

## Section 3.8

# Geology and Soils

### 3.8.1 Introduction

This geology and soils analysis presents the geologic conditions for the project site and vicinity and analyzes potential geologic hazards, including whether the proposed project would: (1) directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, strong seismic ground shaking, or seismic-related ground failure, including liquefaction; (2) 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; or (3) be located on expansive soil, creating substantial direct or indirect risks to life or property. This section describes the general approach and methodology, regulatory framework, environmental setting, significance criteria, and addresses potential geology and soils impacts associated with construction and operation of the proposed project at SDIA. Erosion is addressed in Section 3.10, Hydrology and Water Quality.

No comments specific to geology and soils were received in response to the NOP.

### 3.8.2 General Approach and Methodology

Baseline information for the following analysis was derived from a number of sources, including previous evaluations and reports reflected in the 2008 EIR for the SDIA Airport Master Plan,<sup>1</sup> which provides airport-wide and regional information on geology and soils, fault hazard studies prepared for the project area in May 2017<sup>2</sup> and November 2016,<sup>3</sup> the geotechnical investigation conducted for the Terminal 2 expansion project (Green Build) prepared in 2010,<sup>4</sup> and published technical materials from sources such as the California Geological Survey (CGS) and City of San Diego. The site-specific information focuses on the “Terminal area” portion of SDIA, where most elements of the proposed project would be implemented. The primary source of this project-specific information is the Terminal Area Fault Study<sup>5</sup> prepared by AMEC in 2016. As shown in Figure 3.8-1, the study area for the Terminal Area Fault Study extends from McCain Road south of the T2

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<sup>1</sup> San Diego County Regional Airport Authority. San Diego International Airport Master Plan Final Environmental Impact Report. SCRRAA #EIR-06-01, State Clearinghouse No. 2005091105. April 2008.

<sup>2</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

<sup>3</sup> Amec Foster Wheeler. Terminal Area Fault Study San Diego International Airport San Diego, California. Prepared for San Diego County Regional Airport Authority. November 1, 2016.

<sup>4</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>5</sup> Amec Foster Wheeler. Terminal Area Fault Study San Diego International Airport San Diego, California. Prepared for San Diego County Regional Airport Authority. November 1, 2016.

surface parking lot in the east to the former Teledyne Ryan Property (TDY site) located east of Winship Lane, south of the former Commuter Terminal (current airport administration building).

Additional project-specific information pertaining to the Rose Canyon Fault Zone is primarily sourced from the Fault Hazard Study<sup>6</sup> prepared by Kleinfelder in May 2017. Project-specific information is also provided by the geotechnical investigation conducted for the Green Build prepared in 2010.<sup>7</sup> The Green Build investigation study area encompasses the current site of the T2 Parking Plaza, which is between areas proposed for construction under the proposed project (west of the existing T1 and southeast of the proposed T2 modifications). The surface and subsurface conditions are generally the same at the Green Build study area and the areas where construction would occur under the proposed project.

### 3.8.3 Regulatory Framework

The proposed project is subject to a number of regulatory requirements and/or guidelines related to potential geologic issues. These standards typically involve measures to evaluate risk and address potential hazards through geotechnical evaluation, as well as project/facility design and construction techniques. The regulatory requirements are summarized below and discussed as applicable under the evaluation of potential project impacts.

#### 3.8.3.1 State

##### **California Seismic Hazards Mapping Act**

The California Seismic Hazards Mapping Act of 1990 (Public Resources Code; Division 2, Chapter 7.8, Section 2690 et seq.) provides a statewide seismic hazard mapping and technical advisory program to assist local agencies in protecting public health and safety relative to seismic hazards. The Act provides direction and funding for the CGS to compile seismic hazard maps that identify areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking, and to make those maps available to local governments for use in their planning and building permit process. The Act, along with related standards in the Seismic Hazards Mapping Regulations (California Code of Regulations; Title 14, Division 2, Chapter 8, Article 10, Section 3270 et seq.), also directs local governments to require the completion and review of appropriate geotechnical studies prior to approving development projects.

##### **Alquist-Priolo Earthquake Fault Zoning Act**

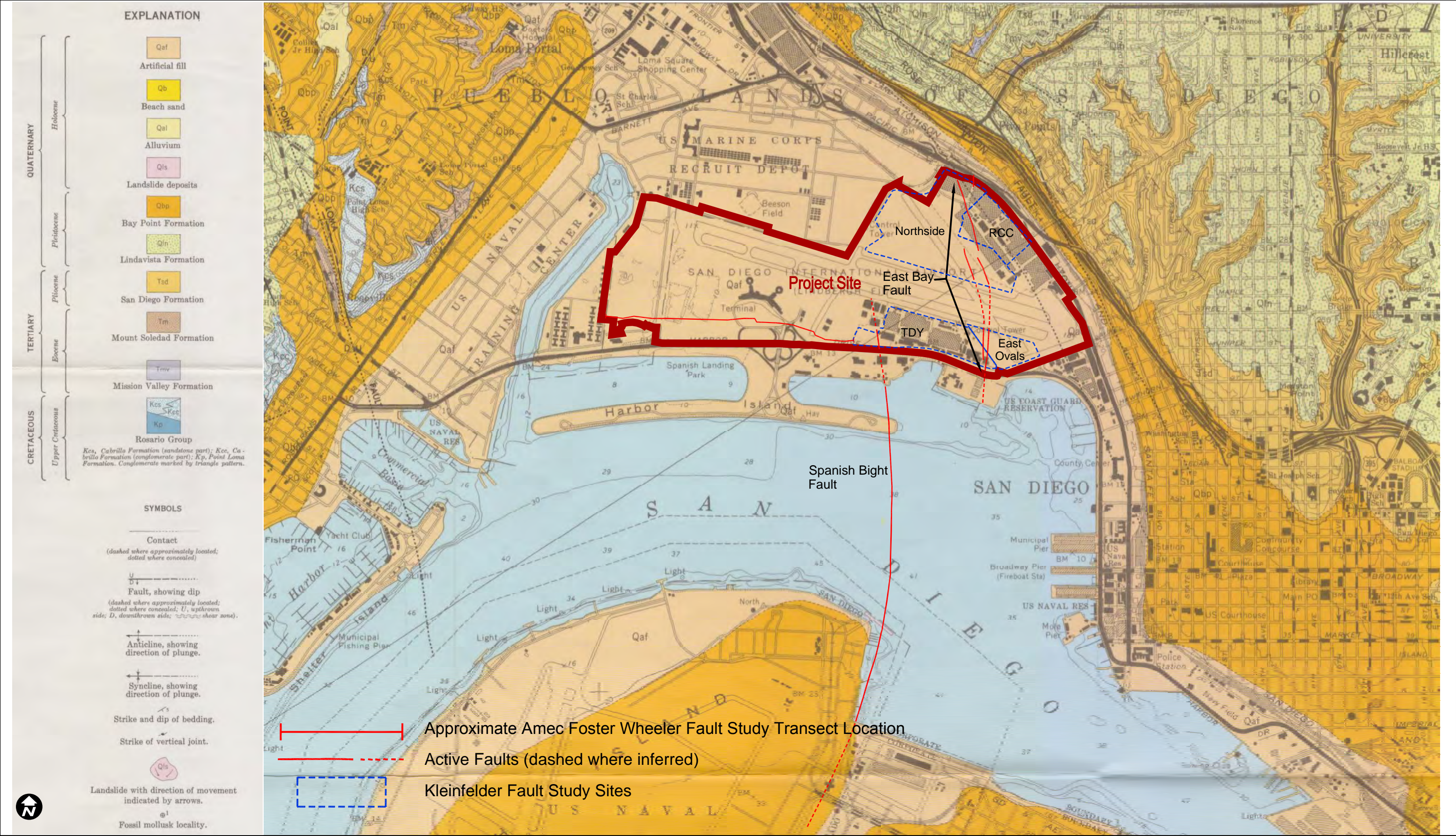
The Alquist-Priolo Earthquake Fault Zoning Act of 1972 is intended to prevent the construction of buildings used for human occupancy<sup>8</sup> on or adjacent to the surface trace of active faults. The law requires the State Geologist to establish regulatory zones known as Earthquake Fault Zones (previously called Special Studies Zones and Fault-Rupture Hazard Zones) around the surface

<sup>6</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

<sup>7</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>8</sup> California Code of Regulations Title 14, Article 13, Section 3600 (e) defines a “structure for human occupancy” as any structure used or intended for supporting or sheltering any use or occupancy, which is expected to have a human occupancy rate of more than 2,000 person-hours per year.





Source: Amec Foster Wheeler, 2016. Basemap source: Michael P. Kennedy, 1975; Kleinfelder, 2013; and Department of Conservation, California Geological Survey, 2003.



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traces of active faults, and to distribute maps of these zones to all affected cities, counties and state agencies. The Act also requires completion of a geologic investigation prior to project approval, to demonstrate that proposed buildings will not be constructed across active faults, and/or that appropriate setbacks from such faults (generally 50 feet) are included in the project design of structures for human occupancy. The Act does not require structural setbacks for potentially active or inactive faults, or for minor structures not for human occupancy located adjacent to active faults. Section 3601 of California Code of Regulations, Title 14, Article 3, Policies and Criteria of the State Mining and Geology Board with Reference to the Alquist-Priolo Earthquake Fault Zoning Act defines an active fault as a fault which has had surface displacement within Holocene time, about the last 11,000 years, hence constituting a potential hazard to structures that might be located across it.

### **California Building Code Standards**

The California Building Code (CBC) codified in Title 24 California Code of Regulations encompasses a number of requirements related to geologic issues, including Part 2, Volume 2, Chapter 18, Soils and Foundations, which outlines the minimum standards for structural design and construction. The CBC augments and supersedes the Uniform Building Code (UBC) with stricter requirements to reduce the risks associated with building in seismic areas to the maximum extent practicable. The CBC is modeled after the International Building Code (IBC) and sets standards for the investigation and mitigation of the site conditions related to fault movement, liquefaction, landslides, differential compaction/seismic settlement, ground rupture, ground shaking, and seismically-induced flooding.

Chapter 18, Soils and Foundations, of the CBC requires that geotechnical evaluations be conducted that include, among other requirements, a record of the soil profile, evaluation of active faults in the area, and recommendations for foundation type and design criteria that address issues as applicable such as (but not limited to) bearing capacity of soils, provision to address expansive soils and liquefaction, settlement and varying soil strength. If a building department, or other appropriate enforcement agency, determines that recommended action(s) presented in the geotechnical evaluations are likely to prevent structural damage, the approved recommended action(s) must be made a condition to the building permit (Section 1803.1.1.3 of Chapter 18).

The CBC provides standards for various aspects of construction, including but not limited to excavation, grading, and earthwork construction; preparation of the site prior to fill placement, specification on fill materials and fill compaction and field testing; retaining wall design and construction, foundation design and construction; and seismic requirements. It includes provisions to address issues such as (but not limited to) construction on expansive soils, liquefaction potential, and soil strength loss. In accordance with California law, project design and construction would be required to comply with provisions of the CBC. The CBC sets seismic design requirements based on seismic risk categories, which are associated with a structure's occupancy category (i.e., structures that represent low hazard to human life, structures that represent substantial hazard to human life, structures designated as essential facilities based on the proposed use), and a structure's seismic risk category (i.e., severity of the design earthquake ground motion and specific soil properties at the site).

## National Pollutant Discharge Elimination System Standards

Regarding soil erosion, the State Water Resources Control Board (SWRCB) adopted a National Pollutant Discharge Elimination System (NPDES) general permit for construction activities, specifically, Order No. 2009-0009-DWQ amended by 2010-0014-DWQ and 2012-0006-DWQ, NPDES Permit No. CAS000002 (Construction General Permit). A requirement of the NPDES permit includes the preparation of a Stormwater Pollution Prevention Plan (SWPPP) prior to the start of construction activities. Under the Construction General Permit (CGP), construction projects involving surface disturbance of one acre or more are required to prepare a SWPPP that specifies best management practices (BMPs) to address and avoid or minimize construction-related stormwater impacts. The SWPPP is required to include a menu of BMPs to be selected and implemented based on the phase of construction and the weather conditions to effectively control erosion, sediment, and other construction-related pollutants to meet the Best Available Technology Economically Achievable and Best Conventional Pollutant Control Technology standards. Erosion control BMPs are designed to prevent erosion, whereas sediment controls are designed to trap sediment once it has been mobilized. The San Diego Regional Water Quality Control Board (RWQCB) oversees implementation and enforcement of the Construction General Permit in the San Diego Region, including SDIA.

SDIA is covered under RWQCB Order No. R9-2013-0001 as amended by Order No. R9-2015-0001, NPDES No. CAS0109266, NPDES Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region, referred to in this document as the Municipal Permit. The Municipal Permit regulates commercial, industrial, residential, municipal, and construction activities. The permit requires regulated entities (including SDCRAA) to develop a Jurisdictional Runoff Management Program (JRMP) to describe the methods and procedures that the jurisdictions will implement or require be implemented to control stormwater pollution. The Municipal Permit requires a pollution control plan/construction BMP plan/erosion and sediment control plan be developed prior to commencement of any construction activity that involves soil disturbance activities, which can potentially generate pollutants in stormwater runoff. The Municipal Permit requires the implementation of effective BMPs to reduce discharges of pollutants in stormwater from construction sites and effectively prohibit non-stormwater discharges from construction sites into the storm drain system or receiving waters.

SDIA is covered under SWRCB Water Quality Order No. 2014-0057-DWQ, NPDES No. CAS000001, NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit). The Industrial General Permit requires a SWPPP that includes a description of the facility locations where soil erosion may be caused by industrial activity, contact with stormwater, authorized and unauthorized non-stormwater discharges, or run-on from areas surrounding the facility. The Industrial General Permit requires the implementation of BMPs to prevent erosion and sediment discharges.

SDIA has developed a Storm Water Management Plan (SWMP) that was prepared in accordance with the requirements of the Municipal Permit and Industrial General Permit cited above. Pursuant to these permits, the SWMP serves as a SWPPP in terms of the Industrial General Permit and a JRMP



document in terms of the Municipal Permit. The SWMP is a written account of the overall program to be conducted by SDCRAA to comply with the requirements of these stormwater permits.

Groundwater extraction to lower groundwater levels or pressures, or to control or eliminate groundwater seepage, is often associated with groundwater control systems employed in construction, foundation, trench, and ditch dewatering projects to stabilize slopes and other earth structures. Locally, the discharge of groundwater removed from the ground to surface waters of the U.S. is subject to RWQCB Order No. R9-2015-0013, NPDES No. CAG919003, General Waste Discharge Requirements for Groundwater Extraction Discharges to Surface Waters within the San Diego Region. This permit sets effluent limitations that must be met and requires the implementation of BMPs and treatment controls to ensure that discharges do not adversely affect beneficial uses of the receiving waters. The permit also requires the preparation of a Disposal Alternative Analysis to evaluate a range of alternative disposal methods to the proposed extracted groundwater discharge to surface waters including reasons and conclusions as to why it is technically or economically infeasible to implement these alternatives. Alternative disposal methods include, but are not limited to, the following:

- a. Collection and recycling of the extracted groundwater for a direct beneficial use, including landscape or agricultural irrigation, dust control, soil compaction during earthwork activities, or other appropriate uses in lieu of potable drinking water supplies;
- b. Reinjection of the extracted groundwater;
- c. Discharge of the extracted groundwater to a MS4 that employs low impact development practices or flows into stormwater capture basins to evaporate or recharge groundwater; and
- d. Discharge of the extracted groundwater to a sanitary sewer system leading to a federally, publicly, or privately owned treatment works.

The Industrial Wastewater Control Program (IWCP) of the City of San Diego Metropolitan Wastewater Department (MWWD) is responsible for regulating industrial discharges to the sewer and eventually the publicly-owned treatment works (POTW) in the City of San Diego and fifteen tributary Metropolitan Sewerage System Participating Agencies within San Diego County. Whenever possible, extracted groundwater should be discharged to surface waters under the current general NPDES permit adopted by the RWQCB, as listed above. However, to protect water quality in the San Diego area, the City recognizes that it may be necessary to accept discharges of extracted groundwater during the period required to obtain this authorization, and in certain other cases, under the conditions defined by MWWD. Temporary discharges to the sewer system of groundwater extracted from dewatering projects will only be allowed if it is determined that sewerage this wastewater is the most appropriate and prudent disposal alternative and when sufficient hydraulic and treatment plant capacity is available to allow such discharges into the sewer system.

### 3.8.3.2 Local

#### City of San Diego Municipal Code

The City of San Diego has adopted the CBC with some exclusions, additions, and modifications. Standards include requirements for grading, structural design, and soils and foundations. In conjunction with the CBC, Chapter 14, Article 5, Division 18 of the Municipal Code requires the preparation of a geotechnical investigation report when criteria set forth in Section 145.1803 are met. The determination whether a geotechnical investigation must be prepared is based in part on the San Diego Seismic Safety Study, which includes hazard maps and requirements to evaluate the relative hazard of a project site. The geotechnical report must address any hazards identified in the Seismic Safety Study and satisfy State of California requirements. Any recommendations to address geologic hazards identified in the geotechnical investigation must be incorporated into the design of the project before a building permit may be issued.

## 3.8.4 Environmental Setting

This section describes the existing geologic and soil conditions at SDIA and vicinity. This includes a description of regional geology and topography, soil stratigraphy, faulting and seismicity, and non-seismic hazards.

### 3.8.4.1 Geology

#### Regional Geology/Topography

SDIA is located within the coastal plain portion of the Peninsular Ranges Geomorphic Province of California (Peninsular Ranges Province). The Peninsular Ranges Province is a region characterized by northwest-southeast trending structural basins and generally parallel intervening fault zones that extends from the north end of the Los Angeles Basin on the north into Baja California on the south. Topographically, the Peninsular Ranges Province is composed of generally parallel ranges of steep-sloping hills and mountains separated by alluvial valleys. In San Diego County, the Peninsular Ranges Province is characterized by foothills and mountains in the east and the coastal plain in the westernmost part of the province.

The foothill and mountain zone in the eastern part of the Peninsular Ranges Province ranges from about 40 to 50 miles in width. It is primarily underlain by Cretaceous-age granitic rock associated with the Southern California Batholith, and Jurassic- to Cretaceous-age, mildly metamorphosed volcanic rocks. The foothill and mountain zone also includes a number of isolated sedimentary roof pendants, remnants of the pre-batholithic metasedimentary cover into which the granitic batholith was intruded.

The coastal plain in San Diego County ranges from less than 1 mile to about 14 miles wide and is underlain at depth by Cretaceous- to Jurassic-age igneous and metamorphic basement rock. The basement rock is overlain by a series of relatively flat-lying and undeformed sedimentary deposits that generally thicken toward the west.

The oldest sequence of sedimentary rocks overlying the basement complex encompasses a variety of sedimentary rock types of late Cretaceous age, thought to be associated with a submarine fan. The next youngest sequence of deposits consists of a variety of Tertiary-age sedimentary rock types



deposited in the San Diego Embayment, which encompassed much of western San Diego County and extended south into Baja California. The youngest sequence consists of a variety of Pleistocene-age sediments associated with wave-cut marine terraces. The sediments underlying the project site are associated with this relatively young sequence of terrace deposits.

The coastal plain in San Diego County slopes gently upward to the east and is characterized by a series of stepped, wave-cut marine terraces that increase in age and elevation with increasing distance from the coastline. These terraces were created by relatively gradual tectonic uplift that occurred during Pleistocene time, combined with a series of sea level transgressions and regressions.

### **Site Geology/Topography**

The project site is located in an area that formerly consisted of mudflats in the northern portion of San Diego Bay. The bay is underlain by Holocene-age bay sediments consisting mainly of poorly consolidated sand, silt, and clay. Between 1925 and 1949, the SDIA site was filled with material derived from a series of harbor dredging projects, and brought to its current elevation of approximately 15 feet above mean sea level (msl). Underlying strata within SDIA and surrounding areas include a number of Quaternary, Tertiary and Cretaceous (between approximately 65 and 144 million years old) age sedimentary units. The SDIA site and adjacent areas exhibit generally level and low-lying topography. The site elevation generally ranges from approximately 7 feet to 15 feet msl. The site has been previously graded and developed in association with existing airport and related facilities. Additional discussion of surficial and geologic deposits in the project site and vicinity is provided below under Stratigraphy.

### **Stratigraphy**

The project site is underlain by artificially placed fill, bay deposits, Bay Point Formation deposits, and possible alluvial deposits as described below.

#### *Artificial Fill*

Artificially placed fill extends to depths of approximately 15 to 20 feet, generally corresponding to elevations of about -2 to -4 feet msl. Most of the fill is hydraulic fill placed as part of a land reclamation project in the late 1920s and/or early 1930s. The fill was most likely derived from dredging of bay-bottom material from nearby areas of the bay, and therefore the fill is generally similar in composition to the bay deposits that underlie it. The hydraulic fill encountered during site exploration for the Terminal Area Fault Study<sup>9</sup> conducted in 2016 consisted of a relatively heterogeneous combination of sand, silty sand, clayey sand, sandy silt, and clay, with variable decayed organics and shell fragments.

#### *Bay Deposits*

Holocene-age (less than approximately 11,000 years in age) bay deposits underlie the artificially placed fill. In the Terminal area, the bay deposits increase in thickness from west to east, ranging from as little as two feet at the western end to approximately 23 feet at the eastern end. The upper

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<sup>9</sup> Amec Foster Wheeler. Terminal Area Fault Study San Diego International Airport San Diego, California. Prepared for San Diego County Regional Airport Authority. November 1, 2016.

contact of the bay deposits (lower contact of the hydraulic fill) was encountered at a relatively consistent elevation of about -2 to -4 feet msl. The observed bay deposits generally consist of dark gray to grayish-brown to olive-brown, micaceous, sand, silty sand, and sandy silt, with variable decayed organic content. A bed containing abundant shell fragments is present at the base of the bay deposits in the central-eastern portion of the Terminal area. The shell bed has an apparent thickness of about 1 to 2 feet.

Carbon-14 age dating analyses on shell samples from the bay deposits underlying the TDY site indicates ages ranging from 630 to 6,300 years before present (BP).<sup>10</sup>

#### *Bay Point Formation*

The Pleistocene (between approximately 11,000 and 2 million years old) Bay Point Formation occurs in most areas surrounding the site, and underlies portions of the fill deposits within SDIA as well as nearby bay deposits. Bay Point Formation deposits were encountered throughout the Terminal area, extending from the base of the bay deposits to the maximum exploration depths for the Terminal Area Fault Study<sup>11</sup> (75 to 90 feet). The Bay Point Formation deposits encountered underlying the Terminal area are comprised of a heterogeneous combination of interbedded sand, silty sand, silt, clay, and various clay/silt and clay/silt/sand mixtures. It is likely that the youngest Bay Point Formation sediments in the Terminal area are Late Pleistocene in age (on the order of 330,000 years old), and that the older sediments are 400,000 years old. Pile foundations for previous developments at SDIA have typically been installed into this formation.<sup>12</sup>

#### *Alluvium*

Holocene alluvial deposits occur in areas north and west of SDIA in association with larger active drainage courses such as the San Diego River. Localized alluvium may also be present beneath fill deposits within SDIA, in association with previous surface drainages. Alluvial materials typically consist of sandy clay, silty sand and clayey sand deposits, with variable amount of gravel and cobbles.

### **3.8.4.2 Faulting and Seismicity**

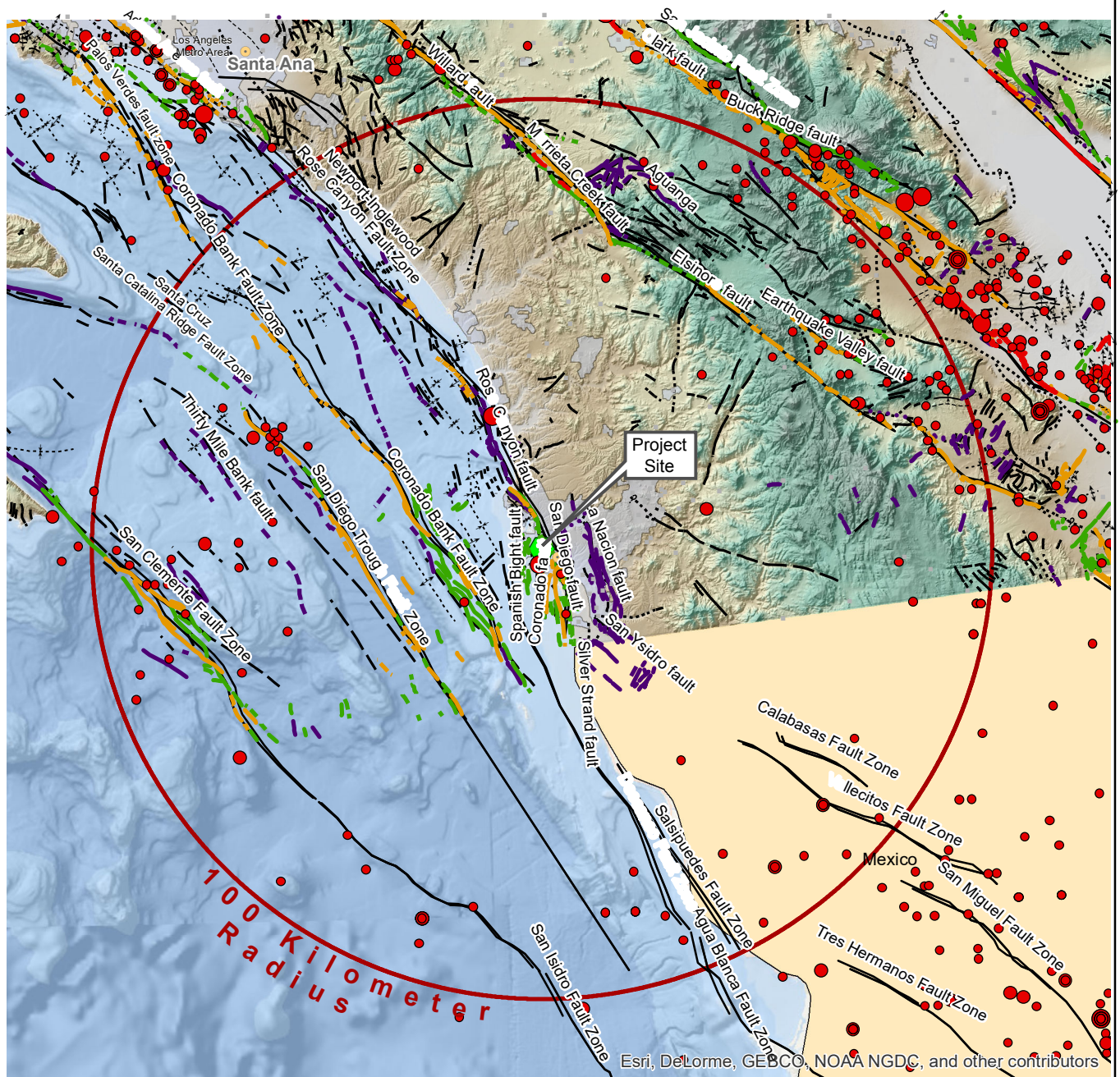
Southern California straddles the boundary between two global tectonic plates, known as the North American Plate (on the east) and the Pacific Plate (on the west). Active faults associated with this plate boundary cross through some of the most densely populated and developed areas of Southern California. The main plate boundary faults are the Imperial and San Andreas faults, which stretch northwest from the Gulf of California in Mexico, through the desert region of the Imperial Valley, crossing the San Bernardino region, and traversing up into northern California, where it eventually trends offshore near San Francisco. Given that the majority of Southern California is located in a seismically active area, the potential for strong earthquake-related ground shaking is considered likely. As shown on Figure 3.8-2, several earthquake fault zones, as well as numerous smaller

<sup>10</sup> Amec Foster Wheeler. Terminal Area Fault Study San Diego International Airport San Diego, California. Prepared for San Diego County Regional Airport Authority. November 1, 2016.

<sup>11</sup> Amec Foster Wheeler. Terminal Area Fault Study San Diego International Airport San Diego, California. Prepared for San Diego County Regional Airport Authority. November 1, 2016.

<sup>12</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.





Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors

#### Quaternary Faults (Bryant, 2005; USGS, 2009)

##### Historic displacement (< 200 years)

- Mapped Fault Location
- - - Dashed were Approximated
- ... Concealed

##### Holocene displacement (< 11,000 years)

- Mapped Fault Location
- - - Dashed were Approximated
- ... Concealed

##### Late Quaternary displacement (< 750,000 years)

- Mapped Fault Location
- - - Dashed were Approximated
- ... Concealed

##### Quaternary displacement (< 1,600,000 years)

- Mapped Fault Location
- - - Dashed were Approximated
- ... Concealed

#### Faulting Legend

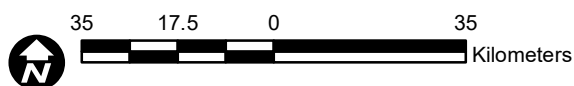
- - - fault, approx. located
- ? - fault, approx. located, queried
- fault, certain
- ..... fault, concealed
- ±..... fault, concealed, queried
- ? - fault, inferred, queried

#### ANSS Earthquakes

##### Magnitude

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- 8.0 - 8.9

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Source: Kleinfielder, 2017

Figure 3.8-2

faults, exist in the San Diego region. A number of these fault zones and the associated individual faults are classified as active or potentially active by the CGS. The major faults east of San Diego (from east to west) include the San Andreas, San Jacinto, and Elsinore faults. Major faults west of San Diego include the Palos Verdes-Coronado Bank, San Diego Trough, and San Clemente faults. The most dominant zone of faulting within the San Diego region is the Rose Canyon Fault Zone recognized as a trend of related fault traces. Activity within the Rose Canyon Fault Zone, which is discussed in greater detail in the following section, dominates the seismic hazard in the metropolitan San Diego region.<sup>13</sup>

Due to the high seismicity of the region, the project site is anticipated to be impacted by ground motion from seismic shaking. Figure 3.8-2 shows many of the active faults within an approximate 60-mile radius (100 kilometers) of SDIA, along with locations of epicenters of historical seismic events. Table 3.8-1 lists 11 of the most significant faults within the same 60-mile radius, and presents other fault parameters such as fault length, maximum magnitude, slip rate (average amount of relative geologic slip per year), and recurrence interval (average interval in years between earthquakes). Table 3.8-1 lists the rupture scenario producing the longest rupture length and largest earthquake magnitude.

**Table 3.8-1: Summary of Faults within 60 Miles of SDIA**

Fault Name	Approximate Fault Length (miles)	Approximate Distance to SDIA (miles)	Magnitude of Maximum Earthquake <sup>1</sup>	Slip Rate (inch/year)	Average Recurrence Interval (years)
Newport Inglewood-Rose Canyon	130	<1	7.5	0.04	1006
Coronado Bank	116	12	7.4	0.12	653
Palos Verdes Connected	62	13	7.7	0.12	650
San Diego Trough	75	23	7.49	0.04	4823
Elsinore <sup>b</sup>	159	38	7.85	0.04 – 0.20	369-1499
Earthquake Valley	12	44.7	6.80	0.08	351
San Clemente North	72	48	7.47	0.08	2296
San Clemente South	37	49	7.10	0.08	1084
Palos Verdes	62	52	7.30	0.02	N.A.
San Joaquin Hills	17	57	7.10	0.02	2500
San Jacinto <sup>2</sup>	161	60	7.88	0.04->.20	65-340

Source: Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

Notes:

1. Moment Magnitude is an estimate of an earthquake's size by utilizing rock rigidity, amount of slip, and area of rupture.
2. Scenario with combined seismic capability of fault segments rupturing together during a single event.

<sup>13</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

## Local Faulting - Rose Canyon Fault Zone

The Rose Canyon Fault Zone is one of several parallel fault zones associated with the San Andreas Fault System, and is the only known active fault zone traversing the San Diego metropolitan area. As depicted on Figure 3.8-3, it stretches north from offshore of Imperial Beach through Coronado, into downtown San Diego and up along the Interstate 5 (I-5) corridor in the vicinity of the project site, into southern Rose Canyon, then across Mount Soledad and finally passing offshore just south of the La Jolla Beach and Tennis Club.

The Rose Canyon Fault Zone comprises a complex system of many sub-parallel fault traces, both active and potentially active, that occupy a band between 0.5 mile to 3 miles wide. South of downtown San Diego and SDIA, the fault zone is comprised of three constituent faults: the Spanish Bight Fault, the Coronado Fault, and the Silver Strand Fault. In the downtown area, the Rose Canyon Fault Zone is characterized by a broad band of faulting. This downtown fault zone is interpreted to be a zone of north-south striking, predominantly strike-slip faults with transtensional, oblique-slip components that transfer slip from the main Rose Canyon and Old Town faults to possibly one or more various fault zones to the south in coastal or inland Baja California. Two areas of active faulting have been identified in the western and eastern parts of the downtown area. North of downtown, including where it crosses the eastern portion of the project site near the I-5 corridor, the fault zone is comprised of a relatively narrow band of sub-parallel faults. The configuration of the fault zone in this area is generally not well defined, in part because it is frequently concealed by very young deposits. The fault zone location and configuration are relatively well defined farther to the north where it traverses Rose Canyon, Mount Soledad, and La Jolla.

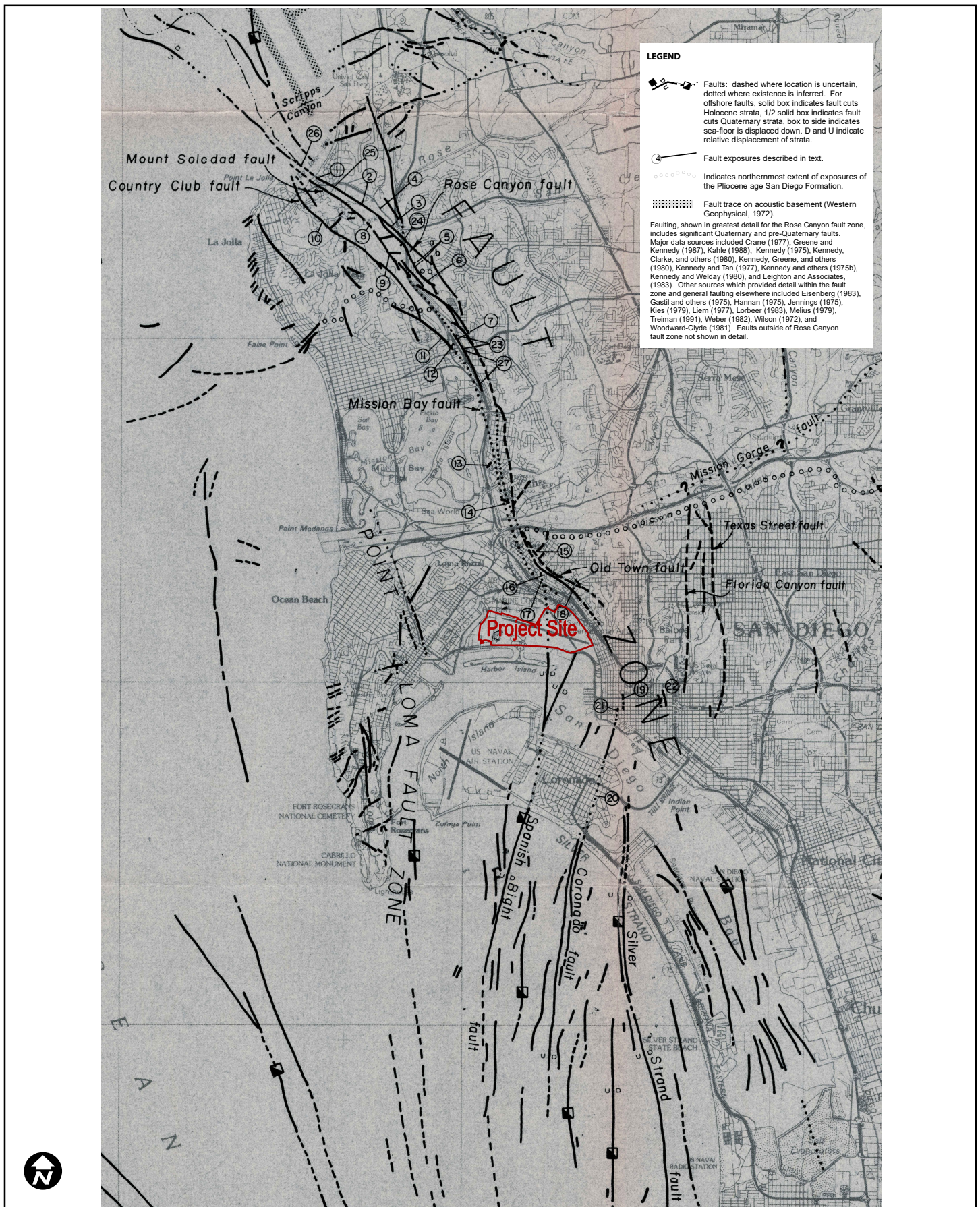
The Rose Canyon Fault Zone is a predominantly right-lateral, strike-slip fault that has been active for at least the past 1 million years and possibly since the late Pliocene. Past studies estimated that the Rose Canyon Fault Zone has a right-lateral slip rate of approximately 1.5 millimeter/year. Up until the late 1980s, it was generally considered to be inactive or potentially active due to a lack of clear evidence for Holocene movement. However, a number of studies of constituent faults beginning in the late 1980s found evidence of offset of Holocene sediments, indicating that the faults should be considered active.<sup>14</sup>

The State of California has designated active Alquist-Priolo Earthquake Fault Zones for sections of the Rose Canyon Fault Zone in San Diego Bay, Coronado, downtown San Diego and the section between the north end of Mission Bay (near De Anza Cove) and the coast in La Jolla. The section of the Rose Canyon Fault Zone north of downtown San Diego to De Anza Cove has not been designated as an active Alquist-Priolo Earthquake Fault Zone. This is due to limited reliable information on the trace of the fault through this area and much of the fault through this area is mapped as a concealed (conjectured) feature, because its traces have not been well located through this area.

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<sup>14</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.





Source: Kleinfelder, 2017. Basemap source: Treiman, J.A., 1993, California Division of Mines and Geology.

Figure 3.8-3



Two zones of active faulting were identified at SDIA during a master planning study by Kleinfelder in 2012 and 2013.<sup>15</sup> The more significant of the two faults is located on the east side of the Airport and extends from the south near the south ovals area near North Harbor Drive, northwest across the east end of the runway and up towards Washington Boulevard just west of the Rental Car Center (RCC). This fault has been named the East Bay Fault and the zone of active faulting ranges from 50 feet up to 200 feet in width. Analysis of the data for the studies indicate that the East Bay Fault has been active within the last 10,000 years with an event occurring possibly as recent as 400 years ago. The second area of active faulting is located southeast of Winship Lane and was mapped across the west side of Parking Lot 8 for a distance of approximately 300 feet. This fault is the northern extension of the Spanish Bight Fault. See Figure 3.8-1 which shows the East Bay Fault and Spanish Bight Fault. In compliance with the Alquist-Priolo Earthquake Fault Zoning Act (described in Section 3.8.3.1 above), no structures for human occupancy can be constructed across the active fault zones at SDIA.

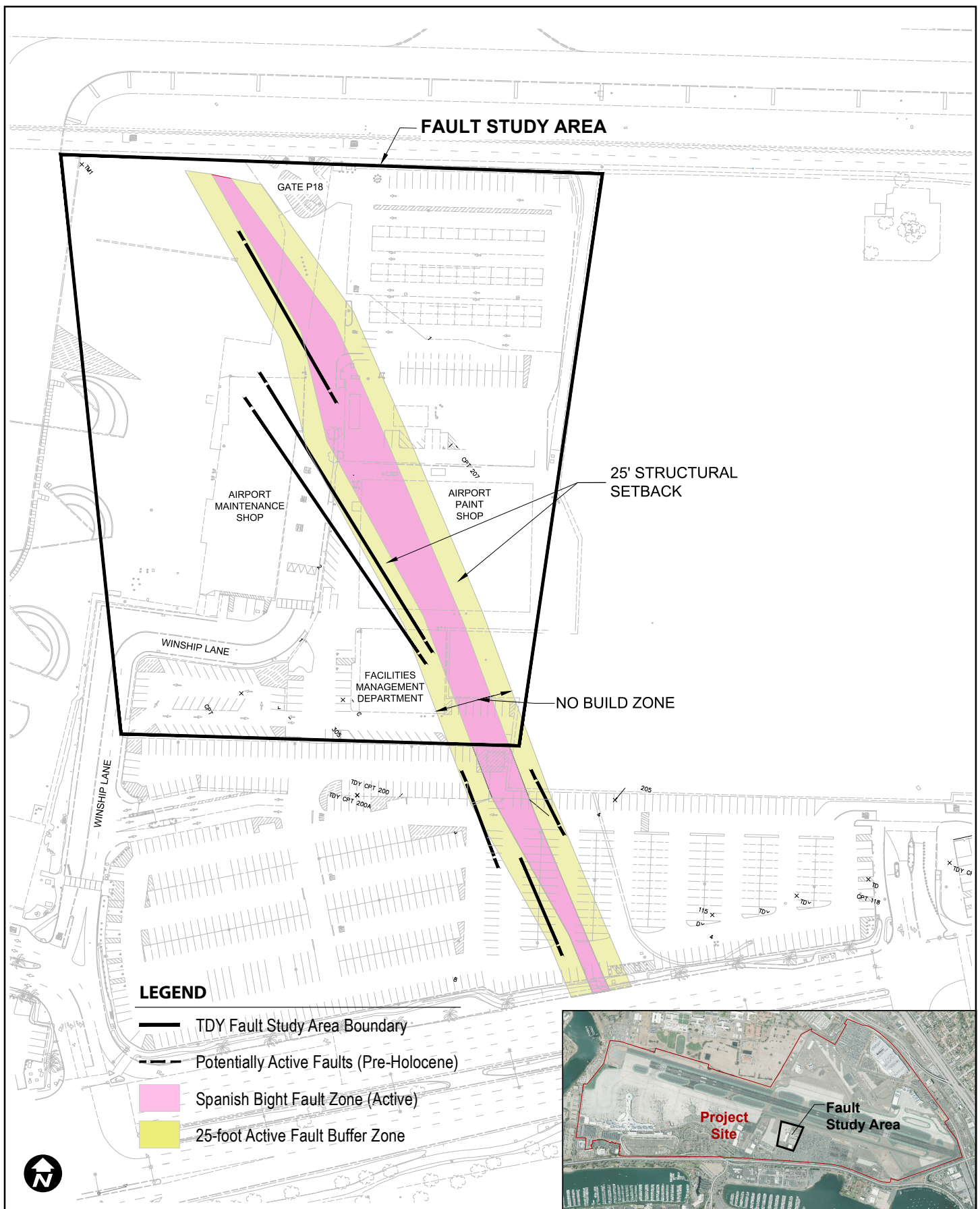
A Fault Hazard Study<sup>16</sup> was prepared in 2017 to characterize the subsurface geologic conditions relative to the Spanish Bight Fault within the project site and to evaluate the presence of through-going fault traces and to estimate how recently activity has occurred. The Fault Hazard Study evaluation consisted of forty-one cone-penetrometer tests along four profile alignments, analysis of the subsurface geologic data collected on the project site, and review of the previous TDY fault report.

The Fault Hazard Study determined that the Spanish Bight appears to be a much less significant fault than the East Bay Fault and that it appears to be diminishing and dying out to the north. However, a northward continuation of an active segment of the Spanish Bight Fault was identified across the full width of the project area.

The Fault Hazard Study identifies a structural “No Build Zone” along the active fault zone, across which structures for human occupancy should not be constructed. The recommended “No Build Zone” provides a 25-foot structural setback zone as a buffer along both sides of the active fault zone, shown in yellow on Figure 3.8-4. The recommended “No Build Zone” ranges from a minimum of approximately 72 feet wide at the north and a maximum of approximately 109 feet wide within the mid portion of the fault zone. As discussed further in Section 3.8.6 below, none of the proposed ADP structures would be constructed within the recommended “No Build Zone.” The final approval of the buffer zone width and overall “No Build Zone” will be subject to review and acceptance by the City of San Diego. The City of San Diego is responsible for review of fault hazard studies and has discretion under state authority to approve setback limits of less than 50-feet around active faults. Typically, the city limits fault setback zones to no less than 25-feet in width, which is based on the quality of the study data and the confidence in the accuracy of the fault locations. Based on

<sup>15</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

<sup>16</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.



Source: Kleinfelder, 2017



this and prior approved setbacks at SDIA, the Fault Hazard Study recommends a 25-foot structural setback zone as a buffer along both sides of the active fault zone to demarcate the “No Build Zone,” across which structures for human occupancy cannot be constructed under state statute.

The City of San Diego Seismic Safety Study identifies the Spanish Bight Fault Zone as an Earthquake Fault Zone located immediately south of SDIA, with a small portion that extends into the southeast corner of SDIA, near the intersection of North Harbor Drive and Laurel Street and identifies portions as “Potentially Active, Inactive, Presumed Inactive, or Activity Unknown.”<sup>17</sup>

### **Liquefaction**

Liquefaction is the phenomenon whereby soils lose shear strength and exhibit fluid-like flow behavior. Loose, granular soils are most susceptible to these effects, with liquefaction generally restricted to saturated or near-saturated soils at depths of less than 50 feet. Liquefaction most typically results from seismic ground acceleration, and along with related effects such as dynamic or differential settlement (i.e., varying degrees of settlement over short distances) can potentially result in significant impacts to surface and subsurface facilities. SDIA is underlain by relatively loose to medium-dense granular soils, with shallow groundwater present. Shallow, unconfined groundwater has been reported at depths of between 5 and 12 feet below the surface at SDIA.<sup>18</sup> Groundwater levels within SDIA are generally static due to the proximity of the bay and lack of substantive withdrawals (i.e., through wells and/or pumping), although aquifer levels can vary locally in accordance with mean high tide elevations and diurnal tidal fluctuations. Based on these conditions, the potential for seismically-induced liquefaction and related effects is generally high within the project site. The City of San Diego Seismic Safety Study identifies SDIA and vicinity as within Hazard Category 31-Liquefaction, an area with a high potential for liquefaction due to “shallow groundwater, major drainages, hydraulic fills.”<sup>19</sup> The results of the liquefaction analysis conducted for the Green Build geotechnical investigation<sup>20</sup> indicated that the loose to medium-dense hydraulic fills and bay deposits underlying the study area have a high potential to liquefy during the design earthquake. These layers generally occur between the high groundwater level (elevation +7 feet North American Vertical Datum 1988 [NAVD 88] and elevation -10 feet NAVD 88). The Green Build investigation also indicated that the range of liquefaction-induced settlements could be about 1 to 4 inches. The fill underlying the project site is the same or similar composition as the fill underlying the Green Build and would have the same or similar susceptibility to liquefaction.

### **Lateral Spreading**

Lateral spreading of the ground surface during a seismic activity may occur when potentially liquefiable soil is present in conjunction with a sloping ground surface and a “free” face (i.e., retaining wall, slope, or channel). Ground shaking leading to liquefaction of saturated soil can

<sup>17</sup> City of San Diego. 2008 Seismic Safety Study Geologic Hazards and Faults, Grid Tiles 16 and 17. April 3, 2008.

<sup>18</sup> San Diego County Regional Airport Authority. San Diego International Airport Master Plan Final Environmental Impact Report. SCRRAA #EIR-06-01, State Clearinghouse No. 2005091105. April 2008.

<sup>19</sup> City of San Diego. 2008 Seismic Safety Study Geologic Hazards and Faults, Grid Tiles 16 and 17. April 3, 2008.

<sup>20</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

result in lateral spreading where the soil undergoes a temporary loss of strength. If the liquefied soil is not contained laterally, it may result in deformation or translation of the slope. Lateral spreading can result in damage to structures, pipelines, and utilities. As described above, the City of San Diego Seismic Safety Study identifies SDIA as an area with a high potential for liquefaction. The edge of San Diego Bay is approximately 300 feet south of the project site. The slope at the edge of the bay consists of riprap cover, with an approximate height of 12 feet above water and an approximate total height of 25 feet to 30 feet including the submerged portion. Given a flatter projection at the project site, the distance from the underwater toe of slope, and the presence of intervening development (i.e., North Harbor Drive and Spanish Landing Park), the risk of lateral spreading to impact the developed areas of the project site is considered to be low.

### 3.8.4.3 Non-Seismic Hazards

#### Expansive Soils

Expansive soils are characterized by an ability to undergo changes in volume due to changes in moisture content (i.e., they expand when they get wet and shrink as they dry out). This behavior is attributable to the water-holding capacity of clay minerals and can adversely affect the integrity of facilities such as pavement or structure foundations. Fine-grained sediments with high clay content are most susceptible to potential expansive soil impacts. The project site encompasses deposits that may potentially be susceptible to expansive soil impacts. However, the Green Build geotechnical investigation determined that the majority of fill soils immediately underlying the Green Build site (adjacent to the proposed project) are predominantly composed of granular material that is non-expansive.<sup>21</sup> The fill underlying the project site is of the same or similar composition as the fill underlying the Green Build, and thus would also be composed of non-expansive material.

#### Corrosive Soils

Corrosive soils contain chemical constituents that can react with construction materials, such as concrete and ferrous metals (metals containing iron), which may damage foundations and buried pipelines. Long-term exposure to corrosive soils could result in deterioration and eventual failure of underground facilities such as concrete and metal structures. Soil moisture, chemistry, aeration, physical characteristics, bacteria, etc., have important effects on corrosion. In general, fine-grained soils have higher corrosion potential due to the smaller particle size that results in greater surface area with high chemical and moisture affinity. The Green Build geotechnical investigation determined that the site would be considered non-corrosive under California Department of Transportation (Caltrans) guidelines. However, given the proximity to tidal water, it would be subject to requirements for a minimum concrete cover and cement type.<sup>22</sup> The fill underlying the project site is the same or similar composition as the fill underlying the Green Build and, thus, would be considered non-corrosive.

<sup>21</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>22</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

## Compressible Materials

Compressible soils are fine-grained soils (silts and clays) that are susceptible to decreasing in volume (i.e., they compress) when weight is placed on them. The amount and rate of settlement can vary greatly, depending on a number of factors, including natural moisture and density, the thickness of the compressible layer, the amount of fill placed over the compressible material, and the ability of pore water to escape from soil pores through drainage paths such as sand lenses and soil fissures. The project site encompasses a number of deposits that may potentially be susceptible to compression under load, including fill, bay deposits, and alluvium. However, the Green Build geotechnical investigation determined that the majority of fill soils immediately underlying the Green Build site adjacent to the proposed project development are predominantly composed of material suitable for use at finish grade, when properly processed, placed, and compacted.<sup>23</sup> The fill underlying the project site is the same or similar composition as the fill underlying the Green Build.

## Subsidence

Subsidence is characterized as a gradual or sudden sinking of ground surface relative to surrounding areas. Subsidence in areas of deep soil deposits is typically associated with withdrawal of groundwater or other fluids such as oil and natural gas. Subsidence can result in cracks and damage to underground and overlying improvements such as subsurface vaults, pipelines, and structures. The project site is not located on a groundwater basin or other fluid extraction area. Further, the Green Build geotechnical investigation determined that the risk of subsidence is considered low at the Green Build site.<sup>24</sup> The geologic conditions, including soils underlying the project site, are the same or similar as the Green Build and similarly, the site is low risk for subsidence.

## Collapse Soils

Collapse soils shrink when they are wetted and/or subject to a load. Collapse soils tend to be young soils that have been rapidly deposited and occur in arid and semiarid areas with variable amounts of organic materials. Under the added weight of fill or buildings, these sediments can settle, causing deformation of overlying improvements such as structures, paving, and pipelines. Given that the project site is located on fill comprised generally of medium-dense materials, and underlain by Holocene bay deposits and the Pleistocene-age Bay Point Formation, the site is not considered susceptible to collapse soils.

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<sup>23</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>24</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.



### 3.8.5 Thresholds of Significance

The following significance criteria for geology and soils are derived from Appendix G of the State CEQA Guidelines. Under these criteria, a proposed project would result in significant impacts associated with geology and soils if it would:

**Impact 3.8-1** Directly or indirectly cause 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.

**Impact 3.8-2** 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.

**Impact 3.8-3** Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property.

Note that Appendix G includes significance criteria for geology and soils that do not apply to the proposed project or its specific context and, thus, were not included in this EIR's impact analysis. These criteria state that a project would have a significant impact on the environment, if the project would: *"Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides"*; or *"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."* The criteria related to landslides and alternative waste water disposal were not evaluated in this Recirculated EIR, because the proposed project is a fully developed site that has a flat topography and is not in an area subject to landslides, and no septic tanks or alternative waste water disposal systems are existing or proposed at the project site. Appendix G also includes significance criteria for geology and soils that are addressed elsewhere in this Recirculated Draft EIR. Specifically, soil erosion is addressed in Section 3.10, Hydrology and Water Quality, and paleontological resources are addressed in Section 3.6, Cultural Resources, of this Recirculated Draft EIR.

### 3.8.6 Project Impacts

#### 3.8.6.1 Impact 3.8-1

**Summary Conclusion for Impact 3.8-1:** The proposed project would not directly or indirectly cause 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; strong seismic ground shaking; and/or seismic-

**related ground failure, including liquefaction. As such, and as further described below, this would be a *less than significant impact* for construction and operations.**

### **Rupture of a Known Earthquake Fault**

Seismically-induced surface rupture, which occurs when movement on a fault breaks through to the surface, can adversely affect surface and subsurface structures including buildings, foundations, pavement, and utilities.

As discussed in Section 3.8.4.2, a northward continuation of an active segment of the Spanish Bight Fault has been identified across the full width of the project area. The Fault Hazard Study<sup>25</sup> provided a recommended “No Build Zone” that includes the zone of active faulting and a setback buffer zone of 25 feet along both sides of the fault. Under the proposed project, no structures would be constructed within the recommended “No Build Zone.” The final review of the fault hazard and approval of the buffer zone width and overall “No Build Zone” would be subject to review and acceptance by the City of San Diego. The proposed project would comply with the “No Build Zone” approved by the City of San Diego. Further, the proposed project would be designed and constructed to address potential ground rupture effects for other facilities located near the active fault such as utilities and pavement. Such measures may include the and, thus, would not be located on the Spanish Bight Fault. Therefore, no structures would be subject to ground rupture risk associated with being located on an active fault. use of engineered fill (e.g., proper composition and placement methodology), appropriate subgrade design and reinforced concrete, and shorter pipeline lengths with flexible joints and would be identified in a project-specific geotechnical investigation required by the City of San Diego (see Section 3.8.3.2) that would occur at the detailed facility design and engineering phase of project development. With compliance with the “No Build Zone” identified in the Fault Hazard Study (and subject to City of San Diego approval) and implementation of the recommendations in project-specific geotechnical investigation, including the use of engineered fill, the potential for the proposed project to expose people or structures to substantial risk related to surface rupture at the project site would be less than significant.

### **Seismic Ground Shaking**

The project site, as is most of Southern California, is a seismically active region and periodic earthquake activity can be anticipated through the lifetime of buildings constructed today. Thus, ground shaking should be expected during the life of the proposed project. As previously described, there are a number of faults in the region that are considered active and could have an effect on the project site in the form of moderate to future strong ground shaking. These faults include, but are not limited to, the Newport-Inglewood-Rose Canyon, Coronado Bank, San Diego Trough, and Elsinore faults (refer to Table 3.8-1).

Although seismic activity can cause damage to substandard construction, new construction built in compliance with the latest earthquake-resistant building design standards can substantially reduce potential structural damage and the risk to public safety from seismic events. The proposed project

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<sup>25</sup> Kleinfelder. Fault Hazard Study CIP 400002B ADP-Programmatic Documents-ADC San Diego International Airport San Diego, California, Kleinfelder Project No. 20174291.001A. Prepared for San Diego County Regional Airport Authority. May 22, 2017.

would be required to adhere to design standards, grading, and construction practices to avoid or reduce seismic hazards. The new replacement T1, along with the other new structures, would be designed, located, and built in compliance with the most up-to-date building code requirements of the CBC and City of San Diego Building Code applicable at the time of development. Additionally, implementation of the proposed project would be required to comply with the recommendations detailed in the approved project-specific geotechnical evaluation and engineering analysis that would occur during the project's design and engineering phase to address construction criteria and specified seismic parameters, including recommendations for proper composition and placement of engineered fill and foundation design. Compliance with up-to-date building code requirements and recommendations identified in the project-specific geotechnical evaluation and engineering analysis would reduce potential impacts associated with seismic ground shaking and would ensure the potential impacts associated with exposing people or structures to substantial risk related to ground shaking would be less than significant.

Further, the new T1 would replace the existing T1, which was constructed in 1967 under less stringent building codes with less stringent seismic requirements. Although additions and modifications have occurred at the existing T1 throughout the years that conform with later seismic requirements in place at the time of construction, T1 is not in compliance with current seismic requirements (see Section 3.6, Cultural Resources, and Appendix R-F). The new T1, along with the other new construction, would be designed, located, and built in compliance with the most up-to-date building code requirements of the CBC and City of San Diego Building Code applicable at the time of development, which, as described above, would ensure that potential impacts associated with exposing people or structures to substantial risk related to ground shaking would be less than significant.

### **Seismic-Related Ground Failure (Liquefaction and Dynamic Settlement)**

As described above in Section 3.8.4.2, SDIA is underlain by artificially-placed fill comprised of relatively loose to medium-dense granular soils with shallow groundwater and, thus, the potential for seismically-induced liquefaction and related effects is generally high. The liquefaction-induced settlements could cause extensive damage and possibly failure of structures supported on foundations above the potentially liquefiable layers.<sup>26</sup> There are soil and foundation design options that address the potential for differential movement due to liquefaction settlement and/or related effects such as dynamic settlement or lateral spreading. The project design would incorporate such measures to address potential liquefaction and related effects, pursuant to recommendations in the required site-specific geotechnical investigation and building code and other regulatory standards. These measures may include standard measures to remediate liquefaction effects such as ground modification (e.g., dynamic compaction to improve on-site soil conditions) or the use of deep foundations. The bay deposits that underly the artificially-placed fill are not considered potentially liquefiable due to geologic age and relative density.<sup>27</sup> Therefore, the use of deep foundations embedded in the Bay Point Formation would support occupied and critical structures

<sup>26</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>27</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.



and would adequately address the risks of damage or failure associated with liquefaction. The precise methods and details (i.e., depth of foundations) would be determined through the project-specific geotechnical investigation and supplemental engineering analysis in compliance with CBC requirements and subsequent recommendations. Additionally, grading, compaction, and foundations at the project site would have to adhere to design- and project-specific standards and requirements of the current CBC and City of San Diego Building Code.

Use of deep foundations and adherence to geotechnical investigation recommendations and regulatory requirements would ensure that potential impacts related to seismically-induced liquefaction and related effects would be less than significant.

### Summary

As described in greater detail above, the proposed project would comply with the “No Build Zone” requirements identified in the Fault Study (and subject to City of San Diego approval) to ensure that no occupied structures would be constructed on a fault zone. Additionally, the project-specific geotechnical investigation, engineering analysis and plans submitted to the City of San Diego’s Development Services Department would include project and site-specific recommendations and conditions to address seismic-related safety, such as recommended fill composition and placement and foundation depth. The resulting final geotechnical engineering recommendations and any additional recommendations that come out of the City’s review and permitting process would be incorporated into the project’s final design plans to address seismic hazards and related conditions present in the project site.

With implementation of the recommendations specified in the geotechnical investigation, and compliance with other regulatory requirements, including the CBC, City of San Diego Municipal Code, and the Alquist-Priolo Earthquake Fault Zoning Act, construction and operation of the proposed project would have a ***less than significant impact*** associated with directly or indirectly causing 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; strong seismic ground shaking; and/or seismic-related ground failure, including liquefaction.

#### 3.8.6.1.1 Mitigation Measures

No mitigation is required for construction or operations.

#### 3.8.6.1.2 Significance of Impact After Mitigation

As indicated above, no mitigation is required relative to this impact. The project would result in a ***less than significant impact*** for construction and operations.

### 3.8.6.2 Impact 3.8-2

**Summary Conclusion for Impact 3.8-2: Although the proposed project would be located on a geologic unit or soil that is unstable, it would not become unstable as a result of the project and would not result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As such, and as further described below, this would be a *less than significant impact* for construction and operations.**

### **Liquefaction/Ground Settlement/Lateral Spreading/Landsliding**

The effects of liquefaction include settlement, reduction in shear strength, lateral spreading, and global instability (i.e., landslides) in areas of sloping ground. Because the project site is flat, should liquefaction occur, it would most likely manifest itself as local ground subsidence, settlement, and reduction in shear strength. The potential for lateral spreading and global instability would be low, since the site is relatively level and because the potentially liquefiable soils are not immediately below the surface.<sup>28</sup> Supporting structures on deep foundations embedded in the Bay Point Formation would address risks associated with liquefaction settlement.

### **Subsidence**

As described in Section 3.8.4.3 above, the project site is not located on a site that is considered a risk for subsidence. Further, the proposed project would replace older non-compliant buildings/structures with new facilities, which comply with current applicable building codes, engineering specifications, and the site-specific geotechnical report. Potential for impacts related to subsidence would be less than significant.

### **Collapsible Soils**

As described in Section 3.8.4.3 above, the project site is not located on a site that is a risk for collapsible soils. Further, the proposed project would replace older non-compliant buildings/structures with new facilities, which comply with current applicable building codes, engineering specifications, and the site-specific geotechnical report. Potential for impacts related to collapse would therefore be less than significant.

### **Corrosive Soils**

Local fill materials may potentially exhibit corrosive hazards related to effects such as pH levels, electrical resistivity, or chloride content. Long-term exposure to corrosive soils could result in deterioration and eventual failure of underground facilities, such as concrete and metal structures. As described in Section 3.8.4.3 above, the project site does not have corrosive soils; however, given the proximity to tidal water, it would adhere to guidelines for a minimum concrete cover and cement type.<sup>29</sup> Further, as previously noted, a detailed geotechnical investigation would be conducted prior to final design. The proposed project would comply with recommendations contained therein and would also adhere to design- and project-specific standards and requirements of the current CBC and City of San Diego Building Code. Potential for impacts related to corrosive soils would, therefore, be less than significant.

### **Compressible Materials**

The project site encompasses a number of deposits that may potentially be susceptible to compression under load, including fill, bay deposits, and alluvium. As described in Section 3.8.4.3

<sup>28</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>29</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

above, fill soils immediately underlying the project site are predominantly composed of material suitable for use at finish grade when properly processed, placed, and compacted.<sup>30</sup> Processing, placement, and compaction of these soils would occur in compliance with the final site-specific geotechnical study recommendations and requirements of the current CBC and City of San Diego Building Code. With incorporation of recommendations contained in the project geotechnical investigation and appropriate regulatory requirements into project design and construction, impacts related to compressible materials would be less than significant.

### **Shallow Groundwater**

As described in Section 3.8.4.2, shallow groundwater is present within SDIA at approximate depths of between 5 and 12 feet below the surface, and would likely be encountered during construction of the proposed project. The occurrence of shallow groundwater within the project site could potentially affect construction activities such as excavation and grading. Specifically, the presence of shallow groundwater in proposed cuts or excavations could require temporary dewatering to allow access by construction equipment and/or personnel. Dewatering activities would require conformance with applicable NPDES permit requirements discussed under Section 3.8.3.1 and in Section 3.10, Hydrology and Water Quality. The majority of these requirements are associated with water quality concerns such as potential erosion/sedimentation effects (e.g., if extracted groundwater is discharged onto graded or unstabilized areas), and the occurrence of contaminants in local aquifers. As noted in Section 3.8.3.1, dewatering discharges might also be discharged to the sanitary sewer with proper approval from the POTW. Conformance with identified discharge requirements in the NPDES Permit would avoid or reduce these associated potential impacts below a level of significance.

The presence of shallow groundwater could also potentially affect the stability of proposed excavations (e.g., trench walls), resulting in safety or damage impacts to construction workers and equipment from caving. Project construction would be conducted in accordance with applicable Occupational Safety and Health Administration (OSHA) and CAL/OSHA standards related to the stability of excavations, among other issues.<sup>31</sup> Conformance with these (or other appropriate) requirements would avoid or reduce potential impacts related to the stability of open excavations below a level of significance. Therefore, no significant impacts related to shallow groundwater would occur from implementation of the proposed project.

### **Summary**

The project-specific geotechnical investigation, engineering analysis, and plans submitted to the City of San Diego's Development Services Department would include recommendations and conditions that are project site-specific and include evaluation of proposed foundation and pavement design, including assessment of proposed grading and excavation. The site-specific project geotechnical investigation would occur during the detailed facility design and engineering phase of project development, and involve coordination between the design-build team and the

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<sup>30</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

<sup>31</sup> 29 Code of Federal Regulations (CFR) Part 1926, Safety and Health Regulations for Construction, Subpart P – Excavations.



geotechnical engineer to inform both the facility design and geotechnical investigation. The site-specific project geotechnical investigation would address site-specific drainage characteristics; structure locations/loading conditions; foundation bearing pressures; and pavement type, thickness, aggregate base, and subgrade preparation. Structural engineering standards to address seismic and other geological conditions are part of standard construction requirements and standard construction practices. The resulting final geotechnical engineering recommendations and any additional recommendations that come out of the City's review and permitting process would be incorporated into the project's final design plans consistent with standard practice to address any unstable geologic and related conditions present in the project site. All new construction would comply with current applicable building codes and recommendations contained in the site-specific geotechnical investigation, thereby, providing safety improvements in comparison to the existing conditions.

With implementation of the recommendations specified in the geotechnical investigation and compliance with other regulatory requirements, including the CBC and City of San Diego Building Code, construction and operation of the proposed project would have a ***less than significant impact*** associated with being located on a geologic unit or soil that is unstable, becoming unstable as a result of the project, and resulting in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

#### 3.8.6.2.1 Mitigation Measures

No mitigation is required for construction or operations.

#### 3.8.6.2.2 Significance of Impact After Mitigation

As indicated above, no mitigation is required relative to this impact. The project would result in a ***less than significant impact*** for construction and operations.

#### 3.8.6.3 Impact 3.8-3

**Summary Conclusion for Impact 3.8-3: The proposed project would not be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property. As such, and as further described below, this would be a *less than significant impact* for construction and operations.**

Expansive (or shrink-swell) behavior is attributable to the water-holding capacity of clay minerals and can adversely affect the integrity of facilities such as pavement or structure foundations. Expansive soils beneath proposed building foundations could result in cracking and distress of foundations, or otherwise damage buildings/structures built on these sediments.

As described in Section 3.8.4.3 above, the Green Build geotechnical investigation determined that the majority of fill soils immediately underlying the Green Build site adjacent to the proposed project development were predominantly composed of non-expansive granular material.<sup>32</sup> It was further concluded that this material was suitable for use at finish grade, when properly processed, placed, and compacted. The fill at the project site would be comprised of the similar materials and,

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<sup>32</sup> URS. Geotechnical Investigation Contract 2 Landside Improvements SDCRAA – The Green Build San Diego International Airport San Diego California. Prepared for KiewitSundt JV. January 27, 2010.

thus, with proper processing, placement, and re-compaction, the existing fill material would be suitable for use and would not pose a direct or indirect risk to life and property.

Re-compaction and placement of new fill, if deemed necessary, would occur based on a design- and project-specific evaluation that would include subsurface soil sampling, laboratory analysis of samples collected, and an evaluation of the laboratory testing results by a geotechnical engineer as part of the detailed geotechnical investigation, which is required to be conducted prior to final design to identify site-specific geologic conditions, potential hazards, and associated design, engineering, and construction requirements. Resulting recommendations would be incorporated into the project's final design plans.

The results of previous geotechnical studies occurring at SDIA indicate that risks associated with expansive soils is low with re-compaction of the existing soils. Further, final geotechnical engineering recommendations and any additional recommendations that come out of the City's review and permitting process would be incorporated into the project's final design plans, which is consistent with standard practice to address any unstable geologic and related conditions present in the project site.

With implementation of recommendations identified in the project geotechnical investigation and compliance with applicable building code provisions and regulatory/industry standards, potential project impacts related to expansive soils creating substantial direct or indirect risks to life or property would be *less than significant*.

#### **3.8.6.3.1 Mitigation Measures**

No mitigation is required for construction or operations.

#### **3.8.6.3.2 Significance of Impact After Mitigation**

As indicated above, no mitigation is required relative to this impact. The project would result in a *less than significant impact* for construction and operations.

### **3.8.7 Summary of Impact Determinations**

Table 3.8-2 summarizes the impact determinations of the proposed project related to geology and soils, as described above in the detailed discussion in Section 3.8.6. Identified potential impacts are based on the significance criteria presented in Section 3.8.5, the information and data sources cited throughout Section 3.8, and the professional judgment of the report preparers, as applicable.

**Table 3.8-2: Summary Matrix of Potential Impacts and Mitigation Measures Associated with the Proposed Project Related to Geology and Soils**

Environmental Impacts	Impact Determination	Mitigation Measures	Impacts after Mitigation
<b>Impact 3.8-1: The proposed project would not directly or indirectly cause 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; strong seismic ground shaking; and/or seismic-related ground failure, including liquefaction. As such, this would be a <i>less than significant impact</i> for construction and operations.</b>	Construction: Less than Significant  Operation: Less than Significant	No mitigation is required	Construction: Less than Significant  Operation: Less than Significant
<b>Impact 3.8-2: Although the proposed project would be located on a geologic unit or soil that is unstable, it would not become unstable as a result of the project and would not result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. As such, this would be a <i>less than significant impact</i> for construction and operations.</b>	Construction: Less than Significant  Operation: Less than Significant	No mitigation is required	Construction: Less than Significant  Operation: Less than Significant
<b>Impact 3.8-3: The proposed project would not be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property. As such, this would be a <i>less than significant impact</i> for construction and operations.</b>	Construction: Less than Significant  Operation: Less than Significant	No mitigation is required	Construction: Less than Significant  Operation: Less than Significant

### 3.8.7.1 Mitigation Measures

No mitigation is required for construction or operations.

### 3.8.8 Significant Unavoidable Impacts

There would be no significant and unavoidable geology and soil impacts associated with construction and operation of the proposed project.