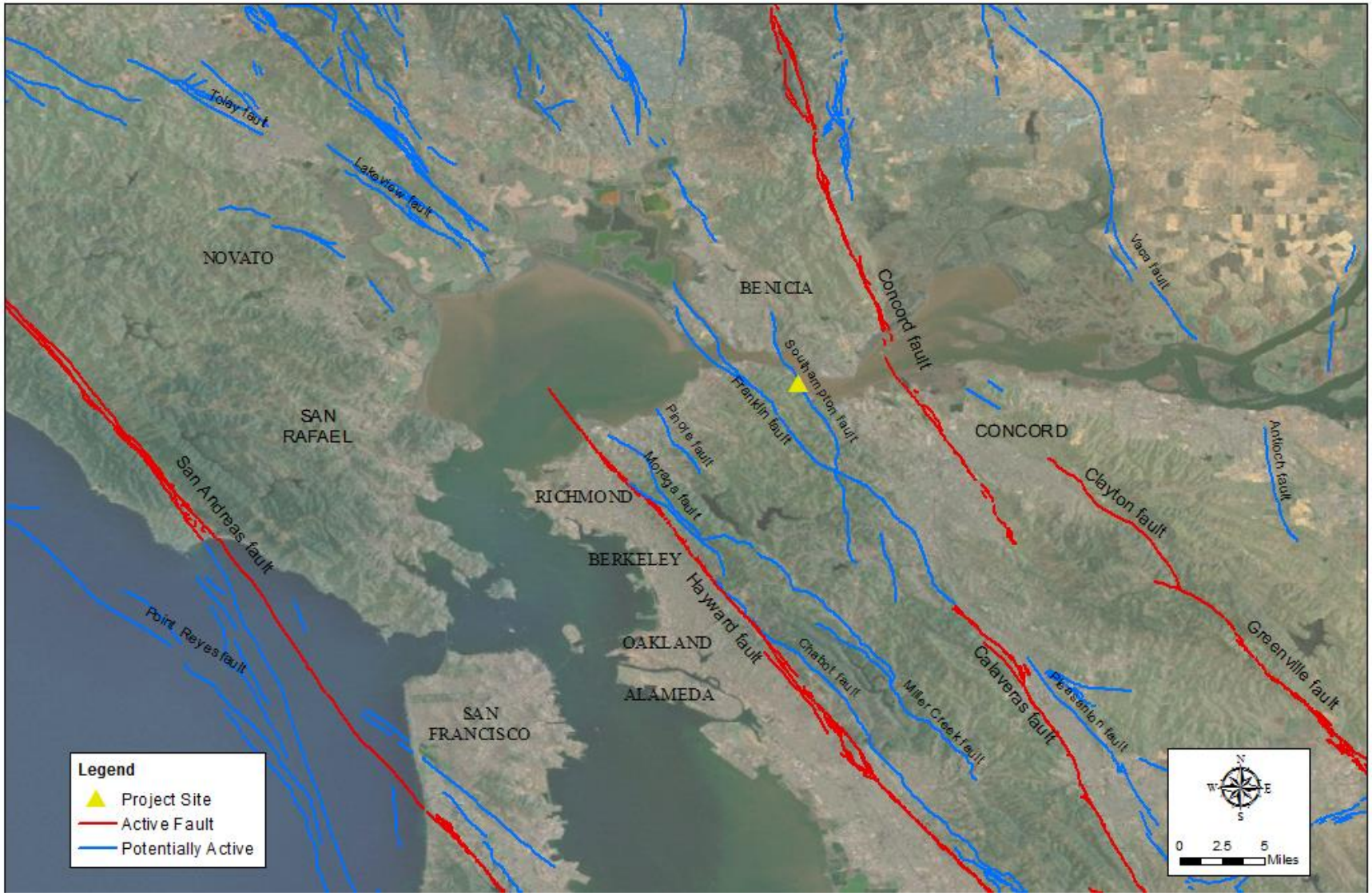
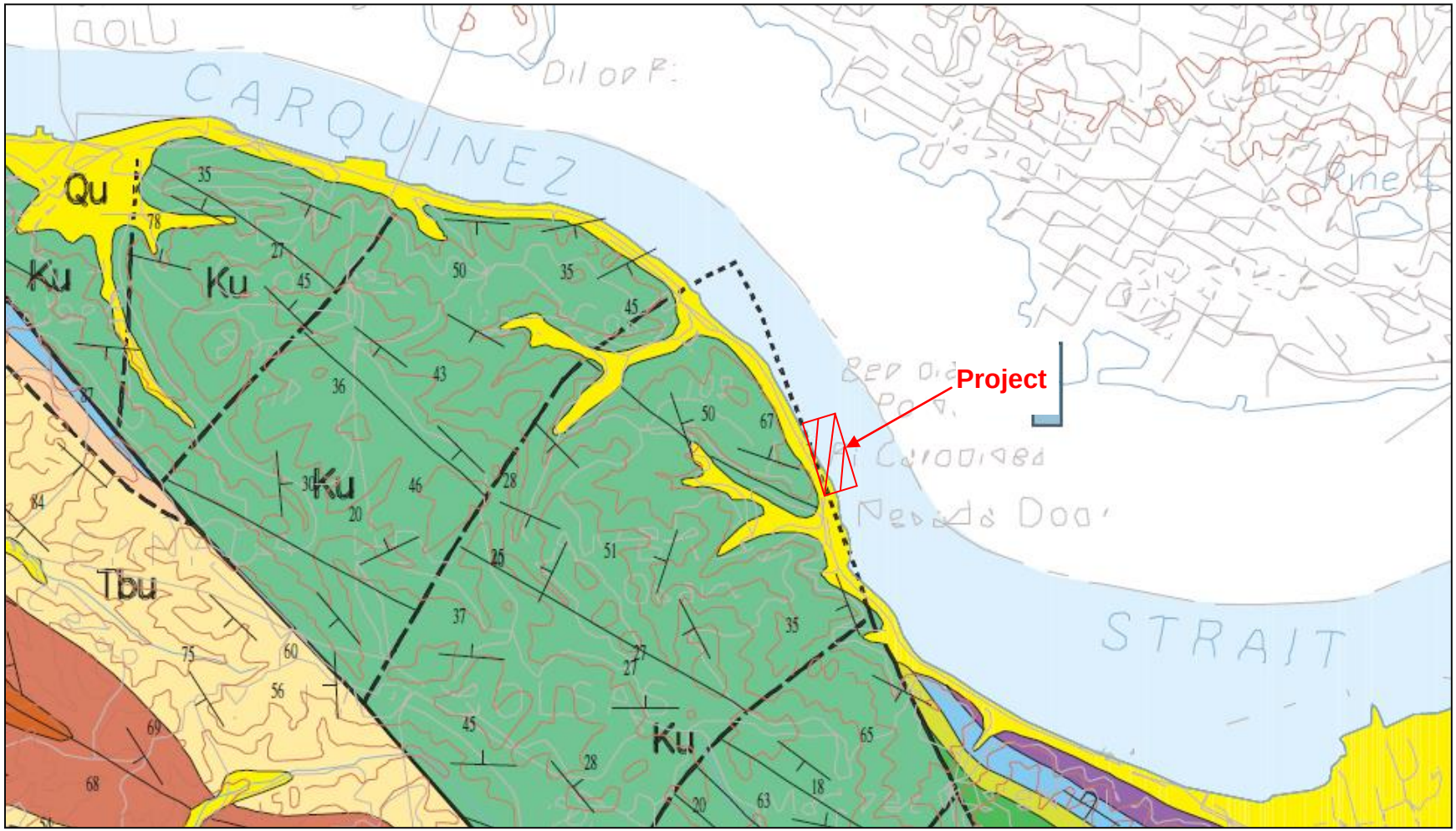


Figure 3.6-2. Geologic Map of the Project Site Vicinity



Map Legend

Qu Surficial deposits, undivided (Holocene and Pleistocene)
Ku Great Valley Sequence (Cretaceous)
TBu Upper sandstone and Shale – Briones Formation (Miocene)

Source: Graymer et al. 1994

Table 3.6-1. Active Faults in the Project Site Vicinity

Fault	Distance/ Direction from Project Area	Fault Classifi-cation	Recency of Movement	Historical Richter Magnitude/ Year	Maximum Moment Magnitude Earthquake
Concord	4 miles east	Active	Historic (1955) Holocene	Historic active creep	7.0
Hayward	10 miles west	Active	Pre-Historic (possible 1836; 1868 ruptures) Holocene	M6.8, 1868	7.5
Greenville-Marsh Creek-Clayton	12 miles southeast	Active	Historic (1980 rupture) Holocene	M5.6 1980	7.2
Calaveras	15 miles southeast	Active	Historic (1961 rupture) Holocene	M5.6-6.4, 1861 M4-4.5 1970, 1990	7.5
San Andreas	28 miles southwest	Active	Historic (1906; 1989 ruptures) Holocene	M7.1, 1989 M8.25, 1906 M7.0 1938 Many < M6	8.3

Source: Borcherdt et al. 1975; Jennings and Byrant 1994; Hart and Byrant 1997

Seismic Hazards

Seismic hazards include ground shaking, liquefaction, land sliding, lateral spreading, differential settlement, and inundation by encroaching waves. No known active faults traverse the Project site; therefore, fault rupture is not considered a potential geologic hazard that could affect the Project.

Liquefaction

Liquefaction is the sudden loss of shear strength in saturated, granular sediments that are subjected to ground shaking. It typically occurs when ground shaking causes the water pressure between granules to exceed the pressure of the soil overburden, which allows the soil to move like a fluid. The potential for liquefaction to occur depends on the duration and intensity of earthquake shaking, the density of the soil, the distribution of soil particle sizes, and the elevation of the groundwater. Based on the Association of Bay Area Governments (ABAG) Liquefaction Susceptibility Map, the onshore portions of the Project have a very low risk of liquefaction (ABAG 2011). The mapping program does not include the submerged areas of the Carquinez Strait.

Landslides and Soil Erosion

The Project site is within waters of the Carquinez Strait. Additionally, between the water line and the rail lines are primarily disturbed areas consisting of concrete riprap and compacted soils, with little potential for soil erosion to occur.

3.6.2 Regulatory Setting

Federal and State laws and regulations pertaining to this issue area and relevant to the Project are identified in Table 3.6-2. Local goals, policies, and/or regulations applicable to this issue area are listed below.

Table 3.6-2. Federal and/or State Laws, Regulations, and Policies Potentially Applicable to the Project (Geology and Soils)

CA	Alquist-Priolo Earthquake Fault Zoning Act (Pub. Resources Code, §§ 2621-2630)	This Act requires that "sufficiently active" and "well-defined" earthquake fault zones be delineated by the State Geologist and prohibits locating structures for human occupancy across the trace of an active fault.
	California Building Code (CBC) (Cal. Code Regs., tit. 23)	The CBC contains requirements related to excavation, grading, and construction of pipelines alongside existing structures. A grading permit is required if more than 50 cubic yards of soil are moved. Sections 3301.2 and 3301.3 contain provisions requiring protection of adjacent properties during excavations and require a 10-day written notice and access agreements with adjacent property owners.
	California Seismic Hazards Mapping Act (Pub. Resources Code, § 2690 and following as Division 2, Chapter 7.8)	This Act and the Seismic Hazards Mapping Regulations (Cal. Code Regs., tit. 14, Div. 2, Ch. 8, Art. 10) are designed to protect the public from the effects of strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. The Act requires that site-specific geotechnical investigations be conducted identifying the hazard and formulating mitigation measures prior to permitting most developments designed for human occupancy. Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (California Geological Survey 2008), constitutes guidelines for evaluating seismic hazards other than surface fault rupture and for recommending mitigation measures as required by section 2695, subdivision (a).

The Safety Element of the Contra Costa County General Plan 1995-2020 includes goals and policies to address seismic hazards within the County. No seismic hazard goals or policies are applicable to the Project site.

3.6.3 Impact Analysis

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

(i) 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 Division of Mines and Geology Special Publication 42.)

(ii) Strong seismic ground shaking?

No Impact. The Project involves the removal of a wharf and does not include the construction of any buildings or structures that could potentially be damaged or cause injury or death. Work would be conducted from a barge adjacent to the structures to be removed. The Project site is not crossed by active faults and does not lie within or near an Alquist-Priolo Earthquake Zone. There is the potential for workers to be subjected to ground shaking in the event of a significant earthquake within the region, but the likelihood of this occurring during the relatively short deconstruction period (up to 5 months) is relatively remote. Therefore, this Project is not likely to expose people or structures to potential substantial adverse effects due to rupture of a fault or seismic ground shaking.

(iii)Seismic-related ground failure, including liquefaction?

No Impact. The mapping compiled by ABAG shows that the onshore areas adjacent to the Project site have a very low risk of liquefaction. All MOT structures would be removed from the Carquinez Strait, thereby decreasing the potential for Bay Mud liquefaction effects on the structures. Therefore, the Project is not likely to expose people or structures to potential substantial adverse effects due to seismic-related ground failure including liquefaction.

(iv) Landslides?

No Impact. The onshore portion of the Project is limited to a temporary staging area within the confines of an existing shore base of the selected contractor, which would be located in a relatively flat industrially-developed area. Therefore, this Project is not likely to expose people or structures to potential substantial adverse effects due to landslides.

b) Result in substantial soil erosion or the loss of topsoil?

c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

d) Be located on expansive soil, as defined in Table 18 1 B of the Uniform Building Code (1994), creating substantial risks to life or property?

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 Impact. The onshore portion of the Project is limited to a temporary staging area within the confines of an existing shore base of the selected contractor, which would be located in a relatively flat industrially-developed area. Therefore, this Project is not likely to result in substantial soil erosion or the loss of topsoil. The site is not located on a geologic unit or soil that is unstable or expansive. Project activities would not require sewers, septic tanks, or alternative wastewater storage or disposal systems.

3.6.4 Mitigation Summary

The Project would not result in significant impacts to geology and soils; no mitigation is required.