4.2 Geology, Soils, and Seismicity

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This section evaluates the potential for construction and operation of the Monterey Peninsula Water Supply Project (MPWSP or proposed project) to result in adverse impacts associated with geologic, soils, and seismic hazards, including faulting, seismically-induced ground failures (e.g., landslides, liquefaction), erosion, expansive or corrosive soils, and coastal retreat. The analysis is based on review of available geologic and geotechnical maps and reports of the project area and vicinity, including reports and information published by the U.S. Geological Survey (USGS) and the California Geological Survey (CGS), the *Monterey County General Plan*, and site-specific investigations conducted for various project components.

Comments received on the April 2015 Draft EIR requested analysis of the slant wells electrical panel (see Section 4.2.5.2, Impact 4.2-10), and clarifications regarding geologic units and soils (see Section 4.2.1.1), LCPLUP Planning Guidelines (see Section 4.2.2.3, Local Regulations), slant well angles (see Section 3.2.1 in Chapter 3, Description of the Proposed Project), the slant well abandonment mitigation measure (see Section 4.2.5.2, Impact 4.2-10), subsidence (see Section 4.2.5.2, Impact 4.2-8), corrosion prevention measures (see Section 4.2.5.2, Impact 4.2-7), and the Reliz (Blanco Section) fault (see Section 4.2.1.2, Seismicity and Faults).

As a result of comments received on the January 2017 Draft EIR/EIS, revisions have been made to this EIR/EIS section. Those changes include:

- *Revisions to Mitigation Measure 4.2-10 (formerly 4.2-9), Slant Well Abandonment Plan, to include reporting requirements, coordination with the property owner, and consideration of the snowy plover nesting season.*

- *Addition of Secondary Impacts of Mitigation Measure 4.2-10, which would be similar to the impacts associated with other project-based construction activities.*

4.2.1 Setting/Affected Environment

The study area for the evaluation of impacts on geology, soils, and seismicity includes the project components and general vicinity, except for the issue of coastal erosion where the study area extends south from the slant well locations to include the sandy beaches of southern Monterey Bay. The study area includes the submerged lands of Monterey Bay National Marine Sanctuary (MBNMS), as the proposed slant wells would extend under the seabed in MBNMS.

4.2.1.1 Geologic Conditions

Topography

Figures 3-2 through **3-15** in Chapter 3, Description of the Proposed Project, show the locations of the proposed MPWSP components, which extend approximately 18 miles, from the connection to the Castroville Community Services District (CCSD) water distribution system located in unincorporated Monterey County in the north to the unincorporated community of Hidden Hills along Highway 68 in the south. In addition to unincorporated areas, project components are also proposed in the cities of Monterey, Marina, and Seaside. Although the topography of the project area is variable, the majority of the project components would be constructed in coastal dune areas or in low-lying inland areas within 2 miles of the coast.

The northern and coastal dune areas are characterized by gently to moderately rolling dunes with elevations ranging from sea level at the coast to 100 feet above mean sea level (msl) at the proposed MPWSP Desalination Plant. Along the shoreline, the coastal dune slopes can be steep and have a high potential for erosion (Ninyo & Moore, 2005, 2014). East of the coastline, the dune deposits have gentle slopes (0 to 10 percent) with increased stability and vegetation cover. Fill embankments up to approximately 30 feet high are located throughout the area with road cuts up to approximately 20 feet high within the dune sands. West of the coastline, the existing MRWPCA ocean outfall pipeline extends about 2.1 miles into waters of MBNMS to a depth of about 90 to 110 feet below mean sea level. The bathymetry[1] in the vicinity of the MRWPCA outfall structure is relatively flat with an average slope of 1 percent to the west of the diffuser for 5 miles. The rim of the Monterey Submarine Canyon, one of the deepest submarine canyons on the west coast of the United States, is less than 4 miles to the northwest of the proposed location of the slant wells at the CEMEX facility.

The topography of the more urbanized southern coastal portion of the project area ranges from rolling coastal dunes to older, more stable dunes and terrace deposits. The topography in this portion of the project area varies, and elevations range from 0 feet msl at the coast to about 340 feet above msl at the proposed ASR injection/extraction wells (ASR-5 and ASR-6 Wells).

The proposed Ryan Ranch–Bishop Interconnection Improvements and Main System-Hidden Hills Interconnection Improvements would be located 3 and 6 miles southeast of the coastline in a

[1] National Oceanic and Atmospheric Administration (2014) refers to bathymetry as the ocean's depth relative to sea level, although it has come to mean "submarine topography," or the depths and shapes of underwater terrain.

relatively rugged mountainous area with elevations of about 200 and 1,000 feet above msl, respectively. The proposed location for the Carmel Valley Pump Station is on the south side of Carmel Valley Road about 3 miles east and inland of the coastline at an elevation of about 80 feet above msl.

Regional Geology

The study area lies within the geologically complex region of California referred to as the Coast Ranges Geomorphic Province.[2] The Coast Ranges province lies between the Pacific Ocean and the Great Valley Geomorphic Province (Sacramento and San Joaquin Valleys) and stretches from the Oregon border to the Santa Ynez Mountains near Santa Barbara. This province is marked by northwest-trending elongated ranges and narrow valleys that roughly parallel the coast and the San Andreas Fault Zone. Much of the Coast Ranges province is composed of marine sedimentary deposits, metamorphic rocks, and volcanic rocks. The project area is also underlain by the "Salinian Block," a continental fragment of the granitic Sierra Nevada that was pushed northward by tectonic forces along the western side of the San Andreas Fault Zone (Tavarnelli, 1998). The tectonics of the San Andreas Fault and other major faults in the western part of California have played a major role in the geologic history of the area. The drainages south of San Francisco Bay are strongly influenced by tectonic-related faults and folds that typically trend parallel to the coast, although some drainages run perpendicular to the coast. The Salinas River, whose course largely lies within a synclinal trough,[3] exemplifies this pattern.

The Santa Lucia Range, the Salinas Valley, and the Santa Cruz Mountains are the prominent geologic features of the region. The rugged Santa Lucia Range generally runs from the Monterey Peninsula southeast to San Luis Obispo; the proposed Ryan Ranch–Bishop and Main System-Hidden Hills Interconnection Improvements, and the Carmel Valley Pump Station would be located in this area. The Salinas Valley is northeast of the Santa Lucia Range and roughly parallels these northwest-southeast-trending mountains. The geologic development of the Salinas Valley, which runs from Monterey Bay southeast into San Luis Obispo County, is largely the result of folding, although the valley also shows characteristics of stream erosion and faulting. The subsurface slant wells, MPWSP Desalination Plant, improvements to the Seaside Groundwater Basin ASR System and conveyance pipelines would be constructed within the Salinas Valley. The Santa Cruz Mountains extend from the San Francisco Peninsula south to the Pajaro River, near Watsonville, where they merge with the Gabilan Range. These mountains help define the northern end of Monterey Bay.

Geologic Units

The discussion of geologic units is based on the geologic mapping compilation prepared by the CGS (2002b; which is based largely on Clark et al. [1997] and Dupre and Tinsley [1980]); geotechnical field reconnaissance conducted in June and November 2004 during which various geologic units within the project area were observed and described (Ninyo & Moore, 2005); and

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2 A geomorphic province is an area that possesses similar bedrock, structure, history, and age. California has 11 geomorphic provinces (CGS, 2002a).

3 A syncline or synclinal trough is a geologic feature where stratified bedrock has been folded into a concave upward form.

subsurface investigations consisting of soil borings and analytical testing at the proposed (CEMEX facility) and alternate (Potrero Road parking area) slant well locations (Geoscience, 2016). **Figure 4.2-1** presents the regional surface geology from the CGS's compilation for the project area. **Figure 4.2-2** presents a north to south regional geologic cross-section along the coast (HydroMetrics, 2009). **Figure 4.2-3** presents a west to east local geologic cross section extending from the coastline, through the proposed slant wells, and to about 2 miles inland.

The Salinas Valley extends about 80 miles inland and is filled with recent to Tertiary (65 million years ago [mya] to 1.6 mya) river and estuary deposits of the current and ancestral Salinas River and regional eolian[4] and marine sediments over the Mesozoic Salinian Block granitic basement (Kennedy Jenks, 2004). Based on a review of geologic literature combined with the field observations, it is expected that fill, active and older coastal dune sands, and terrace deposits would be encountered during construction of the project components. Deeper subsurface geologic units that were not encountered at the surface but are known to be present in the project area include the Aromas Sand, Paso Robles Formation, Purisima Formation, Santa Margarita Formation, and Monterey Formation, as well as an underlying, unnamed sandstone and the granodiorite[5] of the Salinian Block.

Table 4.2-1 summarizes the geologic units and the project components, which are discussed below.

**TABLE 4.2-1
SUMMARY OF GEOLOGIC UNITS AND PROJECT COMPONENT LOCATIONS**

Geologic Unit	Project Component
Fill	Some pipeline segments
Dune Sands	Subsurface slant wells; westernmost portion of Source Water Pipeline
Older Dune Sands	Subsurface slant wells; most pipeline segments; MPWSP Desalination Plant; Castroville Pipeline, all ASR facilities along General Jim Moore Boulevard
Floodplain Deposits	Castroville Pipeline
Terrace Deposits	Subsurface slant wells; portions of the Ryan Ranch–Bishop Interconnection Improvements
Carmel Valley Floodplain	Carmel Valley Pump Station
Aromas Sand	ASR-5 and ASR-6 Wells[a]
Paso Robles Formation	ASR-5 and ASR-6 Wells[a]
Purisima Formation	ASR-5 and ASR-6 Wells[a]
Santa Margarita Formation	ASR-5 and ASR-6 Wells[a]
Monterey Formation	Main System–Hidden Hills Interconnection Improvements

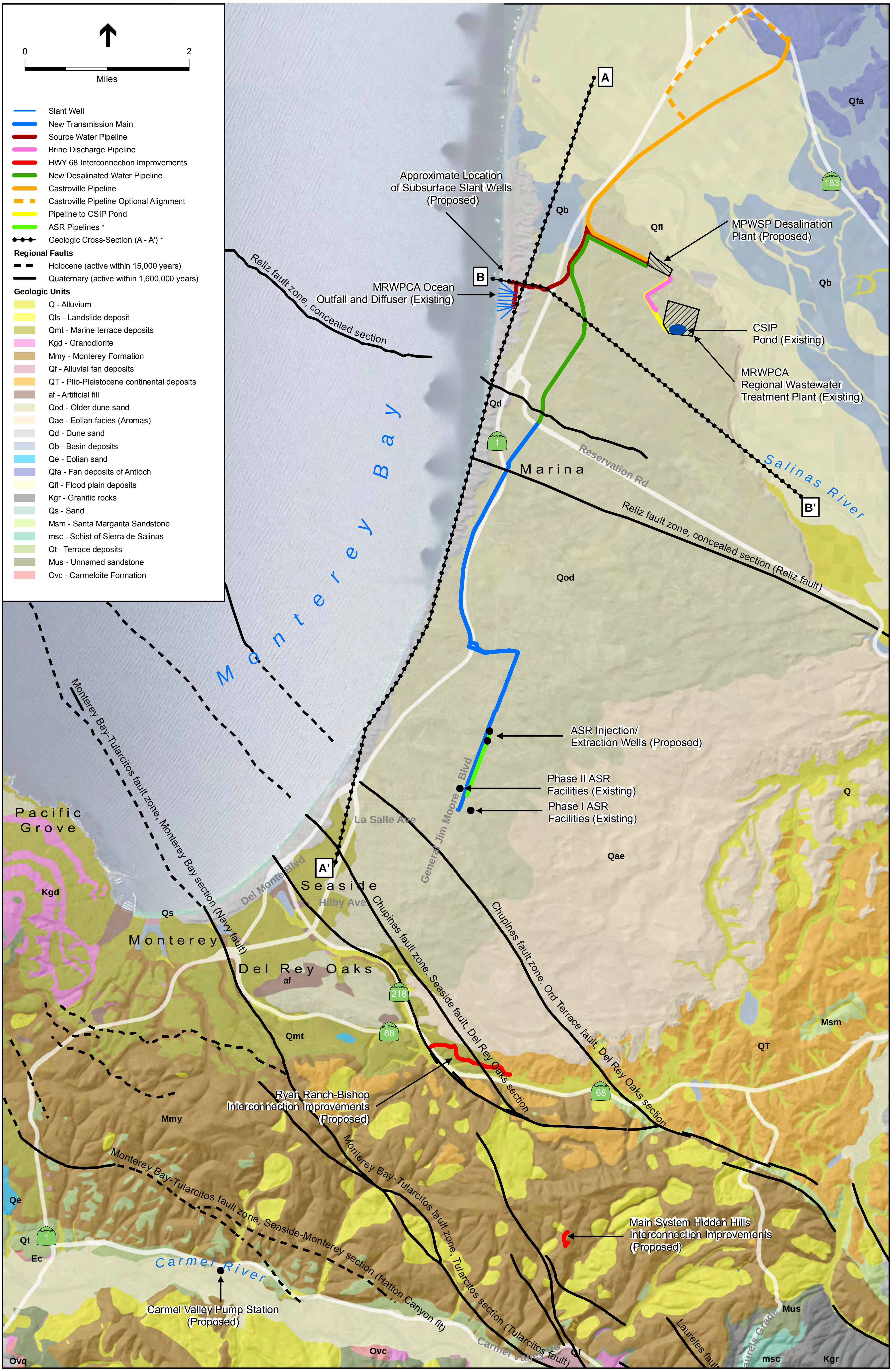
NOTES:

[a] The ASR-5 and ASR-6 Wells would be drilled through the Aromas Sand, Paso Robles, and Purisima Formations, and screened in the Santa Margarita Formation.

SOURCE: CGS, 2002b

[4] Eolian deposits are borne, deposited, produced, or eroded by wind.

[5] Granodiorite is a granular, igneous rock intermediate between granite and quartz-diorite. Igneous rock is produced by fire, great heat, or the action of a volcano, and has been solidified from a molten state.



205335.01 Monterey Peninsula Water Supply Project

Figure 4.2-1
Geologic Map of Project Area

NOTE:
*Refer to figure 4.2-2 for "A" geologic cross-section information and 4.2-3 for "B" geologic cross-section information.

SOURCE: CGS, 2002

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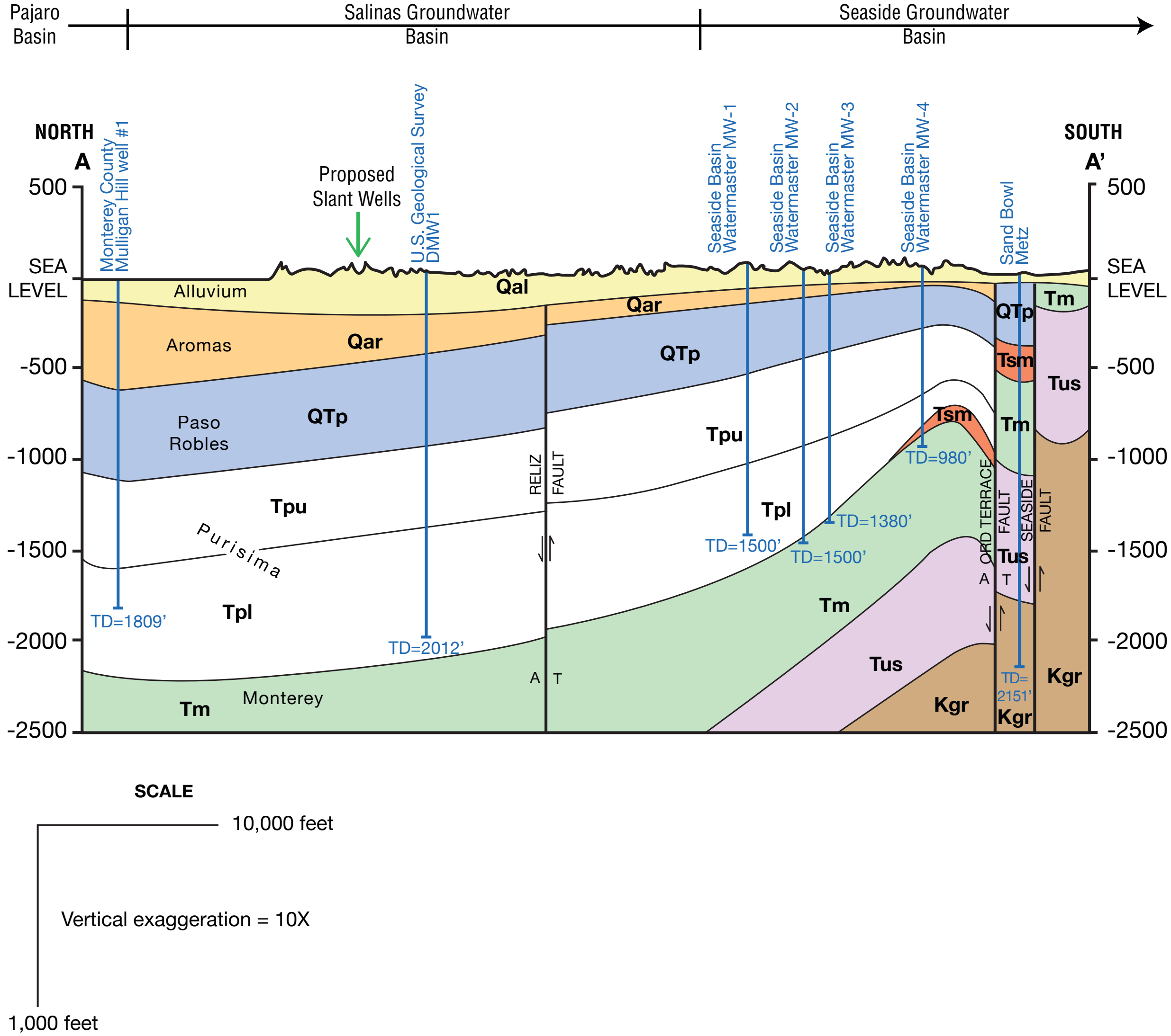


Qal	Alluvium (Holocene)
Qar	Aromas Sand (Pleistocene)
QTp	Paso Robles Formation (Pleistocene-Pliocene?)
Tp	Purisima Formation (Pliocene), subdivided into upper unit (TPu) and lower unit (Tpl)
Tsm	Santa Margarita Sandstone (late Miocene)
Tm	Monterey Formation (middle Miocene)
Tus	Unnamed sandstone (middle Miocene)
Kgr	Granitic rocks (late Cretaceous)
———	Fault, half arrows show direction of vertical separation; A indicates horizontal movement away from viewer, T indicates movement toward viewer

SOURCE: HydroMetrics, 2009

NOTES: TD = Total depth in feet

205335.01 Monterey Peninsula Water Supply Project

Figure 4.2-2

Generalized Geologic Cross-Section

Fill Materials

Fill materials are located throughout the project area (Ninyo and Moore, 2005, 2014). The fill is associated with previous grading for roads, bridges, railroad corridors, agricultural uses, and commercial, residential, and military land developments. The thicknesses of the fill deposits range from relatively shallow fills (a few feet thick) along roadways and railroad alignments in relatively flat, low-lying areas to deeper fills along bridge-approach embankments and in developed hillside areas. Most of the fill materials in the project area were likely derived from local native soils and would be similar in composition to the native soils described in the following sections.

Dune Sand Deposits

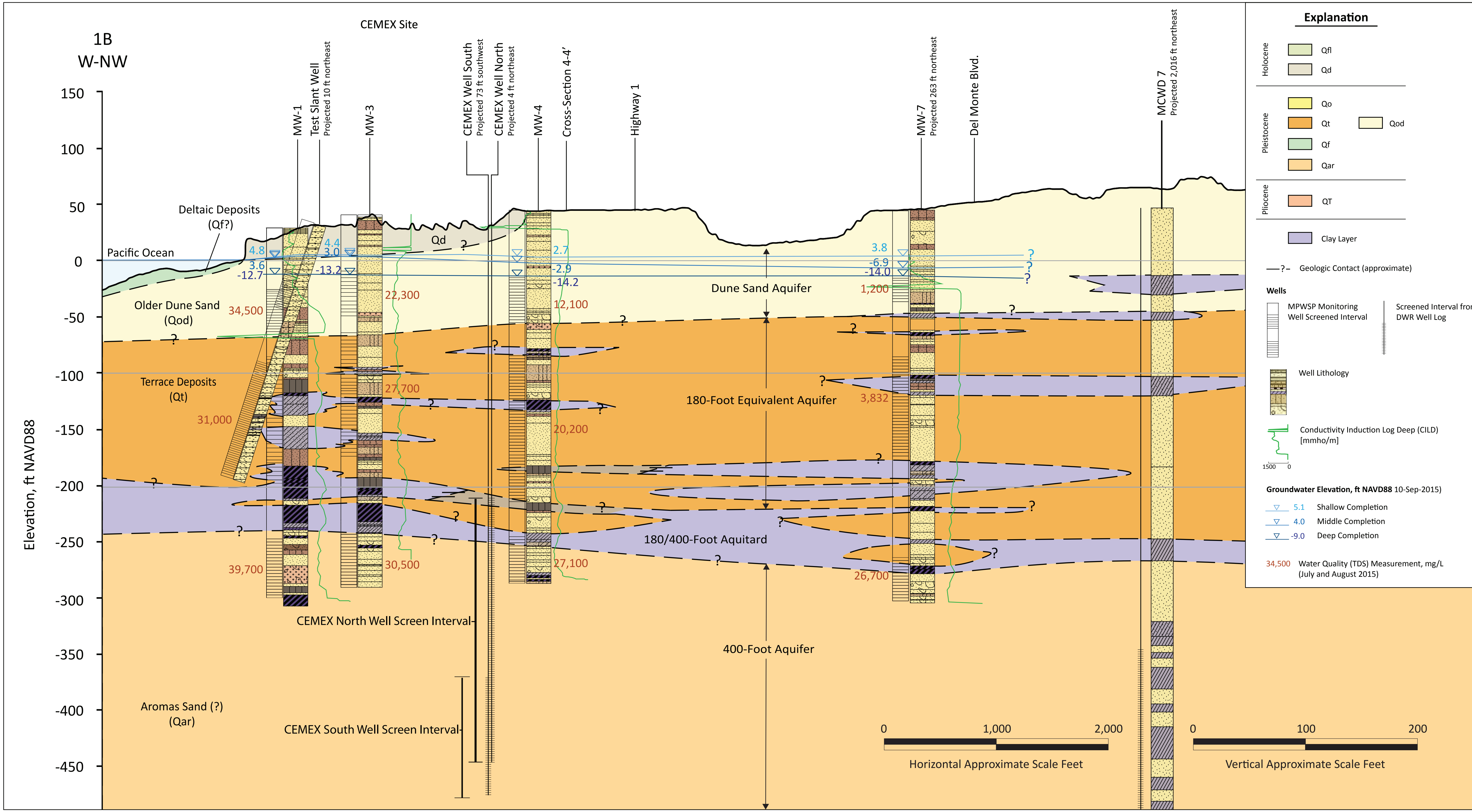
Dune sand deposits are present along the coastal areas from the proposed Seawater Intake System in the north to the eastern area of the city of Monterey in the south where the proposed pipeline additions would connect to the existing system (CGS, 2002b). Active, wind-blown dunes generally extend less than 0.5 mile inland, and older, more stabilized dunes extend up to 4 miles inland as well as offshore. Most of the project components would be located on or within dune deposits, except for the deeper portions of the proposed ASR injection/extraction wells, the Ryan Ranch–Bishop and Main System–Hidden Hills Interconnection Improvements, and the Carmel Valley Pump Station. The proposed subsurface slant wells would be partially screened within the dune sand deposits and some of the source water would be pumped from this unit.

The dune areas typically consist of elevated rolling hills composed of loose to moderately consolidated, fine sand (Ninyo & Moore, 2005; PCE, 2014). Younger, sparsely vegetated, active[6] dunes are present along the coastline. Older dune deposits[7] with more established vegetation are present in the inland areas and underlie the locations of most of the proposed project components. During the geologic reconnaissance, dune deposits were observed in existing cut slopes and excavations and ranged from loose to weakly cemented sands. Shallow groundwater is not expected within the elevated dune deposits, except in localized low-lying areas along the coastline.

Terrace Deposits

Pleistocene-age (1.6 mya to 11,000 years ago [ya]) terrace deposits are present beneath the CEMEX mining facility and the sea floor of MBNMS where the proposed slant wells would be constructed (Geoscience, 2016). The deeper portions of the proposed subsurface slant wells would be screened across these terrace deposits and some of the source water would be pumped from this unit. These terrace deposits are former alluvial fan and river floodplain deposits—which may also include marine terrace deposits—that generally consist of sand with some gravels. Uplifted Pleistocene marine terrace deposits are also present within the southern portion of the project area from Sand City to the city of Monterey (CGS, 2002b; Clark et al., 1997; Ninyo & Moore, 2014). These deposits are fine-grained sands and silts with locally thin, discontinuous gravel layers. The terrace deposits are typically dissected by streams and lie on the Aromas Sand. The deposits are variable in thickness, typically from up to 50 feet to a maximum of 200 feet (Muir, 1977). Terrace deposits at the CEMEX mining facility range from about 140 to 170 feet in thickness (Geoscience, 2016).

6 Active dunes are composed of loose sand shifting in real time.
7 Older dunes are inactive in that much of the sands have become weakly cemented, limiting active movement.



SOURCE: Geoscience, 2016

205335.01 Monterey Peninsula Water Supply Project

Figure 4.2-3
Local Geologic Cross-Section

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Carmel Valley Floodplain Deposits

At the proposed Carmel Valley Pump Station sites, the Quaternary (1.6 mya to present) floodplain deposits along the Carmel River consist of a mixture of unconsolidated sand and silt deposits, commonly including relatively thin layers of clay (Clark et al., 1997). The older floodplain deposits are nearly flat to gently sloping and fill an irregularly shaped valley beneath the Carmel River. The Monterey Formation underlies these floodplain deposits.

Aromas Sand

The Pleistocene-age (1.6 mya to 11,000 ya) Aromas Sand consist of both older river deposits and younger eolian (windblown) deposits of unconsolidated, brown to red sands with interbeds of clay and poorly sorted gravels (Muir, 1977; Hanson, 2003). The eolian portion of the Aromas Sand crops out just east of the central and southern portion of the project area and extends beneath the project area to offshore on the continental shelf and in the Monterey submarine canyon (CGS, 2002b). In addition, the surface outcrops of the Aromas Sand have been mapped about 1 mile east of the CSIP Pond beneath the older dune sands to the west, as shown on **Figure 4.2-1**. The Aromas Sand overlies the Paso Robles Formation north of the east-to-west Ord Terrace Fault in Seaside, but is not present south of the fault (HydroMetrics, 2009). The proposed new ASR injection/extraction wells would be drilled to about 1,000 feet below the surface through the Aromas Sand into the deeper Santa Margarita Sandstone.

Paso Robles Formation

The Plio-Pleistocene-age (about 5.3 mya to 11,000 ya) Paso Robles Formation is a series of fine-grained, oxidized sand and silt beds that contain gravel beds (Clark et al., 1997) interbedded with some less-prevalent calcareous[8] beds (DWR, 2004). The Paso Robles Formation is interfingered[9] with the lower portion of the Aromas Sand and the upper portion of the Purisima Formation (HydroMetrics, 2009). The Paso Robles Formation is present beneath the northern portion of the project area at depths ranging from less than 100 feet to 600 feet (HydroMetrics, 2009). The proposed new ASR injection/extraction wells would be drilled to about 1,000 feet below the ground through the Paso Robles Formation into the deeper Santa Margarita Sandstone.

Purisima Formation

The mostly marine Miocene-age (24 mya to 5.3 mya) to Pliocene-age (5.3 mya to 1.8 mya) Purisima Formation underlies the project area at depths ranging from about 400 feet below the surface in Seaside to as much as 1,100 feet in the northern part of the project area (Powell et al., 2007; HydroMetrics, 2009) and extends westward under Monterey Bay (Muir, 1977). The Purisima Formation consists of layered sand, silt, clay, shale, and some gravel deposited in near-shore and far-shore marine environments. The basal, or lowermost, unit of the Purisima Formation consists of relatively impermeable clay and shale (Muir, 1977; HydroMetrics, 2009).

8 Mostly or partly composed of calcium carbonate i.e. containing lime or being chalky.
9 Pertains to the lateral change from one rock or sediment type to another in a zone where the two types form interpenetrating wedges.

The proposed new ASR injection/extraction wells would be drilled through this unit, into the deeper Santa Margarita Sandstone.

Santa Margarita Formation

The late Miocene-age (24 mya to 5.3 mya) to Pliocene-age (5.3 mya to 1.8 mya) Santa Margarita Sandstone is a marine, coarse-grained sandstone that overlies the Monterey Formation (Clark et al., 1997; MCWRA, 2006). Relatively small pieces of this unit are present beneath the project area in the Seaside vicinity at depths of about 800 feet deep just north of the Ord Terrace Fault and about 500 feet below ground surface (bgs) in between the Ord Terrace and Seaside Faults (HydroMetrics, 2009), as shown on **Figure 4.2-2**. The unit has surface outcrops east of the project area (CGS, 2002b) and is up to 400 feet thick in places (Durbin, 2007). The proposed new ASR injection/extraction wells would be drilled to about 1,000 feet below the surface and screened within the Santa Margarita Sandstone.

Monterey Formation

The Tertiary-age (65 mya to 1.6 mya) Monterey Formation is a marine sedimentary unit generally consisting of siliceous and diatomaceous[10] interbedded layers of mudstone, siltstone, sandstone, and claystone (Clark et al., 1997). Seams of the expandable clay bentonite are also present (Ninyo & Moore, 2005, 2014). This unit is present at the proposed Main System–Hidden Hills Interconnection Improvements. The Monterey Formation is at the surface on both sides of the Carmel Valley and underlies the Carmel Valley floodplain deposits beneath the proposed Carmel Valley Pump Station. The unit extends beneath the remainder of the project area to the north, as well as west into Monterey Bay.

4.2.1.2 Seismicity and Faults

This section characterizes the region’s existing faults, describes historical earthquakes, estimates the likelihood of future earthquakes, and describes probable groundshaking effects.

Earthquake Terminology and Concepts

Earthquake Mechanisms and Fault Activity

Faults are planar features within the earth’s crust that have formed to release strain caused by the dynamic movements of the earth’s major tectonic plates. An earthquake on a fault is produced when these strains overcome the inherent strength of the earth’s crust, and the rock ruptures. The rupture causes seismic waves that propagate through the earth’s crust, producing the groundshaking effect known as an earthquake. The rupture also causes variable amounts of slip along the fault, which may or may not be visible at the earth’s surface.

Geologists commonly use the age of offset rocks as evidence of fault activity—the younger the displaced rocks, the more recently earthquakes have occurred. To evaluate the likelihood that a fault would produce an earthquake, geologists examine the magnitude and frequency of recorded

[10] Diatomaceous deposits consist of fossilized amorphous silica remains of diatoms, a type of hard-shelled algae.

earthquakes and evidence of past displacement along a fault. The State of California defines an active fault as one that has had surface displacement within Holocene time (the CGS defines this as within last 11,000 years; the USGS uses 15,000 years). A Quaternary fault is defined as a fault that has shown evidence of surface displacement during the Quaternary period (the last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not mean that a fault lacking evidence of surface displacement is necessarily inactive. The term "sufficiently active" is also used to describe a fault if there is some evidence that Holocene displacement has occurred on one or more of its segments or branches (Hart, 1997).

For the purpose of delineating fault rupture zones, the CGS historically sought to identify faults defined as potentially active, which are faults that have shown evidence of surface displacement during the Quaternary period. Older maps still use the "potentially active" term. However, under the Alquist-Priolo Earthquake Fault Zoning Act, usage of this term was discontinued when it became apparent that the sheer number of Quaternary-age faults in the state made it meaningless to zone all of them (Bryant and Hart, 2007). In late 1975, the state geologist made a policy decision to zone only those faults that had a relatively high potential for ground rupture, determining that a fault should be considered for zoning only if it was sufficiently active and "well defined."[11] Blind faults do not show surface evidence of past earthquakes, even if they occurred in the recent past; and faults that are confined to pre-Quaternary rocks (more than 1.6 million years old) are considered inactive and incapable of generating an earthquake.

Earthquake Magnitude

When an earthquake occurs along a fault, its size can be determined by measuring the energy released during the event. A network of seismographs records the amplitude and frequency of the seismic waves that an earthquake generates. The Richter magnitude (ML) of an earthquake represents the highest amplitude measured by the seismograph at a distance of 100 kilometers from the epicenter. Richter magnitudes vary logarithmically with each whole-number step, representing a tenfold increase in the amplitude of the recorded seismic waves and 32 times the amount of energy released. While Richter magnitude was historically the primary measure of earthquake magnitude, seismologists now use Moment Magnitude (Mw) as the preferred way to express the size of an earthquake. The Moment Magnitude scale is related to the physical characteristics of a fault, including the rigidity of the rock, the size of fault rupture, and the style of movement or displacement across the fault. Although the formulae of the scales are different, they both contain a similar continuum of magnitude values, except that Mw can reliably measure larger earthquakes and do so from greater distances.

Peak Ground Acceleration

A common measure of ground motion at any particular site during an earthquake is the peak ground acceleration (PGA). The PGA for a given component of motion is the largest value of

[11] A fault is considered well defined if its trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The fault may be identified by direct observation or by indirect methods (e.g., geomorphic and geophysical evidence). The critical consideration is that the fault, or some part of it, can be located in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

horizontal acceleration obtained from a seismograph. PGA is expressed as the percentage of the acceleration due to gravity (g), which is approximately 980 centimeters per second squared. In terms of automobile acceleration, one "g" of acceleration is equivalent to the motion of a car traveling 328 feet from rest in 4.5 seconds. For comparison purposes, the maximum PGA value recorded during the Loma Prieta earthquake in the vicinity of the epicenter, near Santa Cruz, was 0.64 g. Unlike measures of magnitude, which provide a single measure of earthquake energy, PGA varies from place to place and is dependent on the distance from the epicenter and the character of the underlying geology (e.g., hard bedrock, soft sediments, or artificial fills).

Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale assigns an intensity value based on the observed effects of groundshaking produced by an earthquake. Unlike measures of earthquake magnitude and PGA, the Modified Mercalli Intensity Scale is qualitative in nature in that it is based on actual observed effects rather than measured values. Similar to PGA, Modified Mercalli values for an earthquake at any one place can vary depending on the earthquake's magnitude, the distance from its epicenter, the focus of its energy, and the type of geologic material. The Modified Mercalli values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X can cause moderate to significant structural damage. Because the Modified Mercalli scale is a measure of groundshaking effects, intensity values can be correlated to a range of average PGA values, as shown in **Table 4.2-2**.

Faults and Historical Earthquake Activity

The project area is located in a seismically active region of California. The Coast Ranges geomorphic province is composed of a series of parallel, northwest-trending mountain ranges and valleys that are generally controlled by faults. These faults juxtapose blocks of geologic units of different origins called belts. The Monterey Bay region is located within the Salinian Block, which is a northwest-trending belt bounded to the east by the San Andreas Fault and to the west by the San Gregorio (Sur) Fault. Major earthquakes have affected the region in the past and are expected to occur in the near future on one of the principal active faults in the San Andreas Fault System.

The Monterey Bay region contains both active and potentially active faults, and is considered a region of high seismic activity. Throughout the project area, there is the potential for damage resulting from movement along any one of a number of the active faults that are oriented generally perpendicular to the coastline. In 2007, the USGS, the CGS, and the Southern California Earthquake Center formed the Working Group on California Earthquake Probabilities (WGCEP) to evaluate the probability of one or more earthquakes of Mw 6.7 or higher occurring in the state of California over the next 30 years. Accounting for the wide range of possible earthquake sources, it is estimated that the San Francisco and Monterey Bay areas as a whole have a 72 percent chance of experiencing an earthquake of Mw 6.7 or higher in the next 30 years; among the various active faults in the region, the San Andreas Fault System is the most likely to cause such an event (WGCEP, 2015a).

TABLE 4.2-2
MODIFIED MERCALLI INTENSITY SCALE

Intensity Value	Intensity Description	Average Peak Ground Acceleration[a]
I	Not felt	< 0.0017 g
II	Felt by people sitting or on upper floors of buildings	0.0017 to 0.014 g
III	Felt by almost all indoors. Hanging objects swing. Vibration like passing of light trucks. May not be recognized as an earthquake.	0.0017 to 0.014 g
IV	Vibration felt like passing of heavy trucks. Stopped cars rock. Hanging objects swing. Windows, dishes, doors rattle. Glasses clink. In the upper range of IV, wooden walls and frames creak.	0.014 to 0.039 g
V (Light)	Felt outdoors. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing. Pictures move. Pendulum clocks stop.	0.035 to 0.092 g
VI (Moderate)	Felt by all. People walk unsteadily. Many frightened. Windows crack. Dishes, glassware, knickknacks, and books fall off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster, adobe buildings, and some poorly built masonry buildings cracked. Trees and bushes shake visibly.	0.092 to 0.18 g
VII (Strong)	Difficult to stand or walk. Noticed by drivers of cars. Furniture broken. Damage to poorly built masonry buildings. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, unbraced parapets and porches. Some cracks in better masonry buildings. Waves on ponds.	0.18 to 0.34 g
VIII (Very Strong)	Steering of cars affected. Extensive damage to unreinforced masonry buildings, including partial collapse. Fall of some masonry walls. Twisting, falling of chimneys and monuments. Wood-frame houses moved on foundations if not bolted; loose partition walls thrown out. Tree branches broken.	0.34 to 0.65 g
IX (Violent)	General panic. Damage to masonry buildings ranges from collapse to serious damage unless modern design. Wood-frame structures rack, and, if not bolted, shifted off foundations. Underground pipes broken.	0.65 to 1.24 g
X (Very Violent)	Poorly built structures destroyed with their foundations. Even some well-built wooden structures and bridges heavily damaged and needing replacement. Water thrown on banks of canals, rivers, lakes, etc.	> 1.24 g
XI (Very Violent)	Few, if any, masonry structures remain standing. Bridges destroyed. Rails bent greatly. Underground pipelines completely out of service.	> 1.24 g
XII (Very Violent)	Damage nearly total. Practically all works of construction are damaged greatly or destroyed. Large rock masses displaced. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown into the air.	> 1.24 g

NOTES:

[a] Value is expressed as a fraction of the acceleration due to gravity (g). Gravity (g) is 9.8 meters per second squared. 1.0 g of acceleration is a rate of increase in speed equivalent to a car traveling 328 feet from rest in 4.5 seconds.

SOURCES: ABAG, 2016; CGS, 2003.

Several active and potentially active faults have been mapped within or close to the project area. **Figure 4.2-4** shows the approximate locations of the major faults in the region and their geographic relationship and orientation to the project area. **Table 4.2-3** lists the principal active and potentially active faults in the region that could affect the project components; the type of the faults; and the estimated maximum Moment Magnitude of earthquakes that could occur on each fault. The approximate distance to each fault is based on estimated distances from the nearest proposed project component. None of the faults cross, nor are they located near the proposed slant wells or the existing outfall, located within submerged lands and waters of MBNMS.

Regional Faults

San Andreas Fault Zone

The San Andreas Fault Zone is a major structural feature in the region and forms a boundary between the North American and Pacific tectonic plates (Bryant and Lundberg, 2002). The San Andreas Fault is a major northwest-trending, right-lateral,[12] strike-slip[13] fault. The fault extends for about 600 miles from the Gulf of California in the south to Cape Mendocino in the north. The San Andreas is not a single fault trace but rather a system of active faults that diverges from the main fault south of San Jose. Regional faults that are subparallel to the San Andreas Fault, such as the Hayward, Calaveras, and San Gregorio Faults, are within the broader San Andreas Fault System (see **Figure 4.2-4**).

The San Andreas Fault has produced numerous large earthquakes, including the 1906 San Francisco earthquake. That event had an estimated ML 8.3, or Mw 7.8 (WGCEP, 2008a, 2008b) and was associated with up to 21 feet of displacement and widespread ground failure, including several hundred miles of surface fault rupture (Lawson, 1908). In the Watsonville area and to the east, reports of strong groundshaking, toppled chimneys, ground cracks, broken pipes, and twisted and sunken railroad tracks (Lawson, 1908) indicate that groundshaking intensities reached IX on the Modified Mercalli scale.

Numerous moderate-sized earthquakes (approximately magnitude 5.2) in Watsonville (in 1954 and again in 1964 and 1969) resulted in broken irrigation lines, ruptured water mains, and cracked plaster and stucco (PVWMA, 2001). The magnitude 6.9 Loma Prieta earthquake of October 1989, centered in the Santa Cruz Mountains, caused strong groundshaking and ground failure throughout the San Francisco and Monterey Bay areas. Major damage was experienced in downtown and residential Watsonville, Castroville, Gilroy, and Hollister (McNutt and Toppozada, 1990). In the project area, the Loma Prieta earthquake produced a PGA of 0.39 g and groundshaking with a Modified Mercalli intensity of VIII.

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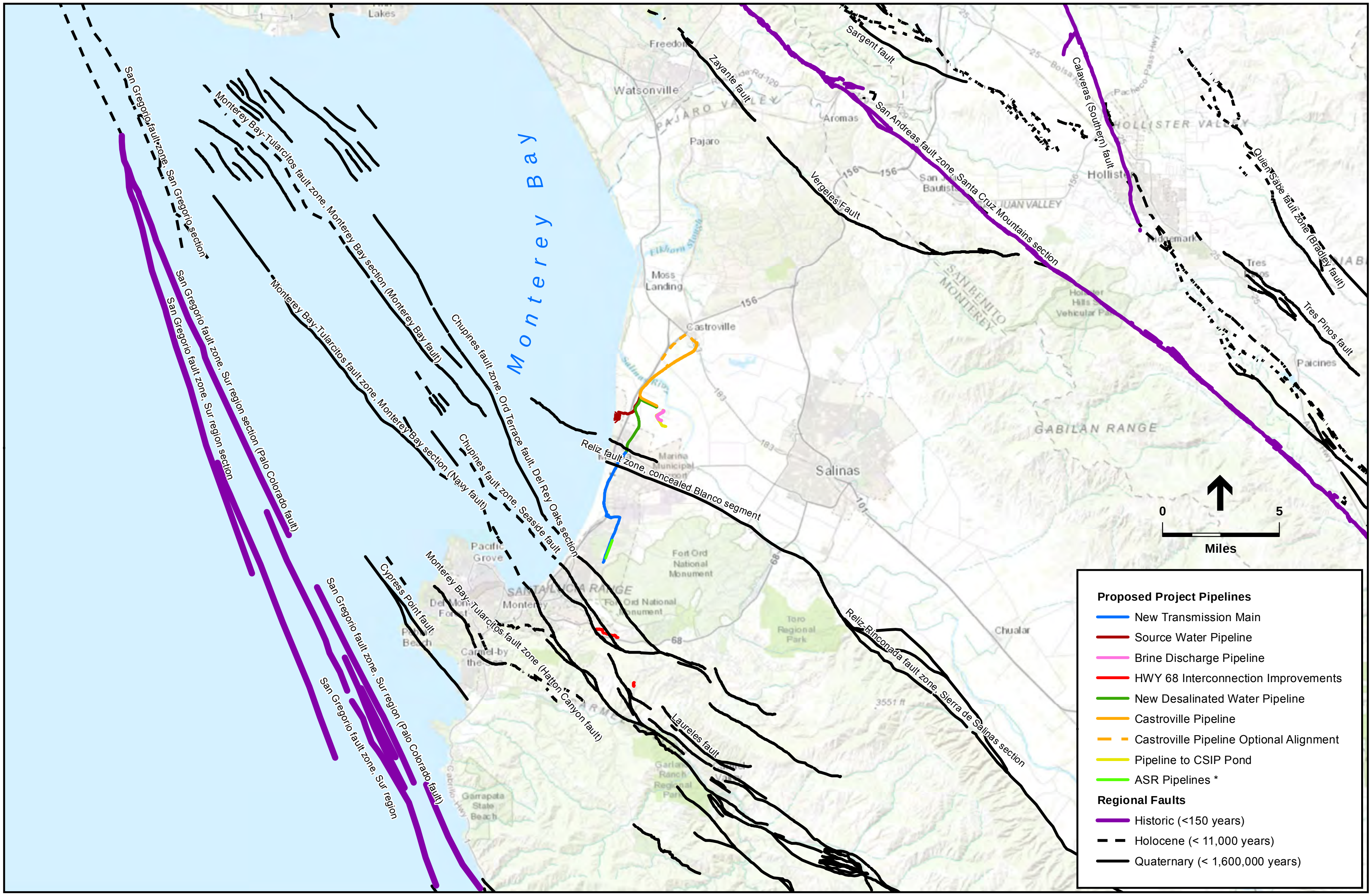
[12] To an observer straddling a right-lateral fault, the right-hand block or plate would move towards the observer.
[13] A strike-slip fault creates vertical (or nearly vertical) fractures (i.e., the blocks primarily move horizontally). If the block opposite an observer looking across the fault moved to the right, the slip style is termed “right lateral;” if the block moved to the left, the motion is termed “left lateral.”



NOTE:
*The ASR Pipelines are the ASR Conveyance Pipeline, the ASR Pump-to-Waste Pipeline, and the ASR Recirculation Pipeline. See Figure 3-9a for the individual pipeline alignments.

SOURCE: USGS/CGS, 2010

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Figure 4.2-4
Active and Potentially Active Regional Faults

TABLE 4.2-3
ACTIVE AND POTENTIALLY ACTIVE FAULTS

Fault or Fault Zone	Location Relative to Project Components	Recency of Faulting	Slip Rate (millimeters/ year)	Maximum Moment Magnitude (Mw)	Historical Seismicity[a]
Monterey Bay – Tularcitos Fault Zone[b]	Beneath Main System–Hidden Hills Interconnection Improvements	Late Quaternary with evidence of Holocene activity (Potentially Active)	0.2 to 1.0	7.3	
Reliz–Rinconada Fault Zone (Blanco Section)	Beneath new Transmission Main	Late Quaternary (Potentially Active)	0.2 to 1.0	7.5	
Hatton Canyon Fault	0.5 miles northeast of Carmel Valley Pump Station	Quaternary with evidence of Holocene Activity (Potentially Active)	0.2 to 1	not estimated	
Laureles Fault	1.5 miles southwest of Main System–Hidden Hills Interconnection Improvements	Late Quaternary (Potentially Active)	Unknown	5.5	
San Gregorio Fault (Sur Region)	5 miles southwest of Carmel Valley Pump Station	Historical (<200 years ago) (Active)	1 to 7	7.0	6+, 1926
Zayante–Vergeles Fault Zone	12 miles northeast of MPWSP Desalination Plant and 8.5 miles northeast of northern terminus of Castroville Pipeline	Holocene (Active)	0.1	7.0	
San Andreas Fault	16 miles northeast of MPWSP Desalination Plant and 13 miles northeast of northern terminus of Castroville Pipeline	Historical (Active)	13 to 21	6.2 to 7.0	6.9, 1989 7.8, 1906 6.7, 1898 6.5, 1885
Sargent Fault Zone	19 miles northeast of MPWSP Desalination Plant and 16 miles northeast of northern terminus of Castroville Pipeline	Late Quaternary (Potentially Active)	1 to 5	6.8	
Calaveras Fault (southern)	25 miles northeast of MPWSP Desalination Plant and 22 miles northeast of northern terminus of Castroville Pipeline	Historical (Active)	10 to 20	5.8	6.3, 1897 6.5, 1911

NOTES:
a Richter Magnitude (M_L) or Moment Magnitude (Mw) and year of recent or large events. References that cite earthquake magnitudes do not always specify whether the measurement used the Richter or Moment Magnitude scale; however, the M_L and Mw values are similar up to about 7.
b Includes the Chupines, Seaside, Ord Terrace, and Navy Faults.

SOURCES: CGS, 2003; USGS, 2010; Johnson, 2004; Clark et al., 1997; Field, et.al., 2013

The San Andreas Fault, which has experienced multiple large earthquake events resulting in large surface fault rupture, is a designated earthquake fault zone under the Alquist-Priolo Earthquake Fault Zoning Act (see Section 4.2.2.2, State Regulations). According to the WGCEP, the Northern California portion of the San Andreas Fault has a 16 percent of producing a Mw 6.7 or larger earthquake during the next 30 years (WGCEP, 2015b). The CCSD connection is located about 12.5 miles southwest of the San Andreas Fault.

San Gregorio Fault Zone

The San Gregorio Fault Zone is a complex of faults that skirt the coastline north of Big Sur and run northwestward across Monterey Bay, briefly touching the shoreline of the San Mateo County coastline at Point Año Nuevo and at Seal Cove, just north of Half Moon Bay (Bryant and Cluett, 1999b). This fault is active and was recently recognized as capable of producing large earthquakes. Studies have shown Holocene displacement on the San Gregorio Fault as recently as 1270 AD to 1400 AD (Bryant and Cluett, 1999b). Additionally, a 1926 earthquake with a Richter magnitude above 6.0—previously thought to have occurred on the Monterey Fault—may have actually ruptured an offshore segment of the San Gregorio Fault Zone (Johnson, 2004). According to the WGCEP, the San Gregorio Fault has a 1.34 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The closest portion of the fault to a proposed project component is approximately 10 miles southwest of the Highway 68 Interconnection Improvement.

Calaveras Fault Zone

The Calaveras Fault Zone, a major right-lateral, strike-slip fault, extends for about 100 miles from Dublin to Hollister, where it merges with the San Andreas Fault (Bryant and Cluett, 1999a). The Calaveras Fault is designated as an earthquake fault zone under the Alquist-Priolo Act. The Calaveras Fault is most active on its southern segment; the magnitude 6.2 Morgan Hill earthquake (April 1984) originated on this fault. Tectonic creep[14] has been documented along the Calaveras Fault in the vicinity of Hollister. According to the WGCEP, the Calaveras Fault has a 17.09 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The CCSD connection is located about 20 miles west of the Calaveras Fault Zone.

Sargent Fault Zone

The Sargent Fault Zone branches from the San Andreas Fault and extends for about 34 miles, from the Lexington Reservoir in the north to just north of Hollister in the south (Bryant, 2000a). The Sargent Fault is a reverse-oblique,[15] right-lateral, strike-slip fault zone that dips steeply to the west and is seismically active. The fault is considered to be capable of surface rupture and is designated as an Alquist-Priolo earthquake fault zone. According to the WGCEP, the Sargent Fault Zone has a 0.82 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The CCSD connection is located about 16.25 miles southwest of this fault.

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[14] Tectonic creep is the slow, apparently continuous movement on a fault (Bates and Jackson, 1980).
[15] In a reverse fault, the block above the fault moves up relative to the block below the fault. This fault motion is caused by compressional forces and results in shortening. Oblique-slip faulting suggests both dip-slip faulting (vertical movement) and strike-slip faulting (horizontal movement).

Zayante-Vergeles Fault Zone

The Zayante-Vergeles Fault Zone is approximately parallel with and about 5 miles west of the San Andreas Fault (Bryant, 2000b). The Zayante Fault is considered to be a late Pleistocene-age (1.6 mya to 11,000 ya), and possibly Holocene, potentially active Quaternary fault. Some portions of the Zayante Fault may be active, and some scientists believe its southern section may be indirectly connected to the San Andreas Fault Zone. Following recent investigations of the Vergeles Fault, the CGS designated portions of the fault as a fault rupture hazard zone USGS Watsonville East and Watsonville West 7.5-minute topographic map). However, other portions of the Vergeles are classified as potentially active and are not designated under the Alquist-Priolo Act. According to the WGCEP, the Zayante-Vergeles Fault Zone has a 0.10 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The CCSD connection is located about 8.25 miles southwest of this fault.

Local Faults

Several Quaternary faults intersect the project area. Additionally, several potentially active faults cross, or are located in close proximity to components of the proposed project.

Reliz-Rinconada Fault Zone

The Reliz-Rinconada Fault Zone runs parallel to Highway 101 along the Salinas River Valley at the base of the Santa Lucia Mountains. This high-angle, reverse fault offsets Salinian Block basement rocks and locally juxtaposes the Pliocene-Pleistocene-age (5.3 mya to 11,000 ya) Paso Robles Formation against basement rocks (Rosenberg and Bryant, 2003). The Reliz Fault has been projected crossing northwest-southeast through the central portion of the project area in the vicinity of Marina (Ninyo & Moore, 2005). The fault trace in this area is concealed by fluvial deposits of the Salinas River Valley and coastal dunes, causing uncertainty as to the precise location of the fault. Geologic evidence indicates that this fault system has displaced materials that are between 50,000 to 100,000 years old and is considered potentially active (Rosenberg and Bryant, 2003; Rosenberg and Clark, 2009). According to the WGCEP, the Reliz-Rinconada Fault Zone has a 0.31 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The new Transmission Main would cross this fault; the slant wells at CEMEX would be north of this fault.

Monterey Bay–Tularcitos Fault Zone

The Monterey Bay–Tularcitos Fault Zone extends for about 52 miles, from Santa Cruz to the crest of the Sierra de Salinas. The onshore portion of the fault zone includes the Chupines, Seaside, Tularcitos, Navy, Ord Terrace, and Hatton Canyon Faults (Bryant, 2001). These faults create an approximately 6- to 9-mile-wide zone of short in-echelon, northwest-striking faults that are related. The activity and locations of these faults are not well defined. Data presented by Jennings (2010) show that no active portions of the Monterey Bay–Tularcitos Fault Zone extend onshore into the southern portion of the project area. Jennings classifies the Ord Terrace, Seaside, Chupines, and Tularcitos Faults as Quaternary. However, Bryant (2001), citing Rosenberg and Clark et al. (1997), provides evidence of Holocene displacement along the Hatton Canyon, and Tularcitos Faults, which are located close to the proposed Carmel Valley Pump Station. The

Monterey section of the Monterey Bay-Tularcitos Fault Zone also crosses the route of the new Transmission Main. Additionally, there is evidence of a probable offshore extension of the Chupines Fault displacing Holocene-age (less than 11,000 years old) deposits and sea floor sediments (Ninyo & Moore, 2014). There is evidence for recent (less than 11,000 ya) displacement on the individual faults of the Monterey Bay-Tularcitos Fault Zone and therefore, considering the proximity of these active strands to project components, these faults should be considered active for planning purposes. According to the WGCEP, the Monterey Bay–Tularcitos Fault Zone has a 0.64 percent chance of producing a MW 6.7 or larger earthquake in the next 30 years (WGCEP, 2015b). The Highway 68 Interconnection Improvements would be about 2 miles northwest of this fault zone.

Laureles Fault Zone

The northwest-striking, nearly vertical, reverse[16] Laureles Fault Zone extends approximately 4 miles along the north side of Carmel Valley and is up to 0.2 mile wide (Clark et al., 1997). The northeast side is upthrown and displaces Pleistocene-age (5.3 mya to 11,000 ya) terrace gravels, suggesting the latest movement to be middle to late Pleistocene. The Laureles Fault is about 1.5 miles southwest of Main System–Hidden Hills Interconnection.

4.2.1.3 Geologic Hazards

Based on the geologic data reviewed during preparation of this EIR/EIS, the potential geologic hazards at the proposed project sites include soil erosion, slope instability, and soils hazards. These geologic hazards are discussed below.

Erosion

Erosion is the wearing away of soil and rock by processes such as mechanical or chemical weathering, mass wasting, and the action of waves, wind, and underground water. Excessive soil erosion can eventually damage infrastructure such as pipelines, wellheads, building foundations, and roadways. In general, granular soils with relatively low cohesion and soils located on steep topography have a higher potential for erosion. The *Monterey County General Plan* (Monterey County, 2010) includes a soil erosion hazard map showing relative erosion hazards within the county. Soils are classified based on the soil surveys consolidated for the soil survey geographic database for Monterey County prepared by the National Resources Conservation Service (NRCS, 2014). In the project area, the steep coastal dune slopes have a high potential for erosion. The dune deposits east of the coastline, where the topography is not as steep, are considered to have a moderate potential for erosion. The soil erosion potential is typically reduced or eliminated once the soil is graded and covered with concrete, structures, asphalt, vegetation, or other slope protection measures are implemented.

[16] A geologic fault in which the hanging wall (the upper block) has moved upward relative to the footwall (the lower block). Reverse faults occur where two blocks of rock are forced together by compression.

Sea Level Rise and Coastal Erosion

Monterey Bay is a large, lowland coastal embayment, with rocky headlands at the north and south and a sweeping arc of sandy, dominantly dune- and cliff-backed shoreline in between. The shoreline of south Monterey Bay (from the Salinas River south to Del Monte Beach in the city of Monterey) includes an 11-mile stretch of continuous sandy beach that is wider at the southern end than at the northern end. The morphology of beaches in this region varies from season to season, with beaches generally being wider and gently sloping in summer and narrower and steeper in winter. The dunes at the back edge of the beach have an average height of 34 feet but can be as high as 151 feet. Some of the dune surfaces that are not directly exposed to wave energy are vegetated, indicating that the dunes are stabilized in some areas.

The topographic surface, including the dunes, beach, and undersea nearshore areas, can be affected by coastal retreat in four ways.

1. **Long-term erosion.** Over time, the dunes and surrounding area have been and will continue to erode as a result of rain and wind.

2. **Sea level rise.** As sea level rises, the shoreline area affected by wave action will migrate inland and will erode the sand dunes. As a result, the dunes and the shoreline will also retreat inland. In addition, the surge from storm events, discussed below, would push further inland.

3. **Storm events.** Storm events also erode sand from the coastal dunes and shoreline areas. Typically, a storm event moves sand out to sea during the event. The strongest of these events are referred to as the 100-year storm event. Similar to the 100-year flood event, the 100-year storm event is the storm that has a 1 percent chance of occurring in a given year. After the storm passes and over the following year, some and possibly most of the sand re-accumulates along the shore and dune areas. However, at the time of that storm event, any structures present within that scoured area would be exposed. For example, a winter storm surge in early March 2016 exposed the buried MRWPCA ocean outfall pipe. Up to 15 feet of scour was observed around the exposed section of the outfall. The last time the outfall pipe was exposed was in 1997. The 2016 storm surge also broke the discharge pipe from the Test Slant Well to the outfall.

4. **Rip embayments.** Rip embayments are caused by the erosive action of cross-shore rip currents and affect an area from just offshore to the toe of the sand dunes closest to the shoreline. As this sand is removed, sand from the shore area and ultimately the dunes can erode seaward to fill in the void. Rip embayments tend to be stronger in the winter and weaker in the summer. After the rip embayment passes by a particular shoreline location, some of the sand re-accumulates.

The northwestern Marina area, including the proposed location of the subsurface slant wells, is characterized by extensive sand dunes. These dunes vary in height and are composed entirely of unconsolidated, highly erodible sand. The erosion of dunes by waves occurs more often in winter months, when the active beach area is narrow and storms are stronger and more frequent. Erosion in this region is highly episodic, occurring in steps when high tides coincide with large, storm-generated waves. The steep to near-vertical bluffs in the vicinity of the CEMEX active mining area indicate that rapid erosion has taken place in this area (see **Figure 4.3-3**, Areas Subject to Sea Level Rise in the Project Area in Section 4.3, Surface Water Hydrology and Water Quality).

The existence of wide sandy beaches throughout the area, as well as the flanking sand dunes, indicate that past sand supply was in excess of sand loss. However, the shoreline of southern Monterey Bay has been retreating for a number of years. Dam impoundments have decreased the historical sediment yield of the Salinas River, thus reducing a major source of sediment for the beaches in the Marina area. The Nacimiento Dam (completed in 1957) and the San Antonio Dam (completed in 1967) have impounded about 15 percent of the Salinas River Watershed, thereby trapping sand that would have been delivered to the beach, as well as reducing peak flow rates that transport the bulk of the river sediments. Additionally, sand mining in the region has increased sediment and sand loss and has contributed to disequilibrium, thus increasing the rate of coastal retreat in the southern Monterey Bay south of the Salinas River (Thornton et. al., 2006).

As discussed in the *Analysis of Historic and Future Coastal Erosion with Sea Level Rise* (ESA, 2014), various studies conducted over the period between 1930 to 2006 indicate sea level is rising at a rate of approximately 5.3 to 7.6 inches per century. With sea level rise, the coastline is expected to retreat inland and has the potential to intersect project components if they are constructed within the extent of that retreat.

Corrosive or Expansive Soils

Table 4.2-4 identifies the soil types and soil properties at proposed facility locations. The subsurface slant wells would be constructed in subsurface dune sands, which are not considered soil because the sand lacks sufficient humus; therefore, information regarding soil properties at the subsurface slant well site is not included. Potential impacts related to problematic soil conditions include corrosivity and expansion (linear extensibility or shrink-swell potential). Drainage pertains to soils that are unable to adequately percolate or shed surface water away from a development site, leading to flooding and water-related damage. Poorly drained soils can increase the risks of corrosion, linear extensibility, differential settlement, and other water-related issues.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical actions that corrode or weaken concrete or uncoated steel, once placed. The rate of concrete corrosion is based mainly on the sulfate, sodium, and chloride content, texture, moisture content, and acidity of the soil. The rate of uncoated-steel corrosion is related to such factors as the moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Steel installations that intersect soil boundaries or soil layers are more susceptible to corrosion than the steel installations that are entirely within one kind of soil or within one soil layer. The risk of corrosion is expressed as low, moderate, or high.

Linear extensibility or shrink-swell potential refers to the change in volume of soil as moisture content is increased or decreased between a moist and dry state. The volume change is reported as a percent change for the whole soil. The amount and type of clay minerals in the soil influence changes in soil volume.

The soil properties listed above are general properties for soil types. A site-specific geotechnical investigation was conducted at the proposed desalination plant (PCE, 2014). Soil samples were analyzed for soil resistivity, chloride, sulfate, and pH. The results indicate the soil to be non-corrosive.

TABLE 4.2-4
SUMMARY OF GENERAL SOIL PROPERTIES

Proposed Project Component	Soil	Drainage	Concrete Corrosion Potential	Unprotected Steel Corrosion Potential	Linear Extensibility[a]
MPWSP Desalination Plant, and Most Pipelines[b]	Oceano Loamy[c] Sand (OaD) or similar	Excessively	Moderate	Moderate	Low (1.5%)
Castroville Pipeline	Pacheco Clay Loam	Poorly Drained	Low	High	Moderate (3 to 6%)
ASR Injection/ Extraction Wells and Pipelines[b,d]	Oceano Loamy Sand (OaD)	Excessively	Moderate	Moderate	Low (1.5%)
Carmel Valley Pump Station	Dissected xerorthents[e]	Excessively	Low	Low	Low to moderate (1.5 to 4.5%)
Main System–Hidden Hills Inter-connection Improvements	Santa Ynez Fine Sandy Loam (ShE)	Moderately well	Low	Low	Moderate (4.5%)
Ryan Ranch–Bishop Interconnection Improvements	Santa Ynez Fine Sandy Loam (ShE); Narlon Loamy Fine Sand (NcC); and badland weathered bedrock (Ba)	Moderately well to somewhat poorly	Low (ShE and Ba); High (NcC)	High (NcC); no data for other units	Moderate to high (4.5 to 7%)

NOTES:
a Also known as shrink-swell potential or expansion potential.
b All pipelines except the ASR Conveyance Pipelines, the ASR Pump-to-Waste Pipeline, and the ASR Recirculation Pipeline.
c Loamy soils are composed of sand, silt, and clay in relatively even concentrations (about 40-40-20 percent concentration, respectively). Loam soils generally contain more nutrients and humus than sandy soils, have better drainage and infiltration of water and air than silty soils, and are easier to till than clay soils.
d These are the ASR Conveyance Pipelines and the ASR Pump-to-Waste Pipeline.
e Dissected xerorthents are deposits located on alluvial fans and terraces with steeper slopes such that the alluvial deposits do not have sufficient time to develop into soils.

SOURCE: NRCS, 2014.

4.2.1.4 Seismic Hazards

Seismic hazards are generally classified into two categories: primary seismic hazards (surface fault rupture and groundshaking) and secondary seismic hazards (liquefaction and other types of seismically induced ground failure, along with seismically induced landslides).

Surface Fault Rupture

Seismically induced ground rupture is defined as the physical displacement of surface deposits in response to an earthquake's seismic waves. The magnitude, sense, and nature of fault rupture can vary for different faults or even along different strands of the same fault. Although future earthquakes could occur anywhere along the length of an active fault, only regional strike-slip earthquakes of magnitude 6.0 or greater are likely to be associated with significant surface fault rupture and offset (CDMG and USGS, 1996). It is also important to note that unmapped subsurface fault traces could experience unexpected and unpredictable earthquake activity and fault rupture.

Ground rupture is considered more likely along active faults, which are referenced above in **Figure 4.2-4** and **Table 4.2-3** and described in Section 4.2.1.2. The highest potential for surface faulting is along existing fault traces that have had Holocene displacement. The closest known active faults with historical earthquake events are the San Gregorio, Zayante-Vergales, and San Andreas at 5, 11, and 15 miles, respectively, from components of the proposed project. The onshore portions of potentially active faults in the Monterey-Tularcitos and the Reliz-Rinconada Fault Zones pass beneath the proposed new Transmission Main. These potentially active faults or segments of faults are not zoned under the Alquist-Priolo Earthquake Fault Zone (see Section 4.2.2, Regulatory Framework, below).

Seismic Groundshaking

As discussed above (Section 4.2.1.2), the WGCEP estimated that a major earthquake has a 72 percent chance of affecting the project vicinity in the next 30 years and would produce strong groundshaking throughout the region (WGCEP, 2015a, b). Earthquakes on active or potentially active faults, depending on magnitude and distance from the project area, could produce a range of groundshaking intensities at the project area. Historically, earthquakes have caused strong groundshaking and damage in the San Francisco Bay Area. However, disregarding local variations in ground conditions, the intensity of shaking at different locations within the area can generally be expected to decrease with distance from an earthquake source.

The primary tool that seismologists use to describe groundshaking hazard is a probabilistic seismic hazard assessment (PSHA). The PSHA for the State of California takes into consideration the range of possible earthquake sources (including such worst-case scenarios as described above) and estimates their characteristic magnitudes to generate a probability map for groundshaking. The PSHA maps depict PGA value of that have a 10 percent probability of being exceeded in 50 years (i.e., a 1 in 475 chance of occurring each year). Use of this probability level allows engineers to design structures to withstand ground motions that have a 90 percent chance of *not* occurring in the next 50-year interval, thus making buildings safer than if they were designed only for the ground motions that are expected within the next 50 years.

In 2008, the USGS and the CGS updated the model by introducing new parameters and updated fault locations (CGS, 2008a). **Table 4.2-5** summarizes the estimated PGAs (10 percent probability of being exceeded in 50 years) at various project components.

As shown on Figure 4.2-1, the majority of the project components would be constructed on fill or alluvial materials; PGAs for fill and alluvial materials were estimated to range from 0.361 g to 0.418 g. The Main System-Hidden Hills Interconnection Improvements would be located in a largely bedrock area with a PGA of 0.320. Using American Society of Civil Engineers (ASCE) Standard 7-10 design criteria, the geotechnical investigation for the desalination plant estimated the PGA could be as high as 0.562 (Zinn, 2014). As listed in **Table 4.2-2**, the estimated range of PGAs equates to Modified Mercalli groundshaking intensities of VII (strong) to VIII (very strong).

TABLE 4.2-5
SUMMARY OF ESTIMATED PEAK GROUND ACCELERATIONS AT PROPOSED FACILITY LOCATIONS

Proposed Project Component	PGA
Subsurface slant wells	0.390 g
MPWSP Desalination Plant	CGS estimate: 0.398 g Zinn calculation; 0.562 g
Northern terminus of Castroville Pipeline	0.418 g
ASR-5 and ASR-6 Wells	0.371 g
Ryan Ranch-Bishop Interconnection Improvements	0.362 g
Main System-Hidden Hills Interconnection Improvements	0.320 g
Carmel Valley Pump Station	0.361 g

NOTE: g = percentage of the acceleration due to gravity

SOURCE: CGS, 2008b; Zinn, 2014

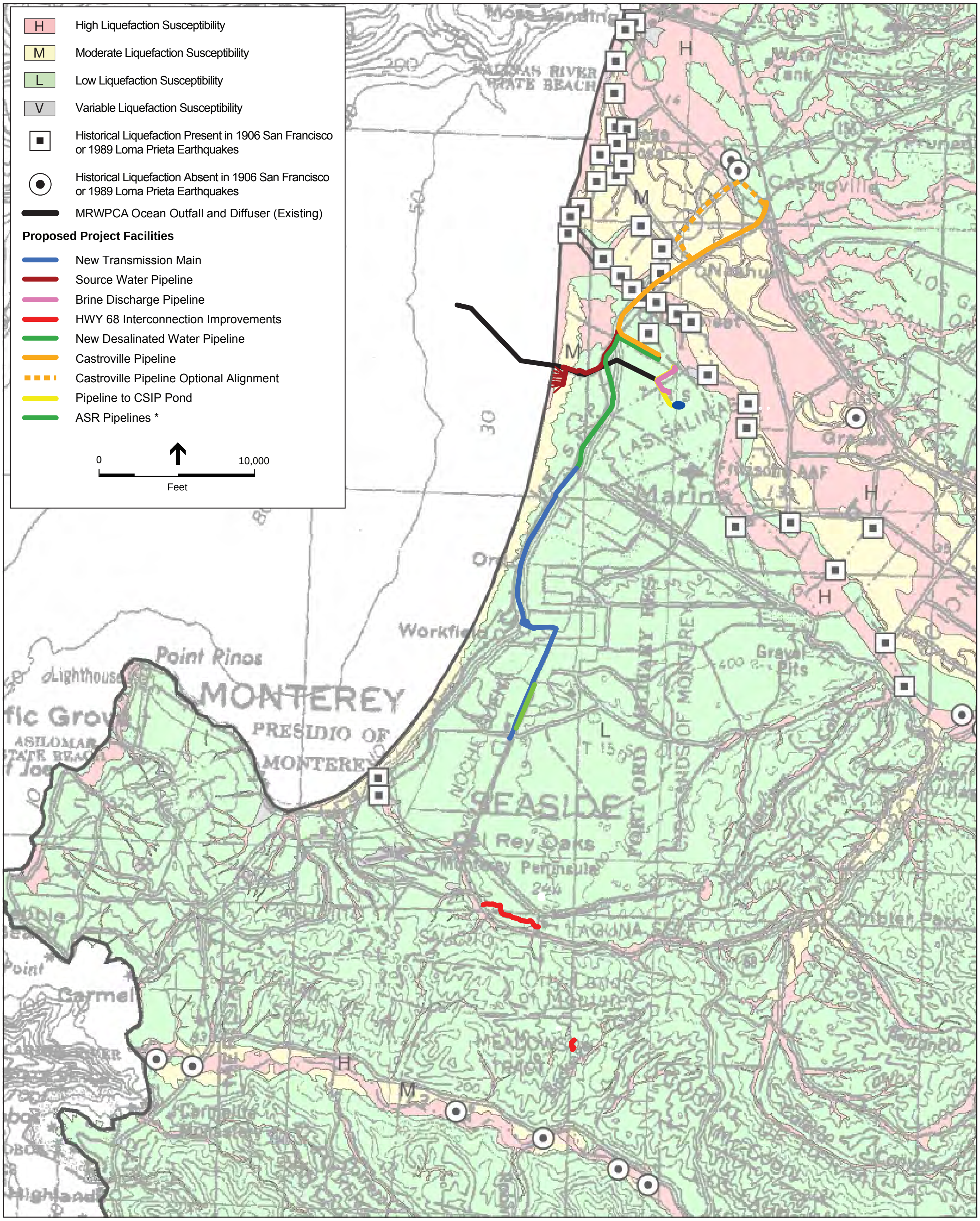
Liquefaction and Lateral Spreading

Liquefaction is the rapid loss of shear strength experienced in saturated, predominantly granular soils below the groundwater level during strong earthquake groundshaking and occurs due to an increase in pore water pressure. Liquefaction-induced lateral spreading is defined as the finite, lateral displacement of gently sloping ground as a result of pore-pressure buildup or liquefaction in a shallow underlying deposit during an earthquake (VT, 2013). The occurrence of this phenomenon is dependent on many complex factors, including the intensity and duration of groundshaking, particle-size distribution, and density of the soil.

The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling[17], and buckling of deep foundations due to ground settlement. Dynamic settlement (i.e., pronounced consolidation and settlement from seismic shaking) may also occur in loose, dry sands above the water table, resulting in settlement of and possible damage to overlying structures. In general, a relatively high potential for liquefaction exists in loose, sandy soils that are within 50 feet of the ground surface and are saturated (below the groundwater table). Lateral spreading can move blocks of soil, placing strain on buried pipelines that can lead to leaks or pipe failure (VT, 2013).

Figure 4.2-5 presents the relative liquefaction hazard potential in Monterey County in the vicinity of the proposed project, with liquefaction susceptibility designations (high, moderate, low, and variable) adapted by Ninyo & Moore (2005) from the *Monterey County General Plan*. Sites with a designation of “low” are considered to have the lowest potential for liquefaction hazards, and sites with a designation of “high” are considered to have the highest potential for liquefaction because of the soil type (sand) and probable groundwater depths.

[17] Sand boiling occurs when water pressure caused by an earthquake causes sand and water to “boil” to the surface.



SOURCE: Ninyo & Moore, 2005

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Figure 4.2-5
Liquefaction Potential

Some locations in the project area, including the floodplain of the Salinas River and other smaller drainage areas, have a moderate to high liquefaction potential. During the 1989 Loma Prieta earthquake, liquefaction caused settlement and ground cracking in the Moss Landing area about 2 miles north of the proposed MPWSP Desalination Plant site, damaging roads and the approach to the bridge linking Moss Landing to the mainland. Over 30 separate locations of historical liquefaction incidents have been documented in the project vicinity, the majority of which were in the northern portion of the project area near the Salinas River. The proposed Castroville Pipeline crosses into the larger Salinas floodplain area, passing through an area of moderate to high potential for liquefaction. The proposed location for the Carmel Valley Pump Station is mapped as having a moderate to high liquefaction potential. The areas mapped with a moderate to high potential for liquefaction are also in drainage areas where the water table could be seasonally higher during the rainy season, which contributes to the increased potential.

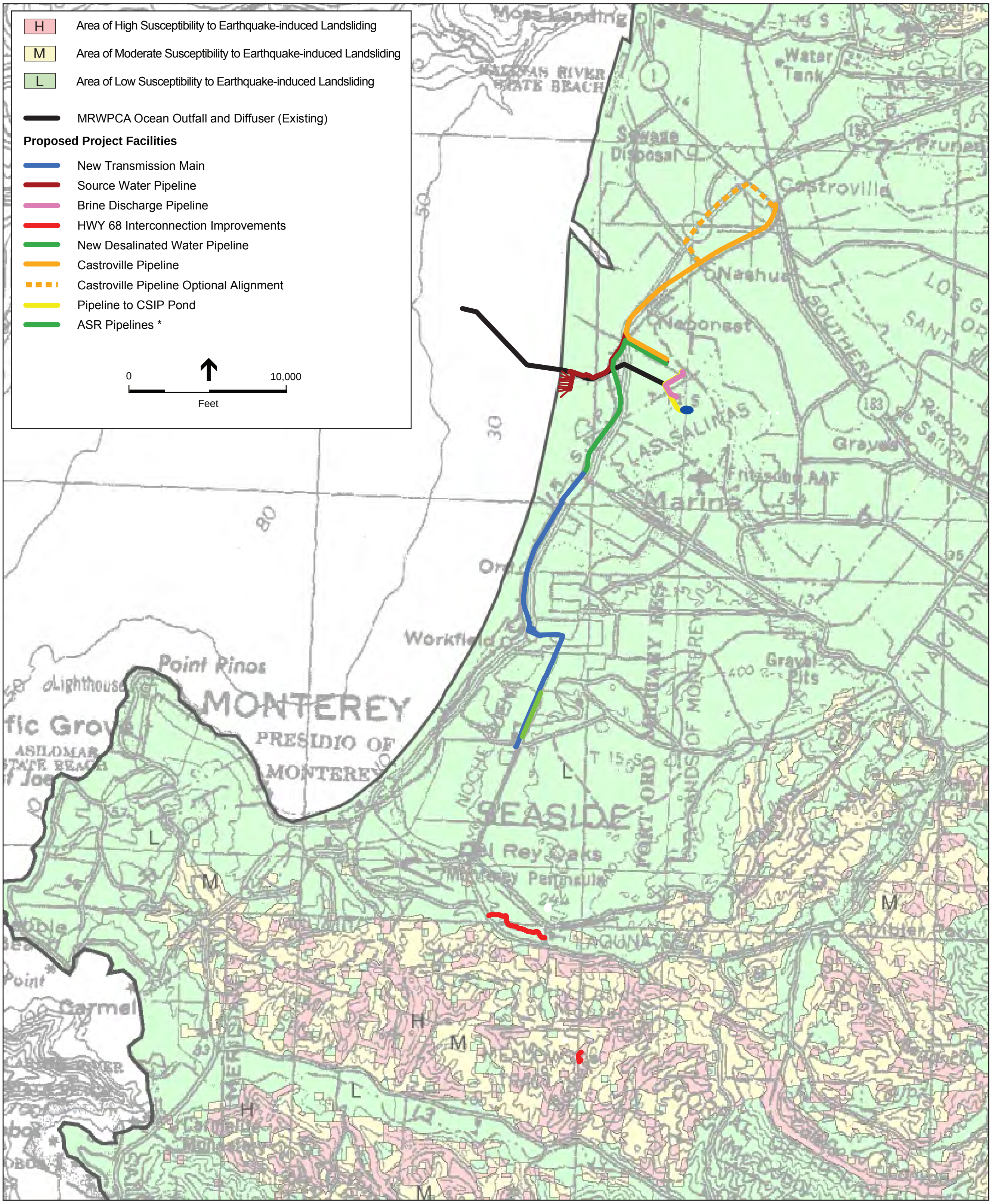
Earthquake-Induced Settlement

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid rearrangement, compaction, and settling of subsurface materials, particularly loose, non-compacted, and variable sandy sediments (PCE, 2014). Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill. Earthquake-induced settlement could occur in the event of an earthquake and is a potential seismic hazard discussed further in Section 4.2.5, Direct and Indirect Effects of the Proposed Project.

Landslides and Ground Cracking

Earthquake motions can induce substantial stresses on slopes and can cause earthquake-induced landslides or ground cracking if the slope fails. Earthquake-induced landslides can occur in areas with steep slopes that are susceptible to strong ground motion during an earthquake. The 1989 Loma Prieta earthquake on the San Andreas Fault triggered thousands of landslides over an area of 5,400 square miles. **Figure 4.2-6** presents the seismically-induced landslide hazard potential in the project vicinity based on a map from the *Monterey County General Plan*, as adapted by Ninyo & Moore (2005). The figure characterizes landslide susceptibility as high, moderate, and low. Because the steepness of topography is a major factor in the potential for landslides, **Figure 4.2-6** provides insight into areas prone to non-seismically induced landslides. Non-seismically induced landslide can be caused by the force of gravity on steep unstable slopes, by construction activities that disturb soil conditions and create unstable slopes, and by water leaks or breaks in pipelines or pumps.

Potential landslide hazards are present in the hillside terrain on and east of the Monterey Peninsula. All but one of the project components would be located in relatively flat to gently sloping topography and would therefore have a low susceptibility to landslides; the proposed Main System-Hidden Hills Interconnection Improvements are located in an area mapped as having a moderate to high susceptibility to landslides.



SOURCE: Ninyo & Moore, 2005

205335.01 Monterey Peninsula Water Supply Project

Figure 4.2-6
Landslide Hazard Map

4.2.2 Regulatory Framework

This section provides an overview of federal, state, and local environmental laws, policies, plans, regulations, and/or guidelines (hereafter referred to generally as “regulatory requirements”) relevant to geology, soils, and seismicity. A brief summary of each is provided, along with a finding regarding the project’s consistency with those regulatory requirements. The consistency analysis is based on the project as proposed, without mitigation. Where the project, as proposed, would be consistent with the applicable regulatory requirement, no further discussion of project consistency with that regulatory requirement is provided. Where the project, as proposed, would be potentially inconsistent with the applicable regulatory requirement, the reader is referred to the specific impact discussion in Section 4.2.5, Direct and Indirect Effects of the Proposed Project, below, where the potential inconsistency is addressed in more detail. Where applicable, the discussion in Section 4.2.5 identifies feasible mitigation that would resolve or minimize the potential inconsistency.

4.2.2.1 Federal Regulations

Federal Occupational Safety and Health Administration Regulations

The Occupational Safety and Health Administration’s (OSHA) Excavation and Trenching standard, Title 29 of the Code of Federal Regulations (CFR), Part 1926.650, covers requirements for excavation and trenching operations. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. These regulations apply to the project because of the proposed construction and trenching activities. All contractors are required to comply with OSHA regulations, which would make the proposed project consistent with OSHA.

4.2.2.2 State Regulations

California Coastal Act

The California Coastal Act (Public Resources Code Section 30000 et seq.) provides for the long-term management of lands within California’s coastal zone boundary. Of primary relevance to geology, soils, and seismicity are Coastal Act policies concerning construction altering natural shorelines and minimizing risk to life and property in areas of high geologic, flood, and fire hazard. A preliminary assessment of project consistency with these priorities is provided below. Final determinations regarding project consistency are reserved for the Coastal Commission. MPWSP subsurface slant wells would be potentially inconsistent with Coastal Act policies. The slant wells would be located along the coast within an area that is subject to erosion which, when considered in the context of sea level rise, will ultimately cause shoreline retreat to the location of the above-ground portions of the MPWSP subsurface slant wells. Exposure of these project components on the beach could alter natural shoreline processes, which would be inconsistent with Coastal Act policies. Similarly, such exposure would subject these project components to increased risk of damage due to flood and wave action, and contribute to beach erosion, which would also be inconsistent with Coastal Act policies. These issues are discussed further in Impact 4.2-10.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to protect structures for human occupancy from the hazard of surface faulting. In accordance with the Act, the State Geologist has established regulatory zones—called earthquake fault zones—around the surface traces of active faults, and has published maps showing these zones. Buildings for human occupancy cannot be constructed across surface traces of faults that are determined to be active. Because many active faults are complex and consist of more than one branch that may experience ground surface rupture, earthquake fault zones extend approximately 200 to 500 feet on either side of the mapped fault trace. Although a number of faults in the area are known to be active, as discussed above in Section 4.2.1.2, none of the faults passing beneath project components have been formally mapped by the state as being within an Alquist-Priolo Earthquake Fault Zone. The Alquist-Priolo Earthquake Fault Zoning Act does not apply to the proposed project because the State of California has not zoned under the Alquist-Priolo Act, the active and potentially active faults that intersect the project components.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was passed in 1990 following the Loma Prieta earthquake to reduce threats to public health and safety and to minimize property damage caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones, and cities, counties, and other local permitting agencies to regulate certain development projects within these zones. For projects that would locate structures for human occupancy within designated Zones of Required Investigation, the Seismic Hazards Mapping Act requires project applicants to perform a site-specific geotechnical investigation to identify the potential site-specific seismic hazards and corrective measures, as appropriate, prior to receiving building permits. The *CGS Guidelines for Evaluating and Mitigating Seismic Hazards* (Special Publication 117A) provides guidance for evaluating and mitigating seismic hazards (CGS, 2008). The CGS is in the process of producing official maps based on USGS topographic quadrangles, as required by the Act. To date, the CGS has not completed delineations for any of the USGS quadrangles in which project components are proposed.

California Building Code

The California Building Code (CBC), which is codified in Title 24 of the California Code of Regulations, Part 2, was promulgated to safeguard the public health, safety, and general welfare by establishing minimum standards related to structural strength, means of egress to facilities (entering and exiting), and general stability of buildings. The purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under State law, all building standards must be centralized in Title 24 or they are not enforceable. The provisions of the CBC apply to the construction, alteration, movement, replacement, location, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The 2016 edition of the CBC is based on the 2015 International Building Code (IBC) published by the International Code Council. The code is updated triennially, and the 2016 edition of the CBC was published by the California Building Standards Commission on July 1, 2016, and takes effect starting January 1, 2017. The 2016 CBC contains California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standard ASCE/SEI 7-10, *Minimum Design Loads for Buildings and Other Structures*, provides requirements for general structural design and includes means for determining earthquake loads[18] as well as other loads (such as wind loads) for inclusion into building codes. Seismic design provisions of the building code generally prescribe minimum lateral forces applied statically to the structure, combined with the gravity forces of the dead and live loads of the structure, which the structure then must be designed to withstand. The prescribed lateral forces are generally smaller than the actual peak forces that would be associated with a major earthquake. Consequently, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse, but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake. However, it is reasonable to expect that a structure designed in-accordance with the seismic requirements of the CBC should not collapse in a major earthquake.

The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients, all of which are used to determine a seismic design category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site; SDC ranges from A (very small seismic vulnerability) to E/F (very high seismic vulnerability and near a major fault). Seismic design specifications are determined according to the SDC in accordance with Chapter 16 of the CBC. Chapter 18 of the CBC covers the requirements of geotechnical investigations (Section 1803), excavation, grading, and fills (Section 1804), load-bearing of soils (1806), as well as foundations (Section 1808), shallow foundations (Section 1809), and deep foundations (Section 1810). For Seismic Design Categories D, E, and F, Chapter 18 requires analysis of slope instability, liquefaction, and surface rupture attributable to faulting or lateral spreading, plus an evaluation of lateral pressures on basement and retaining walls, liquefaction and soil strength loss, and lateral movement or reduction in foundation soil-bearing capacity. It also addresses measures to be considered in structural design, which may include ground stabilization, selecting appropriate foundation type and depths, selecting appropriate structural systems to accommodate anticipated displacements, or any combination of these measures. The potential for liquefaction and soil strength loss must be evaluated for site-specific peak ground acceleration magnitudes and source characteristics consistent with the design earthquake ground motions.

[18] A load is the overall force to which a structure is subjected in supporting a weight or mass, or in resisting externally applied forces. Excess load or overloading may cause structural failure.

Chapter 18 also describes analysis of expansive soils and the determination of the depth to groundwater table. Expansive soils are defined in the CBC as follows:

> **1803.5.3 Expansive Soil**. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1,2 and 3 shall not be required if the test prescribed in Item 4 is conducted:
>
> 1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318
> 2. More than 10 percent of the soil particles pass a No. 200 sieve (75 micrometers), determined in accordance with ASTM D 422
> 3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422
> 4. Expansion index greater than 20, determined in accordance with ASTM D 4829

The design of the proposed project is required to comply with CBC requirements, which would make the proposed project consistent with the CBC.

California Excavation Notification Requirements

California Code of Regulations Section 4216 requires that construction contractors report a project that involves excavation 48-hours prior to breaking ground. This program allows owners of buried installations to identify and mark the location of its facilities before any nearby excavation projects commence. Adherence to this law by contractors of projects reduces the potential of inadvertent pipeline and utility damage and leaks. All contractors are required to comply with California excavation notification requirements, which would make the proposed project consistent with California excavation notification requirements.

California Occupational Safety and Health Administration Regulations

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. In California, the California Division of Occupational Safety and Health (Cal/OSHA) and the federal OSHA are the agencies responsible for ensuring worker safety in the workplace.

The OSHA Excavation and Trenching standard (29 CFR 1926.650), described above in Section 4.2.2.1, Federal Regulations, covers requirements for excavation and trenching operations, which are among the most hazardous construction activities. OSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area. Cal/OSHA is the implementing agency for both state and federal OSHA standards. All contractors are required to comply with OSHA regulations, which would make the proposed project would be consistent with OSHA.

NPDES Construction General Permit

Construction associated with the proposed project would disturb more than one acre of land surface potentially affecting the quality of stormwater discharges into waters of the U.S. The proposed project would therefore be subject to the *NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order 2009-0009-DWQ, NPDES No. CAS000002, Construction General Permit; as amended by Orders 2010-0014-DWQ and 2012-006-DWQ). The Construction General Permit regulates discharges of pollutants in stormwater associated with construction activity to waters of the U.S. from construction sites that disturb one or more acres of land surface, or that are part of a common plan of development or sale that disturbs more than one acre of land surface. The permit regulates stormwater discharges associated with construction or demolition activities, such as clearing and excavation; construction of buildings; and linear underground projects (LUP), including installation of water pipelines and other utility lines.

Portions of the proposed project would fall under the Type 1 LUP category if the following conditions are met:

a) Construction occurs on unpaved improved roads, including their shoulders or land immediately adjacent to them;

b) The areas disturbed during a single construction day are returned to their preconstruction condition, or to an equivalent condition (i.e., disturbed soils such as those from trench excavation are hauled away, backfilled into the trench, and/or placed in spoils piles and covered with plastic), at the end of that same day;

c) Vegetated areas disturbed by construction activities are stabilized and revegetated at the end of the construction period; and

d) When required, adequate temporary soil stabilization best management practices (BMPs) are installed and maintained until vegetation has reestablished to meet the permit's minimum cover requirements for final stabilization.

The Construction General Permit requires that construction sites be assigned a Risk Level of 1 (low), 2 (medium), or 3 (high), based both on the sediment transport risk at the site and the receiving waters risk during periods of soil exposure (e.g., grading and site stabilization). The sediment risk level reflects the relative amount of sediment that could potentially be discharged to receiving water bodies and is based on the nature of the construction activities and the location of the site relative to receiving water bodies. The receiving waters risk level reflects the risk to the receiving waters from the sediment discharge. The Construction General Permit contains requirements for Risk Levels 1, 2 and 3, and the LUP Type 1, 2, and 3 categories. If a project does not meet any one or more of the aforementioned conditions under the Type 1 LUP category, depending on its location within a sensitive watershed area or floodplain, the level of receiving water risk could be considered low, medium, or high. Depending on the Risk Level, the construction projects could be subject to the following Construction General Permit requirements:

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

The Construction General Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) that includes specific BMPs designed to prevent pollutants from contacting stormwater and keep all products of erosion from moving offsite into receiving waters. The SWPPP BMPs are intended to protect surface water quality by preventing the offsite migration of eroded soil and construction-related pollutants from the construction area. Routine inspection of all BMPs is required under the provisions of the Construction General Permit. In addition, the SWPPP is required to contain a visual monitoring program, a chemical monitoring program for non-visible pollutants, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

The SWPPP must be prepared before the construction begins. The SWPPP must contain a site map(s) that delineates the construction work area, existing and proposed buildings, parcel boundaries, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the project area. The SWPPP must list BMPs and the placement of those BMPs that the applicant would use to protect stormwater runoff. Examples of typical construction BMPs include scheduling or limiting certain activities to dry periods, installing sediment barriers such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction. Non-stormwater management measures include installing specific discharge controls during certain activities, such as paving operations and vehicle and equipment washing and fueling. The Construction General Permit also sets post-construction standards (i.e., implementation of BMPs to reduce pollutants in stormwater discharges from the site following construction).

In the project area, the Construction General Permit is implemented and enforced by the Central Coast RWQCB, which administers the stormwater permitting program. Dischargers are required to electronically submit a notice of intent (NOI) and permit registration documents (PRDs) in order to obtain coverage under this Construction General Permit. Dischargers are responsible for notifying the RWQCB of violations or incidents of non-compliance, as well as for submitting annual reports identifying deficiencies of the BMPs and how the deficiencies were corrected.

The permit contains several additional compliance items, including: (1) additional mandatory BMPs to reduce erosion and sedimentation, which may include vegetated swales, setbacks and buffers, rooftop and impervious surface disconnection, bioretention cells, rain gardens, rain cisterns, implementation of pollution/sediment/spill control plans, training, and other structural and nonstructural actions; (2) sampling and monitoring for non-visible pollutants; (3) effluent monitoring and annual compliance reports; (4) development and adherence to a Rain Event Action Plan; (5) requirements for post-construction; (6) numeric action levels and effluent limits for pH and turbidity; (7) monitoring of soil characteristics onsite; and (8) mandatory training under a specific curriculum.

The proposed project would be required to comply with the permit requirements to control stormwater discharges from the construction sites. To obtain coverage under the Construction General Permit, CalAm would be required to electronically file the NOI along with the PRDs, the SWPPP, risk assessment, site map, signed certification statement, and other compliance-related documents required by the Construction General Permit using the Stormwater Multiple Applications and Report Tracking Systems, along with the appropriate permit fee to State Water Resources Control Board (SWRCB). The risk assessment and SWPPP must be prepared by a state-qualified SWPPP Developer and implementation of the SWPPP must be overseen by a state-qualified SWPPP Practitioner. The proposed project would be required to obtain coverage under the Construction General Permit and therefore the proposed project would be consistent.

4.2.2.3 Applicable Land Use Plans, Policies, and Regulations

Table 4.2-6 summarizes the pertinent regional and local land use plans, policies, and regulations that were adopted for the purpose of avoiding or mitigating an environmental effect and indicates project consistency with such plans, policies, and regulations. Where the analysis concludes the proposed project is consistent with the applicable plan, policy, or regulation, the finding is noted and no further discussion is provided. Where the analysis concludes the proposed project is potentially inconsistent with the applicable plan, policy, or regulation, the reader is referred to the specific impact discussion in Section 4.2.5, Direct and Indirect Effects of the Project (Proposed Action). In that subsection, the significance of the potential conflict is evaluated. Where the effect of the potential conflict would be significant, feasible mitigation is identified to resolve or minimize that conflict.

TABLE 4.2-6
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
City of Marina (coastal zone & inland area)	City of Marina General Plan	Community Design and Development	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Policy 4.99:*** New development shall be permitted in areas of high seismic risk only when adequate engineering and design measures can be implemented in accordance with a geotechnical investigation and report.	This policy is intended to reduce risks to people and property associated with seismic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
City of Marina (coastal zone & inland area)	City of Marina General Plan	Community Design and Development	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Policy 4.102.1:*** Ensure that critical or sensitive facilities, e.g., hospitals, fire and police stations, schools, major transportation links, high-occupancy structures, emergency communication facilities, utility lines, and sites containing or storing hazardous materials, are located, designed and operated to maximize their ability to remain functional after the expected or maximum credible event on any of the local active fault systems. Critical facilities shall not be located in areas of high to very high seismic shaking hazard.	This policy is intended to ensure that emergency or vital public facilities are able to withstand a major seismic event.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
City of Marina (coastal zone & inland area)	City of Marina General Plan	Community Design and Development	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Policy 4.102.2:*** Require that new development be sited and designed to conform to site topography and to minimize grading wherever possible. Recommendations to developers as to how to mitigate geologic or seismic hazards should include mention of the need to avoid massive grading or excavation or structures that might require substantial alteration of natural landforms.	This policy is intended to minimize topographic alteration that could increase risks of geologic or seismic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
City of Marina (coastal zone & inland area)	City of Marina General Plan	Community Design and Development	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Policy 4.102.4:*** Where new development is proposed within 300 feet of active dune fields, require that the geotechnical report include an assessment of dune migration rates and recommend appropriate setbacks.	This policy is intended to ensure that development would neither contribute to dune erosion nor encroach on migrating dunes.	<u>Potentially Inconsistent:</u> The slant wells would be located along the coast within an active dune area that will over time be eroded by sea level rise. This issue is addressed in **Impact 4.2-10**.
City of Marina (coastal zone & inland area)	City of Marina General Plan	Community Design and Development	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Policy 4.124.1:*** The City shall continue to require erosion-control and landscape plans for all new subdivisions or major projects on sites with potentially high erosion potential. Such plans should be prepared by a licensed civil engineer or other appropriately certified professional and approved by the City Public Works Director prior to issuance of a grading permit. All erosion control plans shall incorporate Best Management Practices to protect water quality and minimize water quality impacts and shall include a schedule for the completion of erosion- and sediment-control structures, which ensures that all such erosion-control structures are in place by mid-October of the year that construction begins. Site monitoring by the applicant's erosion-control specialist should be undertaken, and a follow-up report should be prepared that documents the progress and/or completion of required erosion-control measures both during and after construction is completed.	This policy is intended to minimize new development soil erosion and associated water quality impacts.	<u>Consistent:</u> As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion, and the project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
City of Marina (coastal zone)	City of Marina Local Coastal Program Land Use Plan	Planning Guidelines, Geotechnical	Subsurface slant wells, Source Water Pipeline, new Desalinated Water Pipeline, and new Transmission Main	***Geotechnical:*** ● Structural development shall not be allowed on the ocean-side of the dunes, in the area subject to wave erosion in the next 50 years, or in the tsunami run-up zone. The only exception to this would be essential support facilities to a coastally dependent industry, and in these areas the City will not undertake any liability for property damage due to hazards. ● Because of the fragile character of the dune vegetation, new development in this area shall be restricted to already-disturbed areas. Development in areas where the natural dune remains shall not alter the basic configuration of the natural dune landform, and shall provide for site reclamation. ● To reduce wind erosion, disturbed areas not being actively used by coastal dependent industries should be revegetated with native plants. Revegetation will be required of all new development on the dunes. ● Before development is permitted in the Coastal Zone, a geotechnical report appropriate to the specific proposal shall be prepared for that development in the dunes or in the vicinity of any vernal pond. The report shall include at least geologic and seismic stability, liquefaction potential, identification of an appropriate hazard setback to protect the economic life of structures, and specific recommendations on drainage, irrigation and mitigation of identified problems.	This policy is intended to protect life and property from wave erosion, wind erosion, tsunami inundation, and shaking from earthquakes.	<u>Potentially Inconsistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes. However, the construction of the slant wells and Source Water Pipeline could affect dune vegetation. This issue is addressed in Impact 4.2-1. In addition, the slant wells would be located along the coast within an active dune area that will over time be eroded by sea level rise. This issue is addressed in **Impact 4.2-10**.

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
Fort Ord Dunes State Park	Fort Ord Dunes State Park General Plan and Environmental Impact Report	Physical Resources	New Transmission Main	**GEO-1:** Exclude construction of new facilities and permanent structures in areas expected to be subject to coastal erosion within 100 years of construction (a maximum of approximately 700 feet). Exceptions may be allowed for roads, trails, and other facilities that may be considered expendable. Existing facilities may remain in use subject to periodic health and safety inspections.	This policy is intended to protect new development from coastal erosion.	<u>Consistent:</u> The new Transmission Main would not be located within the area anticipated to be subject to coastal erosion over the next 100 years.
City of Seaside (coastal zone & inland area)	Seaside General Plan	Safety	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Policy S.1-1:*** Reduce the risk of impacts from seismic and geologic hazards. *Implementation Plan S-1.1.1: CEQA:* Assess development proposals for potential seismic and geologic hazards pursuant to the California Environmental Quality Act (CEQA). Require studies of soil and geologic conditions by state licensed Engineering Geologists and Civil Engineers where appropriate. When potential geologic impacts are identified, require project applicants to mitigate the impacts per the recommendations contained within the soil and geologic studies. If substantial geologic/seismic hazards cannot be mitigated, require the development to be relocated or redesigned to avoid the significant hazards. *Implementation Plan S-1.1.2: Building Codes.* As new versions of building and construction codes are released, adopt and enforce the most recent codes. Specifically, to minimize damage from earthquakes and other geologic activity, implement the most recent State and seismic requirements for structural design of new development and redevelopment.	This policy is intended to protect people and property from seismic and geologic hazards.	<u>Consistent:</u> The EIR/EIS assesses seismic and geologic hazards and identifies mitigation measures. As discussed in the Regulatory Framework, project components must be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
City of Seaside	Seaside Municipal Code	Title 15 Buildings and Construction	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Chapter 15.32 Standards to Control Excavation, Grading, Clearing and Erosion:*** When required by the city engineer, each application for a permit shall be accompanied by two sets of supporting data consisting of a soil and/or civil engineering report and/or engineering geology report, and/or any other reports necessary. B. The civil engineering report shall include hydrological calculations of runoff for ten-year and one-hundred year storm frequencies; conclusions and recommendations for adequate erosion control and grading procedures, comparison of runoff without and with project; design criteria for corrective measures, including the existing and/or required safe storm drainage capacity outlet of channels both onsite and offsite; and opinions and recommendations covering adequacy of the site to be developed by the proposed grading. The City shall require developers to prepare and implement erosion control plans prepared by a registered civil engineer or an approved erosion controls specialist" means a person who has a certificate of qualifications and is recognized by the city engineer as capable of preparing erosion control and grading plans and shall be subject to the approval of the City Engineer. The erosion component of the plan must at least meet the requirements of Storm Water Pollution Prevention Plans (SWPPPs) required by the California State Water Resources Control Board.	These standards are intended to minimize erosion resulting from excavation, grading, and clearing.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
County of Monterey (coastal zone & inland area)	Monterey County Code	Chapter 16.08 – Grading	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Chapter 16.08:*** The Monterey County Grading Ordinance generally regulates grading activities that involve more than 100 cubic yards of excavation and fill. Minor fills and excavations ("cuts") of less than 100 cubic yards that are not intended to provide foundations for structures, or that are very shallow and nearly flat, are typically exempt from the ordinance, as are shallow footings for small structures. Submittal requirements for a County grading permit include site plans, existing contours and proposed contour changes, an estimate of the volume of earth to be moved, and geotechnical (soils) reports. Grading activities that involve over 5,000 cubic yards of soil must include detailed plans signed by a state-licensed civil engineer. Grading is not allowed to obstruct storm drainage or cause siltation of a waterway. All grading requires implementation of temporary and permanent erosion-control measures. Grading within 50 feet of a watercourse, or within 200 feet of a river, is regulated in the Monterey County Zoning Ordinance floodplain regulations. The Monterey County Grading Ordinance requires a soil engineering and engineering geology report (Section 16.08.110: Permit – Soil Engineering and Engineering Geology Reports [Ordinance 4029, 1999; Ordinance 2534, Section 110, 1979], unless waived by the Building Official because information of record is available showing such data is not needed. The soil engineering and engineering geology report must include the following: a. Data regarding the properties, distribution and strength of existing soils	This ordinance is intended to minimize soil erosion, and loss of topsoil, and associated environmental effects.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components must be constructed in compliance with the California Building Code, county codes, and city codes, which require soils and geologic reports and grading permits. The Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion. Water conveyance pipelines would be constructed using standards from the American Water Works Association.

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
County of Monterey (coastal zone & inland area) (cont.)				b. Recommendations for grading and corrective measures for project design, as appropriate c. An adequate description of the geology of the site and potential hazards. The recommendations from the soil engineering and engineering geology report must be incorporated in the grading plans and construction specifications.		
County of Monterey (coastal zone & inland area)	Monterey County Code	Chapter 16.12 – Erosion Control	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Section 16.12:*** The Monterey County Erosion Control Ordinance requires project applicants to implement runoff control measures and avoid creek disturbance; regulates land clearing; and prohibits grading activities during winter. The ordinance generally prohibits development on slopes greater than 30 percent. The Monterey County Director of Building Inspection enforces the ordinance, under which applicants must complete an erosion control plan.	This section is intended to minimize erosion and soil loss, and associated water quality impacts, among other environmental effects.	<u>Consistent:</u> As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Conservation and Open Space	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy OS-3.1:*** Best Management Practices (BMPs) to prevent and repair erosion damage shall be established and enforced.	This policy is intended to minimize erosion and soil loss, and associated water quality impacts, among other environmental effects.	<u>Consistent:</u> As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Conservation and Open Space	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy OS-3.3:*** Criteria for studies to evaluate and address, through appropriate designs and BMPs, geologic and hydrologic constraints and hazards conditions, such as slope and soil instability, moderate and high erosion hazards, and drainage, water quality, and stream stability problems created by increased stormwater runoff, shall be established for new development and changes in land use designations.	This policy is intended to minimize development-related impacts on people, property, and water quality associated with hydrologic and geologic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components must be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. The Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.1:*** Land uses shall be sited and measures applied to reduce the potential for loss of life, injury, property damage, and economic and social dislocations resulting from groundshaking, liquefaction, landslides, and other geologic hazards in the high and moderate hazard susceptibility areas.	This policy is intended to protect people and property from seismic and geologic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components must be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-	***Policy S-1.3:*** Site-specific geologic studies may be used to verify the presence or absence and extent of the hazard on the property proposed for new development and to identify mitigation measures for any development proposed. An ordinance including permit requirements relative to the siting and design of structures and grading relative to seismic hazards shall be established.	This policy is intended to protect people and property from seismic and geologic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
			Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station			
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.4:*** The Alquist-Priolo Earthquake Fault Zoning Act shall be enforced.	This policy is intended to protect people and property from seismic hazards, such as those resulting from fault rupture.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.5:*** Structures in areas that are at high risk from fault rupture, landslides, or coastal erosion shall not be permitted unless measures recommended by a registered engineering geologist are implemented to reduce the hazard to an acceptable level.	This policy is intended to protect people and property from hazards associated with fault rupture, landslides, or coastal erosion.	Potentially Inconsistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. However, the slant wells would be located along the coast within an active dune area that will over time be eroded by sea level rise. This issue is addressed in **Impact 4.2-10**.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.6:*** New development shall not be permitted in areas of known geologic or seismic hazards unless measures recommended by a California certified engineering geologist or geotechnical engineer are implemented to reduce the hazard to an acceptable level. Areas of known geologic or seismic hazards include: a. Moderate or high relative landslide susceptibility. b. High relative erosion susceptibility. c. Moderate or high relative liquefaction susceptibility. d. Coastal erosion and sea cliff retreat. e. Tsunami run-up hazards.	This policy is intended to protect people and property from geologic and seismic hazards.	Potentially Inconsistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. However, the slant wells would be located along the coast within an active dune area that will over time be eroded by sea level rise. This issue is addressed in **Impact 4.2-10**.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.7:*** Site-specific reports addressing geologic hazard and geotechnical conditions shall be required as part of the planning phase and review of discretionary development entitlements and as part of review of ministerial permits in accordance with the California Building Standards Code as follows: a. Geotechnical reports prepared by State of California licensed Registered Geotechnical Engineers are required during building plan review for all habitable structures and habitable additions over 500 square feet in footprint area. Additions less than 500 square feet and non-habitable buildings may require geotechnical reports as determined by the pre-site inspection. b. A Registered Geotechnical Engineer shall be required to review and approve the foundation conditions prior to plan check approval, and if recommended by the report, shall perform a site inspection to verify the foundation prior to approval to pour the footings. Setbacks shall be identified and verified in the field prior to construction. c. All new development and subdivision applications in State- or County designated Earthquake Fault Zones shall provide a geologic report addressing the potential for surface fault rupture and secondary fracturing adjacent to the fault zone before the application is considered complete. The report shall be prepared by a Registered Geologist or a Certified Engineering Geologist and conform to the State of California's most current guidelines for evaluating the hazard of surface fault rupture.	This policy is intended protect people and property from geologic hazards, such as fault rupture, secondary fracturing, landslides, or liquefaction.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. Water conveyance pipelines would be constructed using standards from the American Water Works Association.

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
County of Monterey (coastal zone & inland area) (cont.)				d. Geologic reports and supplemental geotechnical reports for foundation design shall be required in areas with moderate or high landslide or liquefaction susceptibility to evaluate the potential on- and offsite impacts on subdivision layouts, grading, or building structures. e. Where geologic reports with supplemental geotechnical reports determine that potential hazards affecting new development do not lead to an unacceptable level of risk to life and property, development in all Land Use Designations may be permissible, so long as all other applicable General Plan policies are complied with. f. Appropriate site-specific mitigation measures and mitigation monitoring to protect public health and safety, including deed restrictions, shall be required.		
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.8:*** As part of the planning phase and review of discretionary development entitlements, and as part of review of ministerial permits in accordance with the California Building Standards Code, new development may be approved only if it can be demonstrated that the site is physically suitable and the development would neither create nor significantly contribute to geologic instability or geologic hazards.	This policy is intended to protect people and property from geologic hazards (e.g., liquefaction, landslides).	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
County of Monterey (coastal zone & inland area)	Monterey County General Plan	Safety	Source Water Pipeline, MPWSP Desalination Plant, new Desalinated Water Pipeline, Brine Discharge Pipeline/Brine Mixing Box, Pipeline to CSIP Pond, Castroville Pipelines, Ryan Ranch-Bishop Interconnection Improvements, Main System-Hidden Hills Interconnection Improvements, and Carmel Valley Pump Station	***Policy S-1.9:*** A California licensed civil engineer or a California licensed landscape architect can recommend measures to reduce moderate and high erosion hazards in the form of an Erosion Control Plan.	This policy is intended to minimize erosion hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
County of Monterey (coastal zone)	North County Land Use Plan	Geologic Hazards	Source Water Pipeline and new Desalinated Water Pipeline	***Policy 2.8.3.A1:*** All development shall be sited and designed to conform to site topography and to minimize grading and other site preparation activities.	This policy is intended to minimize landform alteration and associated environmental effects.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports, which would include measures to minimize hazards caused by grading and other site activities. Water conveyance pipelines would be constructed using standards from the American Water Works Association.
County of Monterey (coastal zone)	North County Land Use Plan	Geologic Hazards	Source Water Pipeline and new Desalinated Water Pipeline	**Policy *2.8.3.A2:*** All structures, with the exception of utility lines where no alternative route is feasible, shall be sited a minimum of 50 feet from an active fault or potentially active fault. Greater setbacks may be required where it is warranted by local geologic conditions.	This policy is intended to minimize impacts on utility infrastructure from seismic hazards.	<u>Consistent:</u> The Source Water Pipeline does not cross or come within 50 feet of a potentially active fault. There are no alternative routes for the new Desalinated Water Pipeline that would not cross the trace of a potentially active fault.
County of Monterey (coastal zone)	North County Land Use Plan	Geologic Hazards	Source Water Pipeline, new Desalinated Water Pipeline,	***Policy 2.8.3.A4:*** Soils and geologic reports shall be required for all new land divisions and for construction of structures and roads on slopes exceeding 30 percent or in areas of known or suspected geologic hazards. Evaluations of potential onsite and offsite impacts shall be included in the report.	This policy is intended to protect people and property from geologic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports
County of Monterey (coastal zone)	North County Land Use Plan	Geologic Hazards	Source Water Pipeline and new Desalinated Water Pipeline	***Policy 2.8.3.A5:*** Where soils and geologic reports are required, they should include a description and analysis of the following items: a. geologic conditions, including soil, sediment, and rock types and characteristics in addition to structural features, such as bedding, joints, and faults; b. evidence of past or potential landslide conditions, the implications of such conditions for the proposed development, and the potential effects of the development on landslide activity;	This policy Is intended to protect people and property from geologic hazards.	<u>Consistent:</u> As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
County of Monterey (coastal zone) (cont.)				c. impact of construction activity on the stability of the site and adjacent area; d. ground and surface water conditions and variations, including hydrologic changes caused by the development (i.e., introduction of sewage effluent and irrigation water to the groundwater system; alterations in surface drainage); e. potential erodibility of site and mitigating measures to be used to minimize erosion problems during and after construction (i.e., landscaping and drainage design). f. potential effects of seismic forces resulting from a maximum credible earthquakes; g. any other factors that might affect slope stability.		
Fort Ord Reuse Authority (Seaside)	Fort Ord Reuse Plan	Conservation	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Soils and Geology Policy A-4:*** The City shall continue to enforce the Uniform Building Code to minimize erosion and slope instability problems.	This policy is intended to minimize erosion and slope instability.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
Fort Ord Reuse Authority (Seaside)	Fort Ord Reuse Plan	Conservation	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Soils and Geology Policy A-5:*** Before issuing a grading permit, the City shall require that geotechnical reports be prepared for developments proposed on soils that have limitations as substrates for construction or engineering purposes, including limitations concerning slope and soils that have piping, low-strength, and shrink-swell potential. The City shall require that engineering and design techniques be recommended and implemented to address these limitations.	The policy is intended to protect people and property from geologic hazards, including soil instability.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
Fort Ord Reuse Authority (Seaside)	Fort Ord Reuse Plan	Conservation	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Soils and Geology Policy A-6:*** The City shall require that development of lands having a prevailing slope above 30% include implementation of adequate erosion control measures.	This policy is intended to minimize the erosion impacts of new development.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
Fort Ord Reuse Authority (Seaside)	Fort Ord Reuse Plan	Safety	New Transmission Main, ASR Conveyance Pipeline, ASR Recirculation Pipeline, and ASR Pump-to-Waste Pipeline	***Seismic and Geologic Hazards Policy A-2:*** The City shall use the development review process to ensure that potential seismic or geologic hazards are evaluated and mitigated prior to construction of new projects. ***Program A-2.1:*** The City shall require geotechnical reports and seismic safety plans when development projects or other area plans are proposed within zones that involve high or very high seismic risk. Each plan shall be prepared by a certified geotechnical engineer and shall be subject to the approval of the Planning Director for the City of Seaside. ***Program A-2.2:*** Through site monitoring, the City shall ensure that all measures included in the project's geotechnical and seismic safety plans are properly implemented and a report shall be filed and on public record prepared by the Planning Director and/or Building Inspector confirming such. ***Program A-2.3:*** The City shall continue to updated and enforce the Uniform Building Code to minimize seismic hazards impacts from resulting from earthquake induced effects such as groundshaking, ground rupture, liquefaction, and or soils problems.	This policy is intended to protect people and property from seismic and geologic hazards.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Conservation	Ryan Ranch–Bishop Interconnection Improvements	***Soils and Geology Policy A-2:*** The County shall require developers to prepare and implement erosion control and landscape plans for projects that involve high erosion risk. Each plan shall be prepared by a registered civil engineer or certified professional in the field of erosion and sediment control and shall be subject to the approval of the public works director for the City of Marina. The erosion component of the plan must at least meet the requirements of Storm Water Pollution Prevention Plans (SWPPPs) required by the California State Water Resources Control Board.	This policy is intended to minimize erosion resulting from new development.	Consistent: As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Conservation	Ryan Ranch–Bishop Interconnection Improvements	***Soils and Geology Policy A-3:*** Through site monitoring, the County shall ensure that all measures included in the developer's erosion control and landscape plans are properly implemented.	The policy is intended to minimize erosion resulting from new development.	Consistent: As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Conservation	Ryan Ranch–Bishop Interconnection Improvements	***Soils and Geology Policy A-4:*** The County shall continue to enforce the Uniform Building Code to minimize erosion and slope instability problems.	This policy is intended to minimize erosion and slope instability.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which are based on the Uniform Building Code.

TABLE 4.2-6 (Continued)
APPLICABLE REGIONAL AND LOCAL PLANS AND POLICIES RELEVANT TO GEOLOGY, SOILS, AND SEISMICITY

Project Planning Region	Applicable Plan	Plan Element/ Section	Project Component(s)	Specific Plan, Policy, or Ordinance	Relationship to Avoiding or Mitigating a Significant Environmental Impact	Project Consistency with Plan, Policy, or Ordinance
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Conservation	Ryan Ranch–Bishop Interconnection Improvements	***Soils and Geology Policy A-5:*** Before issuing a grading permit, the County shall require that geotechnical reports be prepared for developments proposed on soils that have limitations as substrates for construction or engineering purposes, including limitations concerning slope and soils that have piping, low-strength, and shrink-swell potential. The County shall require that engineering and design techniques be recommended and implemented to address these limitations.	The policy is intended to protect people and property from geologic hazards, including soil instability.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports.
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Conservation	Ryan Ranch–Bishop Interconnection Improvements	***Soils and Geology Policy A-6:*** The County shall require that development of lands having a prevailing slope above 30% include implementation of adequate erosion control measures.	This policy is intended to minimize the erosion impacts of new development.	Consistent: As discussed in the Regulatory Framework, the project would be required to comply with the Construction General Permit that requires the implementation of a SWPPP that would reduce and control erosion.
Fort Ord Reuse Authority (Monterey County)	Fort Ord Reuse Plan	Safety	Ryan Ranch–Bishop Interconnection Improvements	***Seismic and Geologic Hazards Policy A-2:*** The County shall use the development review process to ensure that potential seismic or geologic hazards are evaluated and mitigated prior to construction of new projects. ***Program A-2.1:*** The County shall require geotechnical reports and seismic safety plans when development projects or other area plans are proposed within zones that involve high or very high seismic risk. Each plan shall be prepared by a certified geotechnical engineer and shall be subject to the approval of the Planning Director for the County of Monterey. ***Program A-2.2:*** Through site monitoring, the County shall ensure that all measures included in the project's geotechnical and seismic safety plans are properly implemented and a report shall be filed and on public record prepared by the Planning Director and/or Building Inspector confirming such. ***Program A-2.3:*** The County shall continue to update and enforce the Uniform Building Code to minimize seismic hazards impacts from resulting from earthquake induced effects such as groundshaking, ground rupture, liquefaction, and or soils problems.	This policy is intended to protect people and property from seismic and geologic hazards.	Consistent: As discussed in the Regulatory Framework, project components would be constructed in compliance with the California Building Code, county codes, and city codes, which require the preparation of soils and geologic reports, and are based on the Uniform Building Code.

SOURCES: California State Parks, 2004; City of Marina, 2006, 2013; City of Seaside, 2004, 2013; FORA, 1997; Monterey County, 1999, 2010.

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4.2.3 Evaluation Criteria

Implementation of the proposed project would have a significant impact related to geology, soils, and seismicity if it would:

- Expose people or structures to potential substantial adverse effects, including 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 groundshaking;
  - Seismic-related ground failure, including liquefaction and lateral spreading;
  - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the MPWSP, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse;
- Be located on problematic soils such as expansive or corrosive soils;
- 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;
- Accelerate and/or exacerbate natural rates of coastal erosion, scour, or dune retreat, resulting in damage to adjoining properties or a substantial change in the natural coastal environment; or
- Degrade the physical structure of any geologic resource, or alter any oceanographic process, such as sediment transport, such that it is measurably different from pre-existing conditions.

CEQA requires analysis of a project's effects on the environment; consideration of the potential effects of a site's environment on a project are outside the scope of required CEQA review (*California Building Industry Association v. Bay Area Air Quality Management District* (2015) 62 Cal. 4th 369). As stated in *Ballona Wetlands Land Trust v. City of Los Angeles* (2011) 201 Cal.App.4th 455, 473: “[T]he purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project.” The impacts discussed in this section related to increased exposure of people or structures to risks associated with seismic occurrences and location of people or structures on unstable geologic units are effects on users of the project and structures in the project of preexisting environmental hazards, and therefore “do not relate to environmental impacts under CEQA and cannot support an argument that the effects of the environment on the project must be analyzed in an EIR.” (*Id.* at p. 474.) Nonetheless, an analysis of these impacts is provided for information purposes.

4.2.4 Approach to Analysis

Geologic and seismic information for the project area was derived from various sources and compiled in this chapter to develop a comprehensive understanding of the potential constraints and hazards associated with project construction and operations. Information sources include regional geologic maps prepared by the CGS and USGS, the PSHA of California, and earthquake rupture forecasts developed by the WGCEP, all of which reflect the most up-to-date understanding of the regional geology and seismicity. In addition, geologic and seismic analysis relied on project-specific geotechnical studies and a project-specific coastal erosion study that was designed to evaluate the risk of coastal erosion that would result from future sea level rise and 100-year storm events.

As described in more detail below, the analysis of geologic and seismic impacts in this section takes into account that CalAm would incorporate into their facility designs the engineering recommendations provided by the various geotechnical studies conducted for the proposed project. The analysis also considers the various existing state and local regulations that apply to geotechnical design and construction, which include the CBC and the Monterey County ordinances for building and grading. Through compliance with the existing ordinances, CalAm would be required to demonstrate that the proposed site uses are compatible with the subsurface geology and local seismic conditions; this must occur before building permits are issued. Additionally, CalAm would require its pipeline engineers and construction contractors to adhere to the American Water Works Association (AWWA) standards for pipeline design and construction; this analysis considers that in evaluating potential geologic and seismic impacts.

4.2.4.1 Geotechnical Investigations for Project Facilities

This analysis used geotechnical information and data derived from project-specific geotechnical studies, including geotechnical investigations conducted for the proposed MPWSP Desalination Plant at Charles Benson Road (PCE, 2014; Zinn, 2014) and the conveyance pipelines (AECOM, 2015), as well as a geotechnical investigation conducted to support CalAm's previously proposed Coastal Water Project (Ninyo & Moore, 2005). This analysis also utilized information from the preliminary geotechnical study completed by Ninyo & Moore (2014) for the Groundwater Replenishment Project EIR.

Geotechnical studies are essential for facility and pipeline design because it is the information that informs the structural design of the project components and determines whether the geologic materials underlying the project components are capable of supporting the proposed uses without risk of detrimental effects from potential hazards associated with problematic soils, liquefaction, or excessive seismic shaking. Geotechnical investigations are required under the CBC for most structures intended for human occupancy and by the Monterey County Grading Ordinance. Based on field observation and laboratory testing, the geotechnical engineer can assess whether the soils are adequate to support the structure under static (non-earthquake) or earthquake conditions. If corrective work is necessary to remedy the problem soils or otherwise unstable ground condition, the geotechnical engineer would recommend approaches to correct the condition. Geotechnical engineering recommendations are typically standard engineering practices that have been proven elsewhere to increase the geotechnical performance of an underlying soil or bedrock material. CalAm would incorporate all geotechnical recommendations set forth by the project geotechnical engineer.

4.2.4.2 American Water Works Association Standards for Proposed Pipelines

Pipelines are constructed to various industry standards. The AWWA is a worldwide nonprofit scientific and educational association that, among its many activities, establishes recommended standards for the construction and operation of public water supply systems, including standards for pipe and water treatment facility materials and sizing, installation, and facility operations. While the AWWA's recommended standards are not enforceable code requirements, they nevertheless can dictate how pipelines for water conveyance are designed and constructed. CalAm has committed to requiring its contractors to incorporate AWWA Standards into the design and construction of the proposed pipelines.

4.2.4.3 Seismic Considerations

In California, an earthquake can cause injury or property damage by: (1) rupturing the ground surface, (2) violently shaking the ground, (3) causing the underlying ground to fail due to liquefaction, or (4) causing enough ground motion to initiate slope failures or landslides, any of which could damage or destroy structures.

State and local code requirements ensure buildings and other structures are designed and constructed to withstand major earthquakes, thereby reducing the risk of collapse and the associated risks to human health and safety and private property. The code requirements have been developed through years of study of earthquake response and the observed performance of structures during significant local earthquakes (e.g., the 1989 Loma Prieta Earthquake) and others around the world. As discussed in Section 4.2.2, Regulatory Framework, the proposed project would be required to comply with federal, state, and local laws regulating construction. The laws ensure that proposed development sites are adequately investigated and that seismic hazards are evaluated and addressed in the project design and construction. These laws include the Seismic Hazards Mapping Act, the California Building Code, and Monterey County ordinances pertaining to excavation, grading, and site development in geologic hazard zones. The *CGS Guidelines for Evaluating and Mitigating Seismic Hazards* (Special Publication 117A) (CGS, 2008b) provides guidance for evaluating and mitigating seismic hazards as required by the Public Resources Code Section 2695(a).

Site-specific geotechnical investigations are conducted to determine the presence of problematic soils and identify seismic hazards on a subject site. These investigations identify the geologic and seismic setting of a subject site and provide feasible engineering recommendations to remedy potentially adverse soil and seismic conditions. For projects whose grading activities would move over 5,000 cubic yards of soil, the Monterey County Grading Ordinance requires that a site-specific geotechnical investigation (i.e., soil engineering and engineering geology report) be completed prior to final design in order to obtain a building or grading permit.[19]

Site-specific geotechnical investigations also provide the necessary soil information required by structural engineers to ensure structures and buildings are designed appropriately to withstand earthquake ground motion. Grading plans, foundation designs, and structural designs are prepared based on the geotechnical recommendations presented in the site-specific geotechnical investigation and other pertinent requirements of the CBC.

4.2.4.4 Site-Specific Soil Borings and Monitoring Wells

CalAm consultants drilled several exploratory borings at the CEMEX mining facility to depths of 306 to 350 feet below ground surface, logged the subsurface materials encountered, and collected soil and groundwater samples for laboratory testing. The exploratory boring logs, field screening tests results, and laboratory analytical results are presented in *Technical Memorandum (TM 1) - Summary of Results - Exploratory Boreholes* (Geoscience, 2014). The exploratory work, as described in the Setting above and in Section 4.4, Groundwater Resources, further defined the subsurface geology in the CEMEX active mining area (the proposed site for the subsurface slant wells). While this work was intended to refine groundwater modeling parameters, it also benefits the geology impact analysis.

CalAm consultants installed Monitoring Wells MW-1, and MW-3 through MW-7 at the locations shown on **Figure 4.4-9** and presented the results in *Technical Memorandum (TM2) Monitoring Well Completion Report and CEMEX Model Update, Monterey Peninsula Water Supply Project, Hydrogeologic Investigation* (Geoscience, 2016).[20] These are nested wells with screened intervals in the Dune Sand Aquifer, 180-Foot Equivalent Aquifer, and the 400-Foot Aquifer. The exploratory work, as described in detail in Section 4.4, Groundwater Resources, further defined the subsurface geology and aquifers at the proposed site for the subsurface slant wells. While this work was also intended to refine groundwater modeling parameters, it similarly benefits the geology impact analysis.

The pertinent data gathered from the exploratory work is incorporated, where appropriate, into Sections 4.2.5.1 and 4.2.5.2, below.

4.2.4.5 Coastal Retreat Study

The proposed project would place the seawater intake system along the Monterey Bay coastline. Sea level is predicted to rise over the next century and, in response, coastal erosion is expected to accelerate. The rise in sea level and the resultant increased coastal erosion rate would migrate the beach inland. Depending on the rate of coastal erosion and beach migration, the beach could migrate inland to the locations of the well heads for the slant wells within the project lifetime. The well heads and upper portions of the slant wells would then be exposed to wave action, storm events, and rip embayments, processes that are described above in Sea Level Rise and Coastal

[19] Unless the investigation is deemed unnecessary by the Building Official due to existing information.
[20] The consultant concluded that the planned Monitoring Well MW-2 was unnecessary and not installed.

Erosion. See also **Figure 4.3-3**, Areas Subject to Sea Level Rise in the Project Area, in Section 4.3, Surface Water Hydrology and Water Quality, for more information. The presence of structures on the beach changes the beach dynamics and can result in scour and erosion in the localized area. In turn, these changes can affect the volumes of sand on beaches both at the structure locations and at other beach locations in areas where the coastal drift would otherwise provide sand and maintain sandy beaches. In the case of Monterey Bay, coastal drift is typically to the south and this process provides sand to maintain the sand supply on those beaches.

To evaluate coastal erosion impacts associated with project components proposed in the coastal zone, a project-specific coastal retreat study — *Analysis of Historic and Future Coastal Erosion with Sea Level Rise* — was conducted by a team of licensed coastal engineers and coastal geomorphologists (ESA, 2014). The findings and recommendations of the study inform the analysis of Impact 4.2-10, below. The coastal retreat study is included as **Appendix C2** of this EIR/EIS.

The coastal retreat study examined coastal processes to determine the likelihood for the slant wells and their well heads to become exposed before the end of their usable lifespan. The study estimated coastal retreat both laterally and vertically. The lateral extent of erosion was evaluated using coastal erosion hazard zones; the vertical extent was evaluated using coastal profiles. Both of these methods are described in more detail below.

Coastal Erosion Hazard Zones (Lateral Erosion Estimates)

A coastal erosion hazard zone represents an area where erosion (caused by coastal processes) has the potential to occur over a certain time period. Within any area of such a zone, there is a risk of damage due to erosion during a major storm event. Actual locations of erosion during a particular storm depend on the unique characteristics of that storm (e.g. wave direction, surge, rainfall, and coincident tide). The coastal hazard zones are developed from three components: historic erosion, additional erosion due to sea level rise, and the potential erosion impact caused by a large storm wave event (e.g., 100-year storm event). As sea level rises, higher mean sea level will increase the frequency of wave run-up, thereby undercutting the dune toe and increasing erosion.

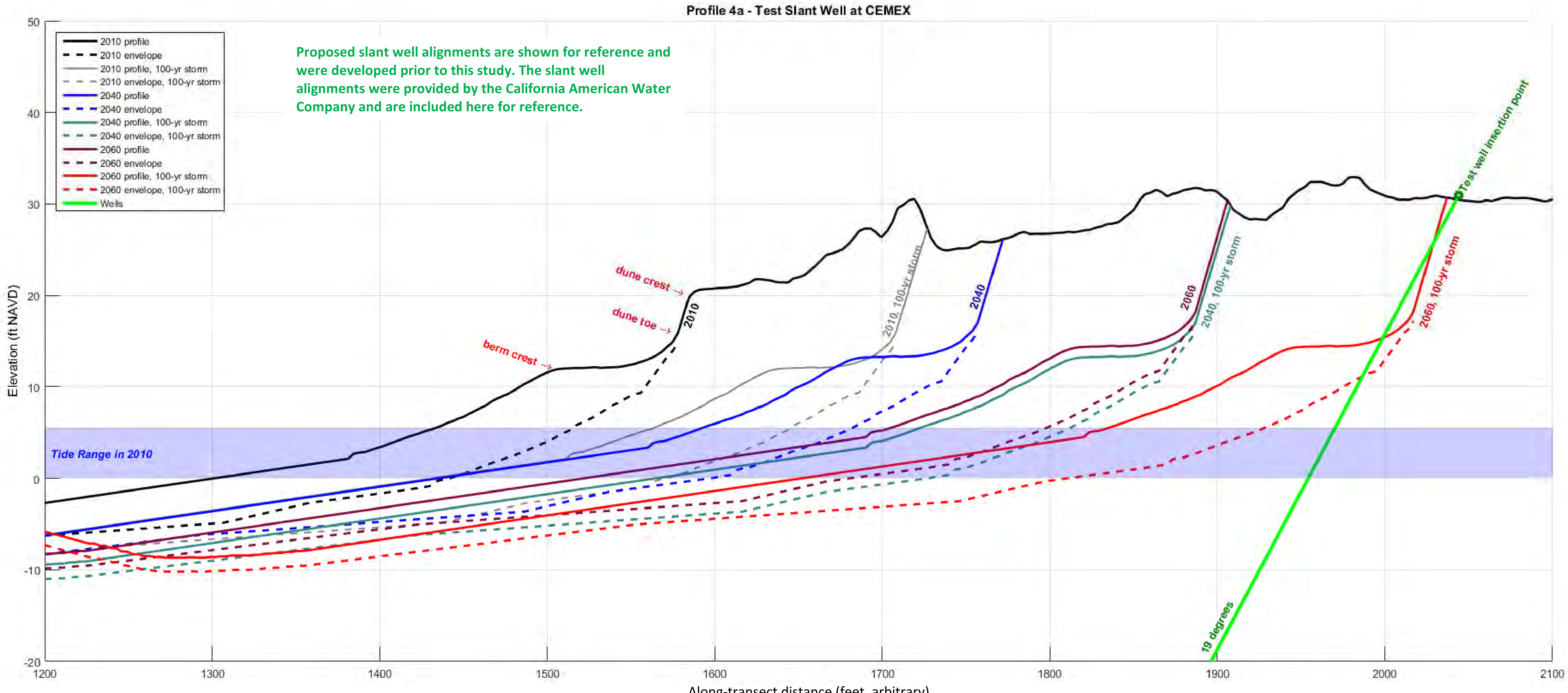
The most important variables in the coastal erosion model are the historic erosion trend, backshore toe elevation, and the total water level. The historic erosion rate was applied to a planning horizon through 2100 to determine the erosion rates that would occur without the project. The erosion model does not account for shore management actions, such as sand placement, that could potentially mitigate future shore recession. In this region, where beaches are controlled in part by sand mining, the study assumed there would be no changes to existing sand mining practices.

The potential for shoreline retreat caused by sea level rise and the impact from a large storm event was estimated using a geometric model of dune erosion and applied with different slopes to make the model more applicable to sea level rise. This method is consistent with the Federal Emergency Management Agency (FEMA) Pacific Coast Flood Guidelines. The potential shoreline retreat estimates account for uncertainty in the duration of future storm events. Instead of predicting storm-specific characteristics and response, the method assumes that the coast would erode or retreat to a maximum storm wave event with unlimited duration. This is a conservative approach to estimating the impact of a 100-year storm event.

Coastal Profile (Vertical Erosion Estimates)

The coastal profile analysis developed a set of representative profiles that show how the shoreline is likely to evolve from the present to 2040 and 2060, and shows the locations of selected project components relative to those profiles. As previously discussed, the Monterey Bay shoreline is affected by seasonal changes, localized erosion (rip currents), long-term erosion, and sea level rise. Each of these factors is important in defining the profile shape and location at a given time. For this reason, the analysis identified a projected future profile and an extremely eroded profile (lower envelope) for each future time horizon. The future profile is the current profile eroded at the historic rate, with added erosion caused by sea level rise. The lower profile envelope represents a highly eroded condition, which could occur from a combination of localized erosion (rip currents), a large winter storm, and seasonal changes. The upper envelope (a highly accreted profile) was not analyzed because the key concern for the project is that buried or inland project components would become exposed over time. There are two profile/envelope combinations for each time step: one to represent long term profile evolution (historic erosion and accelerated erosion from sea level rise) and another that adds potential erosion from a 100-year storm event, which could be as high as much as 100 feet.

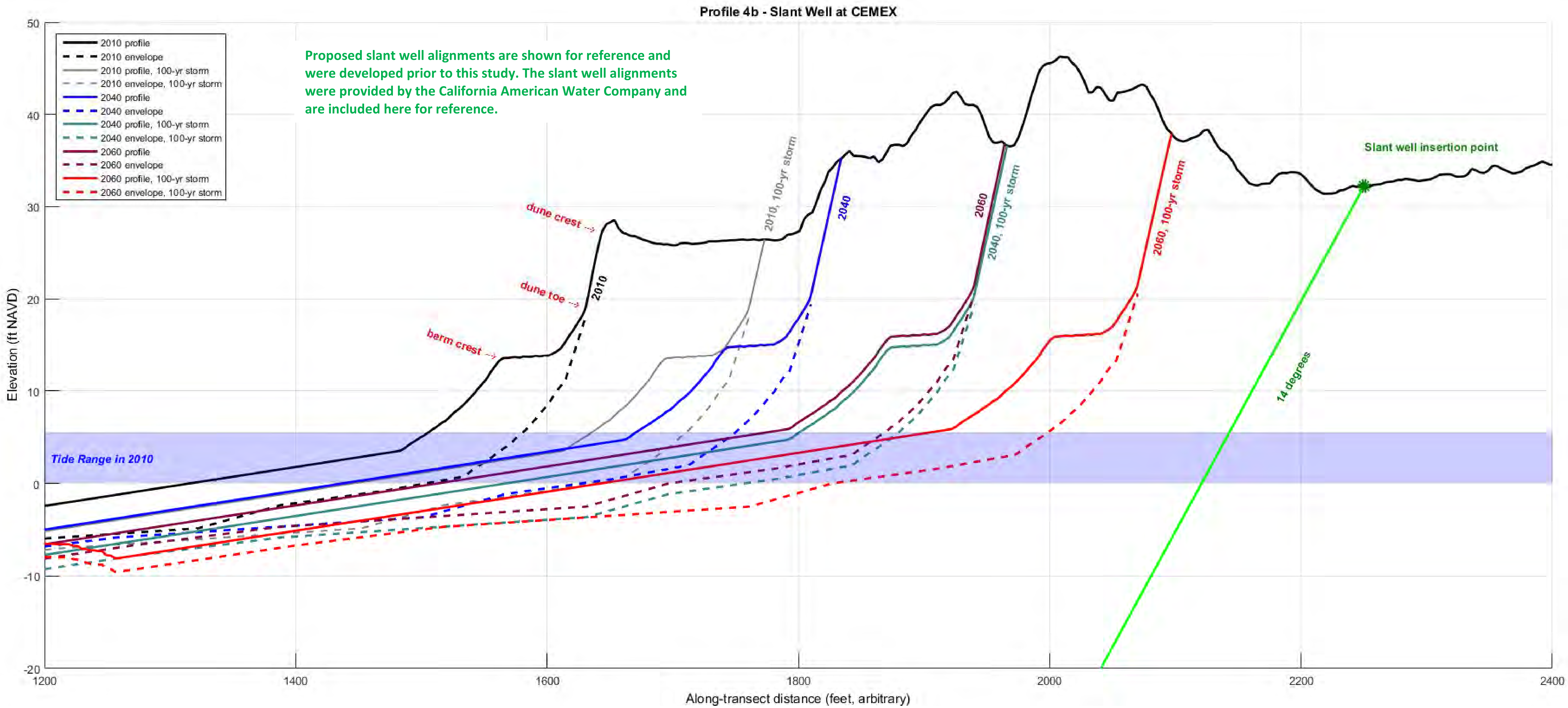
The high and low rates of sea level rise were estimated for each year from 2012 to 2073, the time period for which input data was needed by the groundwater modeling efforts discussed in Section 4.4, Groundwater Resources. The coastal erosion hazard zones maps delineate the estimated areas along the coast expected to be at or below sea level by the years 2030, 2040, 2050, 2060, and 2100, and thus subject to erosive wave action. Coastal profiles were then prepared at various locations to show the current (2010) profile and estimate the coastal profiles in 2040 and 2060, where project components would be close to the coastline and potentially subject to the damage that would be the result of coastal retreat. The test slant well would be exposed as a result of the 100-year storm event in the year 2060, as shown on **Figure 4.2-7**. The initially-proposed locations for the other nine slant wells would have been about the same distance from MHW and would have been within the anticipated extent of coastal retreat. These initial slant well locations are shown on the coastal profiles in Appendix C2. To avoid this condition, the well heads for the other nine slant wells were relocated to a line south of the existing test slant well, so that the proposed new slant wells would be located inland of the effects of the 100-year storm event in the year 2060, as shown on **Figure 4.2-8**.



Notes:

1. These envelopes of erosion consider seasonal changes in beach width, localized erosion (rip currents), long-term erosion, and accelerated erosion caused by sea level rise.
2. The profile shape is linearly interpolated between the bathymetry data and the topography data (between x = 919 ft and x = 1385).
3. This profile is located immediately south of the CEMEX Pacifica Lapis sand mining plant. No data is available to quantify the uncertainty in adjacent beach and dune erosion related to sand mining activities. The potential for fluctuations in beach width associated with sand mining were not considered in this analysis.
4. Slant well location and angle are based on the “Geological Cross Section through Test Slant Well” drawing provided by Geoscience on January 7 2016.

Figure 4.2-7
Representative Profile at Test Slant Well



Notes:

1. These envelopes of erosion consider seasonal changes in beach width, localized erosion (rip currents), long-term erosion, and accelerated erosion caused by sea level rise.
2. The profile shape is linearly interpolated between the bathymetry data and the topography data (between x = 820 ft and x = 1480).
3. This profile is located immediately south of the CEMEX Pacifica Lapis sand mining plant. No data is available to quantify the uncertainty in adjacent beach and dune erosion related to sand mining activities. The potential for fluctuations in beach width associated with sand mining were not considered in this analysis.
4. Slant well location and angle are based on the “Cross-Section SW-3” drawing provided by Geoscience on January 7, 2016.

Figure 4.2-8
Representative Profile at Proposed Slant Wells

4.2.5 Direct and Indirect Effects of the Proposed Project

Table 4.2-7 summarizes the impacts and significance determinations related to geology, soils and seismicity that could result from implementation of the proposed project (10 slant wells at CEMEX). Due to the nature of the proposed project, the following criterion is not addressed in the impact analysis sections for the reasons described below:

> ***Degrade the physical structure of any geologic resource or alter any oceanographic process, such as sediment transport, such that it is measurably different from pre-existing conditions.*** Construction, operations, and maintenance of the components of the proposed project (10 wells at CEMEX) would not affect onshore or offshore geologic resources, and would not alter oceanographic processes because construction would be below the seabed; the seabed would not be altered and would not be disturbed during operations or maintenance activities.

TABLE 4.2-7
SUMMARY OF IMPACTS – GEOLOGY, SOILS, AND SEISMICITY

Impacts	Significance Determinations
Impact 4.2-1: Substantial soil erosion or loss of topsoil during construction.	LSM
Impact 4.2-2: Exposure of people or structures to substantial adverse effects related to fault rupture.	LS
Impact 4.2-3: Exposure of people or structures to substantial adverse effects related to seismically-induced groundshaking.	LS
Impact 4.2-**4**: Exposure of people or structures to substantial adverse effects related to seismically-induced ground failure, including liquefaction, lateral spreading, or settlement.	LS
Impact 4.2-5: Exposure of people or structures to substantial adverse effects related to landslides or other slope failures.	LS
Impact 4.2-6: Exposure of people or structures to substantial adverse effects related to expansive soils.	LS
Impact 4.2-7: Exposure of structures to substantial adverse effects related to corrosive soils.	LS
Impact 4.2-8: Exposure of people or structures to substantial adverse effects related to land subsidence.	NI
Impact 4.2-9: Exposure of people or structures to substantial adverse effects related to alternative wastewater disposal systems.	LS
Impact 4.2-10: Accelerate and/or exacerbate natural rates of coastal erosion, scour, or dune retreat, resulting in damage to adjoining properties or a substantial change in the natural coastal environment.	LSM
Impact 4.2-C: Cumulative impacts related to geology, soils, and seismicity.	LSM

NOTES:
NI = No Impact
LS = Less than Significant impact, no mitigation required
LSM = Less than Significant impact with Mitigation

4.2.5.1 Construction Impacts

Impact 4.2-1: Substantial soil erosion or loss of topsoil during construction. (*Less than Significant with Mitigation*)

Soil Erosion

All Proposed Project Components

Project construction would involve localized ground disturbance activities (e.g., grading, excavation, drilling, and the construction of structures and pipelines) associated with drilling of the subsurface slant wells and ASR injection/extraction wells, installation of pipelines, and construction of buildings and structures. These activities could result in substantial soil erosion.

The construction activities would involve short-term ground disturbance. As described above in Section 4.2.1, Setting/Affected Environment, many of the project facilities and all conveyance pipelines would be constructed in relatively flat areas with little topographic relief. The gentle topographic relief would minimize the potential for soil erosion during construction.

Because the overall footprint of construction activities would exceed 1 acre, the proposed project would be required to comply with the *NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction and Land Disturbance Activities* (Order 2009-0009-DWQ, NPDES No. CAS000002; as amended by Orders 2010-0014-DWQ and 2012-006-DWQ) (Construction General Permit), the Monterey County Grading Ordinance, and Monterey County Erosion Control Ordinance, all of which are described in Section 4.2.2, Regulatory Framework. These state and local requirements were developed to ensure that stormwater is managed and erosion is controlled on construction sites. The Construction General Permit requires preparation and implementation of a SWPPP, also described in Section 4.2.2, which requires applications of BMPs to control run-on and runoff from construction work sites. The BMPs would include, but would not be limited to, physical barriers to prevent erosion and sedimentation, construction of sedimentation basins, limitations on work periods during storm events, use of bio-infiltration swales, protection of stockpiled materials, and a variety of other measures that would substantially reduce or prevent erosion from occurring during construction. The Monterey County Grading Ordinance, as well as similar city grading and erosion ordinances, requires implementation of temporary construction and permanent post-construction erosion control measures. The applicable erosion control ordinances restrict grading activities during winter months and require preparation of an erosion control plan prior to issuance of building permits.

Because project construction activities would be subject to the numerous requirements noted above and in Section 4.2.2, impacts associated with substantial increases in soil erosion during construction would be less than significant for all project components.

Loss of Topsoil

Source Water Pipeline, new Desalinated Water Pipeline, and Castroville Pipeline, ASR-5 and ASR-6 Wells, and the Carmel Valley Pump Station

Several of the project-related construction activities would disturb vegetated areas, including sensitive natural vegetation communities. Grading, excavation, and backfill activities in these areas could result in the loss of topsoil (a fertile soil horizon that typically contains a seed base) if there is a well-developed topsoil horizon and it is mixed with other soil horizons or otherwise lost during excavation and backfilling. Impacts related to the loss of topsoil during construction of these components would be significant. However, the impact associated with loss of topsoil in sensitive natural communities would be reduced to a less-than-significant level with implementation of **Mitigation Measure 4.6-2b (Avoid, Minimize, and Compensate for Construction Impacts to Sensitive Communities and Environmentally Sensitive Habitat Areas)**. The impact associated with loss of topsoil on agricultural lands would be reduced to a less-than-significant level with implementation of **Mitigation Measure 4.16-1 (Minimize Disturbance to Farmland)**. These measures require that topsoil be salvaged, stockpiled separately from subsoils, and returned to its appropriate location in the soil profile during backfilling activities.

Subsurface slant wells, MPWSP Desalination Plant, Pipeline to CSIP Pond, Brine Discharge Pipeline/Brine Mixing Box, pipelines south of Reservation Road, Main System-Hidden Hills and Ryan Ranch-Bishop Interconnection Improvements

Surface soils at the subsurface slant wells and MPWSP Desalination Plant site are sandy and do not have a well-developed soil horizon. The site is covered in ruderal and disturbed habitat and does not support sensitive natural communities or crop production. The pipelines and interconnection improvements south of Reservation Road would be constructed within existing roadways and highly disturbed areas and would have no effect related to the loss of topsoil. Therefore, construction of the subsurface slant wells, MPWSP Desalination Plant and pipelines and interconnection improvements south of Reservation Road would have no impact related to loss of topsoil and no mitigation is necessary.

Consistency with Plans & Policies

As discussed above, the construction of the project has the potential to result in the loss of topsoil. This results in a potential inconsistency with the City of Marina Local Coastal Program Land Use Plan, as discussed above in Table 4.2-6. However, with implementation of **Mitigation Measure 4.6-2b (Avoid, Minimize, and Compensate for Construction Impacts to Sensitive Communities and Environmentally Sensitive Habitat Areas)** and **Mitigation Measure 4.16-1 (Minimize Disturbance to Farmland)**, and through compliance with applicable laws and regulations, the potential for loss of topsoil during construction would be reduced to a less-than-significant level and the MPWSP would be brought into conformance with the above-noted plan.

Impact Conclusion

Impacts associated with soil erosion during construction would be less than significant for all project facilities. Impacts associated with loss of topsoil during construction would be significant for the Source Water Pipeline, new Desalinated Water Pipeline, and Castroville Pipeline, ASR-5 and ASR-6 Wells, and the Carmel Valley Pump Station. Implementation of **Mitigation Measures 4.6-2b (Avoid, Minimize, and Compensate for Construction Impacts to Sensitive Communities and Environmentally Sensitive Habitat Areas)** and **4.16-1 (Minimize Disturbance on Farmland)** would reduce this impact to a less-than-significant level. No impact related to the loss of topsoil would result from construction of the subsurface slant wells, the MPWSP Desalination Plant or pipelines south of Reservation Road.

Mitigation Measures

Mitigation Measure 4.6-2b applies to the Source Water Pipeline, new Desalinated Water Pipeline, and Castroville Pipeline, ASR-5 and ASR-6 Wells, and the Carmel Valley Pump Station.

Mitigation Measure 4.6-2b: Avoid, Minimize, and Compensate for Construction Impacts to Sensitive Communities and Environmentally Sensitive Habitat Areas.

(See Impact 4.6-2 in Section 4.6, Terrestrial Biological Resources, for the description.)

Mitigation Measure 4.16-1 applies to the Source Water Pipeline, new Desalinated Water Pipeline, and Castroville Pipeline.

Mitigation Measure 4.16-1: Minimize Disturbance to Farmland.

(See Impact 4.16-1 in Section 4.16, Agriculture and Forestry Resources, for the description.)

4.2.5.2 Operational and Facility Siting Impacts

The proposed project would not result in erosion-causing activities such as stormwater discharges to vegetated areas during project operations and maintenance because the project operations would be conducted entirely within the areas previously disturbed by construction of the project facilities and would not disturb any new areas. Therefore, project operations and maintenance would have no effect on erosion and topsoil.

Impact 4.2-2: Exposure of people or structures to substantial adverse effects related to fault rupture. (*Less than Significant*)

New Transmission Main and Ryan Ranch-Bishop Interconnection Improvements

The proposed project would not alter the seismic environment or increase the risk of fault rupture. None of the proposed facilities are located within an Alquist-Priolo Earthquake Fault Zone (i.e., on a State-recognized active fault trace). Although there is evidence of Holocene movement along some of the faults that cross the project area, these faults are unlikely to generate an earthquake or result in surface fault rupture because the segments with Holocene movement are concealed, do not exhibit any surface expression of fault movement, and/or are comparatively short (i.e., in comparison to an active fault such as the San Andreas Fault).

As shown on **Figures 4.2-1** and **4.2-4** and discussed in Section 4.2.1.2, the Monterey Bay–Tularcitos Fault Zone passes through the project area in Monterey, Del Rey Oaks, and Seaside. This fault zone creates a 6- to 9-mile wide zone of short in-echelon, northwest striking faults. These faults are not zoned under the Alquist-Priolo Earthquake Fault Zoning Act (see Regulatory Framework, Section 4.2.2) because they do not exhibit surface displacement that is younger than 11,000 years and are not considered sufficiently active or well defined. This distinction is discussed in more detail above in Section 4.2.1.2. From east to west, the individual faults in the Monterey Bay–Tularcitos Fault Zone are referred to as the:

- Chupines Fault Zone, Ord Terrace Fault, Del Rey Oaks section
- Chupines Fault Zone, Seaside Fault, Del Rey Oaks section
- Monterey Bay-Tularcitos Fault Zone, Monterey Bay section (Navy Fault)
- Monterey Bay-Tularcitos Fault Zone, Monterey Bay section (Hatton Canyon Fault)

Although these faults are not zoned by the State of California as active and the Fault Activity Map of California (Jennings, 2010) identifies these faults as older Quaternary-age faults (i.e. displacement between 1.6 mya to 11,000 ya or older), there has been evidence (Bryant, 2001) of Holocene displacement along the Hatton Canyon and Tularcitos Faults. Additionally, there is evidence of a probable offshore extension of the Chupines Fault displacing Holocene-age (less than 11,000 years old) deposits and sea floor sediments (Ninyo & Moore, 2014). Therefore, because there is evidence of Holocene–age displacement on certain segments of these otherwise Quaternary-aged and older faults, the potential for earthquake activity and possible ground surface displacement (ground rupture) cannot be dismissed. However, because the majority of these faults have not exhibited Holocene displacement and are not considered sufficiently active or well-defined, the potential is very low that the individual traces of these faults could generate an earthquake and result in surface fault rupture.

New Transmission Main

The proposed new Transmission Main would cross over the Reliz Fault Zone (Blanco Segment). The Reliz Fault Zone, Blanco Segment, is concealed and covered with dune sands along the coast and there is no reported evidence of Holocene-age fault displacement in this area.

In the event of an earthquake along the Reliz Fault Zone, groundshaking could occur, but because there has not been historic (less than 200 years) or Holocene (less than 11,000 years) activity on this fault, the active trace would be buried beneath sand and marine terrace deposits. In addition, because the fault segments are comparatively short (i.e., in comparison to an active fault such as the San Andreas Fault), any surface expression of fault movement would be minor if it would occur at all. In the unlikely event that the Reliz Fault Zone, Blanco Segment, generated earthquake activity or surface fault displacement along the New Transmission Pipeline, the pipeline would likely accommodate the lateral movement and not be damaged. If damage did occur, it would amount to a pipe break and possibly leakage that would be readily repaired, as previously explained. This impact is considered less than significant.

Ryan Ranch-Bishop Interconnection Improvements

The Ryan Ranch-Bishop Interconnection Improvements across the southern portion of the Chupines Fault Zone, Seaside Fault, and Del Rey Oaks section. The Chupines Fault in this area is mapped as a Quaternary fault with no evidence of recent or Holocene displacement. Considering its age and lack of recent activity, the potential for this fault to generate a damaging earthquake or rupture at the surface is considered low. In the unlikely event that the Hatton Canyon Fault generated earthquake activity or surface fault displacement, the pump station and pipeline would likely accommodate the lateral movement and not be damaged. If damage did occur, it would amount to a pipe break and possibly leakage that would be readily repaired, as previously explained. This impact is considered less than significant.

All Other Proposed Components

None of the other project components, including the subsurface slant wells and desalination plant, are close enough to known active faults to be vulnerable to surface fault rupture. Therefore, no impact would occur from implementation of the other project components.

Impact Conclusion

Mapped faults intersect the proposed new Transmission Main and the Ryan Ranch-Bishop Interconnection Improvements. These faults are not mapped as active by the State of California because they do not display evidence of recent displacement. However, past studies have identified that certain segments of these faults do exhibit Holocene-age displacement leading to the conclusion that certain segments could be considered active. While it is possible that these faults could generate an earthquake and rupture at the surface, the potential for such an occurrence to expose people or structures to substantial adverse effects related to fault rupture is low because the faults are either concealed beneath sediments or at a sufficient distance from the project components. In the unlikely event that one of the faults crossing the project components did generate an earthquake and cause surface rupture, the rupture area would be localized, resulting in a minor offset associated with a low level groundshaking. Damage could include localized pipeline leaks that would be immediately repaired. Considering the low potential for fault rupture on the project area faults, this impact is considered less than significant for the new Transmission Main and Ryan Ranch-Bishop Interconnection Improvements. For all other components of the proposed project, no impact would result because mapped faults do not occur at or near to the locations of the other components.

Mitigation Measures

None proposed.

Impact 4.2-3: Exposure of people or structures to substantial adverse effects related to seismically-induced groundshaking. (*Less than Significant*)

All Proposed Project Components

As discussed in Section 4.2.1, Setting, Monterey County will likely experience a large regional earthquake within the operational life of the MPWSP. There is a potential for high-intensity groundshaking associated with a characteristic earthquake in this region. The intensity of such an event would depend on the causative fault and the distance to the epicenter, the moment magnitude, the duration of shaking, and the nature of the geologic materials on which the MPWSP components would be constructed. Intense groundshaking and high ground accelerations would affect the entire area around the proposed facilities and associated pipelines. The primary and secondary effects of groundshaking could damage structural foundations, distort or break pipelines and other water conveyance structures, and cause structural failure.

The MPWSP Desalination Plant would be staffed full-time, and the Carmel Valley Pump Station would be staffed on an as-needed maintenance schedule. During operations, intense groundshaking could cause damage to these facilities, facility outages, and temporary water service disruptions in the CalAm Monterey District service area. Pumps could be rendered inoperable. Broken pipelines could result in soil washout and sinkholes that could damage nearby non-project facilities or the environment. Locating and repairing damaged pipelines and the pumps could require a cessation of operation of the facilities for a period of time. The 1989 Loma Prieta earthquake reportedly caused more than 60 water pipeline breaks in Santa Cruz, the nearest urbanized area to the epicenter (McNutt and Toppozada, 1990). As the proposed project would be part of an essential public utility (public water supply), repairs would be made promptly.

The structural elements of the proposed project would undergo appropriate design-level geotechnical evaluations prior to final design and construction. Implementing the regulatory requirements in the CBC and County ordinances and ensuring that all buildings and structures constructed in compliance with the law is the responsibility of the project engineers and building officials. The geotechnical engineer, as a registered professional with the State of California, is required to comply with the CBC and local codes while applying standard engineering practice and the appropriate standard of care for the particular region in California, which, in the case of the proposed MPWSP, is the Monterey Bay area.[21] The California Professional Engineers Act (Building and Professions Code Sections 6700-6799), and the Codes of Professional Conduct, as administered by the California Board of Professional Engineers and Land Surveyors, provides the basis for regulating and enforcing engineering practice in California. The local Building Officials are typically with the local jurisdiction (i.e. Monterey County) and are responsible for inspections and ensuring CBC and local code compliance prior to approval of the building permit.

[21] A geotechnical engineer (GE) specializes in structural behavior of soil and rocks. GEs conduct soil investigations, determine soil and rock characteristics, provide input to structural engineers, and provide recommendations to address problematic soils.

Impact Conclusion

It is likely that the structural elements of the proposed project would be subjected to a moderate to strong earthquake at least once during their operational life. Damage from an earthquake could result in temporary water service disruptions. However, because of the location of project facilities relative to the faults and the limited potential for ground surface rupture associated with these faults, there is a low potential for the groundshaking associated with an earthquake to cause injury, loss of life, or substantial property damage. Completion of a comprehensive design-level geotechnical investigation, adherence to the current CBC and local ordinances regulating construction, and the application of proven seismic design criteria that are standard engineering practice would ensure that structures are designed to withstand seismic events without sustaining substantial damage or collapsing. Therefore, this impact is considered less than significant.

Mitigation Measures

None proposed.

Impact 4.2-4: Exposure of people or structures to substantial adverse effects related to seismically-induced ground failure, including liquefaction, lateral spreading, or settlement. (*Less than Significant*)

Castroville Pipeline, Source Water Pipeline, and Carmel Valley Pump Station

The potential for liquefaction is higher in areas composed of granular soils with a shallow depth to groundwater. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling, and buckling of deep foundations due to liquefaction-induced ground settlement. The placement of structures on such soils could place the public at risk of injury or structures at risk of damage. Lateral spreading is the movement of blocks of soil on liquefiable soils.

Figure 4.2-5 shows the liquefaction hazard potential in Monterey County. As shown on the figure, most of the project components would be located in areas with a low susceptibility. However, the Castroville Pipeline would be constructed in areas of the Salinas River floodplain that have experienced documented historic liquefaction during the 1906 San Francisco and 1989 Loma Prieta earthquakes and are mapped with a moderate to high potential for liquefaction. The Source Water Pipeline is partially located on soils with a moderate to high potential for liquefaction. The Carmel Valley Pump Station is located on soils with a moderate liquefaction potential. Those project components located on or in soils with a moderate to high potential for liquefaction that could experience damage or failure as a result of liquefaction are discussed below.

The water conveyance pipelines would consist of 6- to 42-inch diameter pipelines buried from about 4 to 8 feet below the ground surface. Most of the conveyance pipelines would be underlain by deposits and fill materials consisting of dune sand and most of these deposits are anticipated to consist of dry sand and silt mixtures (Ninyo and Moore, 2005, 2014; AECOM, 2015). Fill materials likely consist of compacted mixtures of sand and silt generated locally from the natural dune deposits. Portions of the Source Water Pipeline close to and under the coastal areas could have shallow depths to groundwater; in this case seawater intruded from the ocean, and thus could be susceptible to liquefaction damage. Although not located in the coastal zone, the Carmel Valley Pump Station would be located on similarly sandy deposits near enough to the Carmel River to seasonally have shallow groundwater conditions.

As discussed above in the Section 4.2.3, Approach to Analysis, the proposed project components would undergo a final geotechnical investigation and be designed to resist damage from seismic shaking. CalAm would implement all geotechnical recommendations provided by the project geotechnical engineer if liquefiable soils are identified. Solutions to rectify liquefaction are modern engineering approaches used throughout California and are considered standard industry practice. Methods to correct liquefiable soils include removal and replacement of problematic soils, the use of pile foundations, and drainage columns to reduce saturated conditions. The geotechnical investigation and corrective actions for potential liquefiable soils, where needed, would be based on the CGS Special Publication 117A (see Section 4.2.2).

In comparison to aboveground structures, underground pipelines, and buried structures are generally less susceptible to liquefaction damage because they are embedded in compacted backfill that can tolerate more seismic wave motion. While this practice would not completely eliminate the potential for damage to the facilities, it would ensure that the resultant improvements would have the structural fortitude to withstand anticipated groundshaking and seismically induced ground failures without significant damage.

All Other Project Components

The potential for liquefaction is higher in areas composed of granular soils with a shallow depth to groundwater. As shown on Figure 4.2-5, the other project components would not be located in areas susceptible to liquefaction-induced ground settlement.

Impact Conclusion

With implementation of standard engineering practices, compliance with Monterey County requirements for geotechnical study, implementation of the design recommendations from the geotechnical engineer, and standard construction methods, this impact would be less than significant for all components of the proposed project.

Mitigation Measures

None proposed.

Impact 4.2-5: Exposure of people or structures to substantial adverse effects related to landslides or other slope failures. (*Less than Significant*)

Figure 4.2-6 shows the locations of the proposed project components and the potential slope stability hazards associated with seismically-induced landslides. The designation of a given area as having high landslide susceptibility does not necessarily mean that an active landslide is present at that location, only that the steepness of the topography and soil type renders that location more susceptible to landslides. Because steep topography increases landslide risk, the map also shows areas prone to non-seismically induced landslides. Non-seismic slope movement can be caused by the force of gravity on steeper unstable slopes, construction activities that change the existing surface water drainage and create unstable slopes, or the addition of water into the slope material through leaks or breaks in pipelines in steeper landslide prone areas.

Main System-Hidden Hills Interconnection Improvements

The steep hillside terrain on and east of the Monterey Peninsula has an elevated susceptibility to landslides. All but one of the project components would be located in relatively flat to gently-sloping topography and would therefore have a low susceptibility to landslides. Only the Main System-Hidden Hills Interconnection Improvements would be located in an area characterized as having a moderate to high susceptibility to earthquake-induced landslides.

The Main System-Hidden Hills Interconnection Improvements consist of a 100-foot long, 6-inch-diameter pipeline to connect the Hidden Hills section of the system with the main distribution system. The entire pipeline section would be buried from about 4 to 8 feet below the surface in the Tierra Grande Drive road right-of-way, as shown in Chapter 3, Description of the Proposed Project, Figure 3-10b. Upon the completion of construction activities, the surface would be restored to the original existing paved condition. This existing road would continue to be maintained with curbs and gutters to collect and control surface water runoff. Although the Main System-Hidden Hills Interconnection Improvements would be placed in an area with a moderate to high landslide susceptibility, there are no existing active landslides in the area and the project does not include activities that would exacerbate an otherwise unstable slope condition. Furthermore, this area would be evaluated during the project geotechnical evaluation and if potentially unstable slope conditions exist, the geotechnical recommendations that would be developed through that study would be implemented by CalAm to diminish the potential for slope failure. Therefore, the potential impact related to landslide susceptibility is considered less than significant.

All Other Project Components

All other project components would be located in relatively flat to gently-sloping topography and would therefore have a low to no susceptibility to landslides. Therefore, there would be no impact for all other project components.

Impact Conclusion

Impacts associated with landslides would be less than significant for the Main System–Hidden Hills Interconnection Improvement. For all other project components, no impact would occur.

Mitigation Measures

None proposed.

Impact 4.2-6: Exposure of people or structures to substantial adverse effects related to expansive soils. (*Less than Significant*)

Unless properly removed or reconditioned during construction, expansive soils could exert additional pressures on foundations and below-grade facilities, producing shrinkage cracks that allow water infiltration and compromise the integrity of backfill material. Depending on the depth of buried pipelines, soil in expansion or contraction could lead to lateral pipeline stress and stress of structural joints. Lateral stresses could, over time, lead to pipeline rupture or leaks in the coupling joints. Shrinkage cracks could form in native soils adjacent to the pipeline trench or in backfill material if expansive soils are used. If shrinkage cracks extend to sufficient depths, groundwater can infiltrate into the trench, causing piping (progressive erosion of soil particles along flow paths) or settlement failure of the backfill materials. Settlement failure can also occur if expansive soils are used in backfill and undergo continued expansion and contraction. Over time these soils could settle, resulting in misalignment or damage to buried facilities.

The effects of expansive soils could damage foundations of aboveground structures, paved service roads, and concrete slabs. Surface structures with foundations constructed in expansive soils would experience expansion and contraction depending on the season and the amount of surface water infiltration. The expansion and contraction, also referred to as linear extensibility, could exert enough pressure on the structures to result in cracking, settlement, and uplift.

Castroville Pipeline, Carmel Valley Pump Station, Main System–Hidden Hills Interconnection Improvements, and Ryan Ranch–Bishop Interconnection Improvements

Table 4.2-4 lists the properties of all of the soil units on or within which project components would be constructed. Proposed components that would be placed on or in soils with moderate to high expansion or linear extensibility potential include the Castroville Pipeline, Carmel Valley Pump Station, the Main System-Hidden Hills Interconnection Improvements, and the Ryan Ranch–Bishop Interconnection Improvements.

As discussed in Section 4.2.3, Approach to Analysis, the project geotechnical engineer for CalAm has completed a preliminary geotechnical assessment of the pipeline route and project facility sites and would complete a final geotechnical design investigation prior to project construction. The geotechnical evaluation of the project sites includes field sampling and testing of surface soils to determine the presence of expansive soils. The investigation of and treatment for expansive soils is considered standard engineering practice for most development projects. Completion of a geotechnical evaluation and implementation of its recommendations reduces the likelihood that expansive soils could impact project components. In addition, all project elements and pipeline facilities would be designed consistent with AWWA standards for pipelines (discussed in the Approach to Analysis, Section 4.2.3), which account for problematic soils and require remedies for adverse soils in order to adhere to specific standards for pipeline trench excavation, pipe bed material, and backfill. Methods to address expansive soils include removal of the expansive soils or treating the expansive soils by mixing the soil with lime or other additives that reduce the potential for expansion. Given all of these requirements and compliance with standards, the potential for expansive soils to adversely impact project components is low and therefore this impact is less than significant.

All Other Project Components

All other project components would be located in soils with a low linear extensibility potential. Therefore, there would be no impact.

Impact Conclusion

With compliance with applicable construction requirements and design criteria, this impact would be less than significant for the Castroville Pipeline, Carmel Valley Pump Station, Main System–Hidden Hills Interconnection Improvements, and Ryan Ranch–Bishop Interconnection Improvements. There would be no impact for the other project components.

Mitigation Measures

None proposed.

Impact 4.2-7: Exposure of structures to substantial adverse effects related to corrosive soils. (*Less than Significant*)

Soils with a high conductivity can corrode unprotected underground metal pipes and electrical conduits. Over time, pipe corrosion could lead to pipeline failure, resulting in localized surface flooding of water or localized settlement of surface soils at the location of the failure. Failed subsurface electrical conduits could result in electrical short-circuiting. Soils with an acidic pH can corrode unprotected concrete. Over time, concrete corrosion could lead to the degradation of concrete resulting in the cracking and failure of concrete foundations and other support structures. Failed foundations and support structures could result in the breakage of equipment or pipelines and possibly result in temporary shutdown of operations interrupting the public water supply.

MPWSP Desalination Plant, ASR-5 and ASR-6 Wells, ASR Pipelines, and Ryan Ranch–Bishop Interconnection Improvements

Table 4.2-4 lists the properties of all of the soil units within which project components would be constructed. Clayey soils are potentially corrosive. Project components that would be located on or in soils with moderate to high concrete and unprotected steel corrosion potential include the MPWSP Desalination Plant, ASR-5 and ASR-6 Wells, ASR Pipelines, and the Ryan Ranch–Bishop Interconnection Improvements.

As discussed in Section 4.2.3, Approach to Analysis, the project geotechnical engineer for CalAm has completed a preliminary geotechnical assessment of the pipeline route and would complete a final geotechnical design investigation prior to project construction. The geotechnical evaluation of the project area boundaries includes an evaluation for the presence of corrosive soils. Managing corrosive soils is standard engineering practice especially for pipeline projects. If corrosive soils are identified during the final geotechnical design study, the project geotechnical engineer would recommend remedies to eliminate damage from corrosive soils, and those recommendations would be implemented by CalAm. Methods to reduce corrosion of metal and concrete caused by soils include avoidance and removal or the use of cathodic protection. In addition, all project elements and pipeline facilities would be designed consistent with AWWA standards for pipelines (discussed in the Approach to Analysis, Section 4.2.3), which account for problematic soils and require remedies for adverse soils in order to adhere to specific standards for pipeline trench excavation, pipe bed material, and backfill.

All Other Project Components

All other project components would be located in sandy soils with a low corrosivity potential. Therefore, there would be no impact.

Impact Conclusion

The presence of corrosive soils would be evaluated and addressed through the final geotechnical investigation prior to project construction. As previously discussed, the CBC and local permitting regulations require a geotechnical investigation. If the investigation finds corrosive soils, the geotechnical engineer would recommend avoidance, removal, or cathodic protection, and CalAm would be required to implement those recommendations. Therefore, the impact of corrosive soils is considered less than significant for the MPWSP Desalination Plant, ASR-5 and ASR-6 Wells, ASR Pipelines, and the Ryan Ranch–Bishop Interconnection Improvements. There would be no impact for the other project components.

Mitigation Measures

None proposed.

Impact 4.2-8: Exposure of people or structures to substantial adverse effects related to land subsidence. (*No Impact*)

When groundwater is extracted from a confined aquifer, subsidence of the overlying land surface can occur. This type of subsidence is usually associated with severe, long-term withdrawal in excess of recharge that eventually leads to overdraft of the aquifer. As groundwater is pumped out, water is removed from the soil pore spaces leading to a reduction in soil strength. The subsurface conditions more conducive to subsidence include clay or organic-rich soils. Sand- and gravel-rich soils are less prone to subsidence because the larger grains comprise a skeleton less dependent on water pressure for support. The subsidence can result in damage to infrastructure such as buildings or pipelines, or can result in a decrease in the volume of available aquifer storage.

Subsurface Slant Wells

Overdrafting of the Salinas Valley Groundwater Basin has taken place over an extended time, and saltwater has replaced the freshwater in those affected areas, thereby preventing subsidence (Monterey County, 2010). According to the *Monterey County General Plan*, subsidence is not a critical hazard in the county. As described in Section 3.2.1.1 of Chapter 3, Description of the Proposed Project, the subsurface slant wells would be 900 to 1,000 feet long and extend offshore. The slant wells would be screened at depths corresponding to both the Dune Sand Aquifer and the underlying 180-Foot-Equivalent Aquifer of the Salinas Valley Groundwater Basin. These aquifer units are composed predominantly of sand and gravel. Geologic units composed of sands and gravels are less prone to subsidence because the granular structure is better able to support the overlying weight of soil. In addition, because the subsurface slant wells would draw water from the offshore coastal aquifers, seawater would replace the water pumped from the slant wells, as discussed in Section 4.4, Groundwater Resources. The continuous replacement of water would keep the pore spaces between the grains filled with water, further supporting the granular structure. Consequently, the soil structure above the slant wells would be unable to subside as a result of pumping and there would be no impact from subsidence impacts associated with the subsurface slant wells.

ASR-5 and ASR-6 Wells

The screened sections of the proposed ASR-5 and ASR-6 Wells would be located about 1,000 feet bgs in the sandstone portions of the Santa Margarita Formation in the Seaside Groundwater Basin. The sandstone structure of the geologic unit would be expected to support the granular structure during groundwater pumping, especially considering the depth. In addition, the proposed project would typically extract water injected and stored in the ASR system in the same water year. Therefore, the water pumped into the system during the winter and spring would be extracted during the following summer or fall. Furthermore, for the first 25 years of the proposed project, 700 acre-feet annually would be left in the Seaside Groundwater Basin to restore water extracted in years prior to this project. This means that the overall groundwater levels in the Seaside Groundwater Basin would increase as a result of the proposed project. This would result in a decreased potential for surface ground subsidence and there would be no subsidence impacts associated with the ASR-5 and ASR-6 Wells. Also note that the ASR wells are proposed to be located at least 2 miles away from the active, offshores traces of the Chupines Fault Zone, as shown on EIR/EIS Figure 4.2-4. Therefore, the injection of water would not have the potential to activate movement on an active fault.

All Other Project Components

None of the other project components would extract groundwater. Therefore, there would be no impact for all other project components.

Impact Conclusion

Given the existing lack of clay in the aquifer units to be pumped and the management of groundwater levels to reduce or eliminate overdraft, there would be no impacts related to subsidence caused by the ASR injection/extraction wells. Given the continuous recharge of seawater to the slant wells, there would be no impact related to subsidence caused by the slant wells. For all other project components, there would be no impacts.

Mitigation Measures

None proposed.

Impact 4.2-9: Exposure of people or structures to substantial adverse effects related to alternative wastewater disposal systems. (*Less than Significant*)

This impact analyzes alternate wastewater locations relative to the physical suitability of the proposed locations to infiltrate water. The potential impacts relative to water quality are discussed in Section 4.3, Surface Water Hydrology and Water Quality.

Subsurface Slant Wells

After completing the construction of the subsurface slant wells, the wells would be developed to remove sand, silt, and clay from the well and clean out the well screen and sand pack[22] around the well screen. As described in Section 3.2.1.1, subsurface slant wells, the development water would be discharged to pump-to-waste vaults located at the well heads for the percolation of turbid water back into the sand (see **Figure 3-3**) or conveying it to the existing discharge pipeline for the test slant well and discharging it to the ocean via the MRWPCA ocean pipeline and outfall. The pump-to-waste vault would be a precast 12-foot-long, 8-foot-wide, and 1-foot-tall concrete vault covered with a metal grate and underlain by clean gravel and permeable geotextile fabric. The sand, silt and clay would remain in the pit; the water would infiltrate back down to groundwater. If the materials at and beneath were to have low permeability, the water would not be able to infiltrate back into the underlying aquifer.

The area where the water would be placed is composed of Oceano Loamy Sand (see **Table 4.2-4**). However, in the specific area of the slant wells, the materials are dune sands with little to no fine-grained components (silt and clay) or soil components (organic materials) that would impede infiltration. The high permeability of the dune sand would be suitable for the infiltration of water.

ASR-5 and ASR-6 Wells

After completing the construction of the ASR wells, the wells would be developed to remove sand, silt, and clay from the well and clean out the well screen and sand pack around the well

[22] Sand or gravel packs are sand or gravel installed between the well casing and the surrounding native materials and filters out finer-grained materials from entering the well.

screen. The development water would be discharged to the natural depression shown on **Figure 3-9b**. The sand, silt and clay would remain in the depression; the water would infiltrate back down to groundwater. If the materials at and beneath were to have low permeability, the water would not be able to infiltrate back into the underlying aquifer.

The area where the water would be placed is composed of Baywood Sand (see **Table 4.2-4**). The materials are predominantly sands with little fine-grained components (silt and clay) or soil components (organic materials) that would impede infiltration. The high permeability of the sandy materials would be suitable for the infiltration of water.

All Other Project Components

None of the other project components would require the disposal of wastewater. Therefore, there would be no impact for all other project components.

Impact Conclusion

The alternate wastewater disposal locations for the subsurface slant wells and the ASR wells are sandy areas that would be suitable for the infiltration of water and potential impacts related to the suitability of the locations for wastewater disposal would be less than significant. For all other project components, there would be no impacts. The potential impacts relative to water quality are discussed in Section 4.3, Surface Water Hydrology and Water Quality.

Mitigation Measures

None proposed.

Impact 4.2-10: Accelerate and/or exacerbate natural rates of coastal erosion, scour, or dune retreat, resulting in damage to adjoining properties or a substantial change in the natural coastal environment. (*Less than Significant with Mitigation*)

The sea level in Monterey Bay has been rising for years and is expected to continue rising over the next several decades (ESA, 2013). The Monterey Bay coastline is expected to retreat inland due to the rising sea level and the resulting erosion (ESA, 2014). Erosion and bluff retreat would result in a beach and surf zone that is inland of its current location. The primary concern associated with the proposed project is that coastal retreat could migrate the beach inland such that the subsurface slant well casings, concrete well head vaults, electrical panels, and certain sections of conveyance pipelines would become located on the beach within the project lifetime. As discussed above in the Coastal Retreat Study section, the exposure of the project components to wave action, storm events, and rip embayments could alter the existing natural beach dynamics and the coastal environment, resulting in an increase in beach erosion and/or an interruption in the sand supply to other beaches along the Monterey Bay that would be considered an impact of the proposed project. In addition, beach erosion and bluff retreat caused by the rise in sea level would be a predicted environmental condition that could adversely affect certain components of the project sometime in the future.

The project components that could become located on the beach due to coastal retreat are the subsurface slant wells and associated infrastructure (e.g., well heads, pipelines, and electrical control panels) in the CEMEX active mining area. The area of the slant wells is within the coastal erosion hazard zones that were delineated in the coastal retreat study prepared to evaluate potential coastal erosion hazards associated with the proposed project. The assumptions and methodologies used in the coastal retreat study are discussed above in Section 4.2.3, Approach to Analysis.

Subsurface Slant Wells

The coastal retreat study (ESA, 2014) anticipated that the subsurface slant wells in the CEMEX active mining area could become located on the beach within the project lifetime. It is important to note that predicting the future rate of coastal retreat is an approximation based on anticipated future climate conditions that may vary substantially from actual climate conditions. The coastal retreat study assumes a worst case scenario for planning purposes; the actual amount or rate of coastal retreat could be less.

As described in Sections 3.2.1.1, the seawater intake system would include 10 subsurface slant wells: the existing test slant well, which would be converted to a production well, and the 9 additional new slant wells that would be constructed as part of the proposed project. The subsurface slant wells would originate at an above-ground well head vault behind the beach and radiate out a distance of between 900 and 1,000 feet at an angle of 19 degrees off the horizontal for the existing test slant well and about 14 degrees for all other slant wells off the horizontal toward the Monterey Bay. As shown in **Figure 3-3**, some wells would radiate out in clusters and other wells would be single wells. However, all of the slant wells to be installed would originate from a line about 800 feet back from the shoreline. The wells would extend to the west beneath the sea floor and be screened in the Dune Sand Aquifer and the 180-Foot Equivalent Aquifer.

Figures 4.2-7 and **4.2-8** are coastal profiles developed from the coastal retreat study that show the predicted cross-sectional profile of the coastal bluffs at the CEMEX mining facility through 2060. The methodology and assumptions applied to developing these erosion profiles are discussed above in Section 4.2.3, Approach to Analysis, and in the coastal retreat study (see **Appendices C1 and C2**). The cross-sectional profiles in **Figures 4.2-7** and **4.2-8** show a projected future profile (solid line) and an extremely eroded profile or "lower profile envelope" (dashed line) for the time horizons of 2010, 2040, and 2060. These modeled erosion profile envelopes account for long-term erosion and sea level rise, additional seasonal scour from rip embayments that would predominantly occur in winter, and the additional erosion that would occur from a 100-year storm event.

As originally proposed by CalAm, some slant well clusters were considered in preliminary locations that the coastal retreat study conservatively indicated could either be undermined or exposed, or undergo damage during a large storm event. Consequently, the final design locations for these wells were relocated approximately 400 feet further inland from the originally proposed locations to the locations shown on **Figures 4.2-7**, **4.2-8**, and **3-3**.

Based on the profile, the proposed slant wells would now be located behind the predicted 2060, 100-year lower profile envelope. The coastal retreat study determined that under a conservative predicted erosion rate and considering the additional scour caused by a 100-year storm event in that time horizon, the proposed slant wells would remain buried in the dunes and would not become exposed on the beach until sometime after 2060. The rate of bluff retreat used in the coastal retreat study is conservative in that it may not account for natural accretion of sand on the beach and bluffs that could occur during years of below normal storm activity. As a result, it is possible that the 2060 bluff retreat envelope shown on the profile may not be realized until years after 2060. According to the evaluation criteria for coastal erosion (see Section 4.2.4, Evaluation Criteria, above), the proposed project would cause a significant impact if it accelerated and/or exacerbated natural rates of coastal erosion, scour, or dune retreat resulting in a substantial adverse change in the coastal environment. The proposed slant wells would not be exposed during the useful life of the slant production wells (anticipated to be 20 to 25 years) and would not contribute to further coastal erosion or changes in the beach environment. Therefore, the proposed location of the proposed slant wells would not represent a potential erosion hazard and would not contribute to a significant impact of the proposed project.

Based on the profile, the well head and insertion point for the existing test slant well is about 300 feet closer to the ocean than the nine proposed subsurface slant wells. The test slant well is anticipated to be within the 2060 future 100-year storm coastal erosion profile and lower profile envelope. As noted above, the modeled coastal retreat rate is conservative and the actual rate of coastal retreat may be less.

The coastal erosion modeling anticipates that the beach could migrate inland to the location of the test slant well by the year 2060. Assuming the pilot program being conducted for the test slant well confirms the CEMEX active mining area to be a viable location for the Seawater Intake System, the test slant well would be converted into a permanent well and incorporated into the seawater intake system with a well head vault. Given the test slant well's forward location on the beach at the estimated 2060 future 100-year storm coastal erosion profile and lower profile envelope, it is possible that the well casings and concrete wellhead vault might become exposed on the beach sometime during the operational life of the project. If exposed, the subsurface slant well could contribute to accelerated and/or exacerbated natural rates of coastal erosion, scour, and dune retreat that could alter the natural coastal environment. In addition, exposure of these structures could adversely affect scenic resources and recreational uses on the beach.

All Other Proposed Facilities

None of the other project components are close enough to the coast to be vulnerable to coastal retreat. Therefore, there would be no impact on coastal erosion. But the brine generated by the desalination plant could scour the seafloor as it is released from the existing outfall diffuser. A comparison of the jet plume velocity with oceanic current measurements and estimates based on ocean circulation models at Monterey Bay, indicate that the currents produced by the jet plumes are on the same order of magnitude and similar to the ambient ocean currents for average values and considerably smaller when compared to the maximum currents estimated and observed in Monterey Bay and at the outfall location. **Table 4.2-8** summarizes the ambient ocean currents at

Monterey Bay at a 30m depth and the estimated current velocities of the jet plume at the moment it touches the sea floor for the worst case scenario discussed Section 4.3, Surface Water Hydrology and Water Quality. This impact would be less than significant.

TABLE 4.2-8
COMPARISON OF JET PLUME AND AMBIENT OCEAN CURRENTS AT MONTEREY

	Mean (ft/s)	Maximum (ft/s)
Ocean Currents – ROMS[a]	0.13	0.76
Ocean Currents – ADCP[b]	0.16	
Wave Induced Currents[c]	0.3	1.87
Jet Plume Centerline[d]		0.4
Jet Plume - 3 ft from centerline[e]		0.02

NOTES:
a Ocean currents from ROMS model from January 2011 to March 2012 at the outfall location 30 m depth
b ADCP measurements of Tenera (2014) at a depth of 30 m near the mouth of Monterey Cannon
c Wave induced currents at 30 m depth based on 5 years of wave measurements from January 2007 to December 2012 (NDBC, 2013, ID buoy 46236).
d Visual plume results for scenario P2 at the centerline.
e From Phillip Roberts Appendix D1. The entrained velocity of the jet plume decreases rapidly with distance from the jets in inverse proportion to the distance r. So at a distance of 3 ft from the jet centerline, the velocity will fall to about 0.02 ft/s

Consistency with Plans & Policies

In addition to the physical impacts described above, as noted in **Table 4.2-6**, the MPWSP could conflict with applicable land use plans, policies, or ordinances related to coastal erosion that were adopted for the purpose of avoiding or mitigating an environmental effect. Specifically, coastal-erosion-induced exposure of the subsurface slant wells would conflict with California Coastal Act Sections 30235 and 30253; Marina General Plan Policy 4.102.4; Marina Local Coastal Land Use Plan Geotechnical Guidelines; Monterey Harbor Land Use Plan Policies 3.b, 3.c, and 3.d; Del Monte Beach Land Use Plan Policies 3.1, 3.3, 3.4, 3.7, and 3.11; and Monterey County General Plan Policy S-1.6. As discussed in the subsequent paragraphs, **Mitigation Measure 4.2-10 (Slant Well Abandonment Plan)** would require abandonment of the subsurface slant wells before coastal retreat migrates the beach inland to the location of the subsurface slant wells. With these measures implemented, the MPWSP would be brought into conformance with the above-noted policies.

Impact Conclusion

The anticipated future presence of the test slant well on the beach due to coastal retreat would result in a significant impact. **Mitigation Measure 4.2-10 (Slant Well Abandonment Plan)** would reduce the impact to a less-than-significant level by requiring CalAm to monitor coastal retreat rates and initiate well decommissioning before the beach migrates inland to the location of the subsurface slant wells. As previously discussed, the proposed new slant wells would be located inland of the modeled anticipated inland extent of coastal retreat. However, the rate of coastal retreat may vary due to unforeseen changes in climate change. Therefore, this mitigation measure shall also apply to all of the slant wells.

Mitigation Measures

Mitigation Measure 4.2-10 applies to all slant wells.

Mitigation Measure 4.2-10: Slant Well Abandonment Plan.

CalAm shall monitor and report the rate of coastal retreat and implement the following corrective measure:

1. CalAm shall conduct annual monitoring of the rate of coastal retreat relative to the slant wells at the CEMEX site by measuring the distance from the wellhead to the western dune face. The data shall be reported no later than June 30 each year to the agency issuing the Coastal Development Permit and shall establish an annual erosion rate to be used to estimate the year at which the wells and associated pipelines have 5 years before exposure, assuming that at least one 100-year storm event will have occurred within that exposure timeframe.

2. Beginning at least 5 years prior to the anticipated exposure of the slant wells, CalAm shall implement the planning and permitting necessary to abandon the slant wells in accordance with state well destruction standards. An application to destroy the slant well would be submitted to the Monterey County Environmental Health Bureau, Drinking Water Protection Services Unit, for approval. The abandonment plans shall be prepared in coordination with the property owner.

3. Once an estimated exposure window is established through annual monitoring and a removal date is identified, CalAm shall remove the slant wells from service prior to their exposure. Slant well abandonment activities would be restricted to the snowy plover non-nesting season (October 1 through February 28) to avoid impacts on nesting plovers and other sensitive species. The wellhead vault, electrical panel, buried electrical conduit, and discharge piping would all be excavated and removed, followed by backfilling and compaction of the excavated vault location and trenches. The well abandonment shall be conducted in coordination with the property owner.

4. The slant well casing shall be pressure grouted such that the screened section is sealed, pursuant to the requirements of State of California Well Standards Bulletin 74-81 and 74-90, Part III Section 23. The section of well casing and pipelines at risk of exposure shall be cut and removed to a depth of five feet below the 2060, 100-year lower profile envelope as determined by the 2014 Coastal Erosion Study (ESA, 2014) or as directed by any permit condition.

Secondary Impacts of Mitigation Measure 4.2-10

Slant well abandonment would take approximately 4 weeks and all abandonment activities would occur within the original construction footprint. Re-grading of the CEMEX access road would be necessary at the conclusion of abandonment activities, consistent with property owner requirements.

Potential secondary impacts associated with implementation of **Mitigation Measure 4.2-10 (Slant Well Abandonment Plan)** would be similar to the impacts associated with construction activities such as mobilization, site clearance, grading, excavation, and other earthmoving activities in the original construction footprint. However, slant well abandonment would not involve drilling or excavation but would involve cutting and removing the well casing.

Slant well abandonment could result in secondary impacts on water quality, including:

- Increased soil erosion and the potential for a hazardous chemical release. See Impact 4.3-1, in Section 4.3.5.1. Mandatory compliance with the NPDES Construction General Permit requirements would require the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP), which would prevent significant construction-related impacts on water quality. The Plan would be required to identify standard Best Management Practices to be implemented to control erosion and reduce sedimentation. Site monitoring by the applicant's erosion-control specialist would be undertaken and a follow-up report would be prepared that documents the progress and/or completion of required erosion-control measures both during and after slant well abandonment activities. No synthetic plastic mesh products could be used in any erosion control materials. All plans would be required to show that sedimentation and erosion control measures are installed prior to any other ground disturbing work.

Slant well abandonment could result in potentially significant but mitigable secondary impacts on terrestrial biological resources, including:

- Special-Status Species. See Impact 4.6-1 in Section 4.6.5.1. Implementation of Mitigation Measures 4.6-1a through 4.6-1g, 4.6-1i, 4.6-1n, 4.6-1p, 4.12-1b, and 4.14-2 would reduce impacts to a less-than-significant level.
- Sensitive natural communities and critical habitat. See Impact 4.6-2 in Section 4.6.5.1. Implementation of Mitigation Measures 4.6-1a through 4.6-1d, 4.6-1n, 4.6-1p, 4.6-2a, and 4.6-2b would reduce impacts to a less-than-significant level.
- Introduction or spread of invasive non-native species. See Impact 4.6-5 in Section 4.6.5.1. Implementation of Mitigation Measures 4.6-1a and 4.6-1p would reduce impacts to a less-than-significant level.

Slant well abandonment could result in potentially significant but mitigable secondary impacts related to hazards and hazardous materials, including:

- The potential to encounter contaminated soil/and or groundwater. See Impact 4.7-2 in Section 4.7.5.1. Implementation of Mitigation Measures 4.7-2a and 4.7-2b would reduce the impacts to a less-than-significant level.

Slant well abandonment could result in potentially significant but mitigable secondary impacts on air quality, including:

- The potential to violate ambient air quality standards associated with ozone, NO_2, and, PM_{10}. See Table 4.10-5, Estimated Maximum Daily Construction Emissions, which includes the estimated emissions for construction of the slant wells. Slant well abandonment would produce a fraction of the emissions associated with the slant well construction period since abandonment would take 4 weeks rather than 15 or more months, and because there would be no drilling; construction emissions would only occur as a result of grading, excavation, and earth moving activities. Since slant well abandonment is projected to occur decades after the completion of construction, it would not contribute to total maximum daily project construction emissions, and impacts would be less than significant with mitigation for PM_{10}. Mitigation Measures 4.10-1a through 4.10-1c would apply to slant well abandonment.

Slant well abandonment could result in potentially significant but mitigable secondary impacts on greenhouse gas (GHG) emissions, including:

- The potential to incrementally contribute to climate change from GHG emissions. See Table 4.11-3, Total GHG Emissions from Project Construction, which includes the estimated emissions for construction of the slant wells. Slant well abandonment would produce a fraction of the emissions associated with the slant well construction period since abandonment would take 4 weeks rather than 15 or more months, and because there would be no drilling; construction emissions would only occur as a result of grading, excavation, and earth moving activities. Although slant well abandonment would contribute to overall project (lifetime) emissions, when amortized over the 40-year period described in Impact 4.11-1, these emissions would add only marginally to total annual amortized emissions shown in Table 4.11-5. Impacts would be less than significant with implementation of Mitigation Measure 4.18-1, which would apply to slant well abandonment.

Slant well abandonment could result in potentially significant but mitigable secondary impacts on aesthetic resources, including:

- Nighttime lighting. See Impact 4.14-2 in Section 4.14.6.1. Slant well abandonment could adversely affect nighttime views of this mostly undeveloped stretch of coastline from the viewpoint of Highway 1 motorists and coastal Marina residents. If slant well abandonment involves nighttime lighting, implementation of Mitigation Measure 4.14-2 would reduce impacts to a less-than-significant level.

4.2.6 Cumulative Effects of the Proposed Project

The cumulative scenario and cumulative impacts methodology are described in Section 4.1.7. Table 4.1-2 lists potential cumulative projects.

Impact 4.2-C: Cumulative impacts related to geology, soils, and seismicity. (*Less than Significant with Mitigation*)

Although the Monterey Bay area is located within a seismically active region with a wide range of geologic and soil conditions, these conditions can vary greatly within a short distance. Accordingly, geologic, soils, and seismic impacts tend to be site-specific and depend on the local geology and soil conditions. For these reasons, the geographic scope for potential cumulative geologic and seismic impacts consists of the project component locations and the immediate vicinity. The timeframe during which the MPWSP could contribute to cumulative geology, soils, and seismicity effects includes the construction and operations phases.

Cumulative Impacts during Project Construction

As described in Impact 4.2-1, construction activities have the potential to cause soil erosion and loss of topsoil. Two of the MPWSP's water conveyance pipelines (Castroville and New Desalinated Water Pipelines) and TAMC's Monterey Peninsula Light Rail Project (No. 38 in Table 4.1-2 in Section 4.1) would be constructed adjacent to each other and within the same alignment. The alignments may cross each other at the northern end of the Castroville Pipeline. The Marina Station project (No. 12) would be constructed on either side of Del Monte Boulevard where the new Desalinated Water Pipeline would be constructed. The new Transmission Main would cross through the southwest portion of the area that may be redeveloped as part of the Main Gate Specific Plan (No. 18).

If the projects are constructed at the same time, the erosion effects could be cumulatively significant. However, the state Construction General Permit would require each project to prepare and implement a SWPPP. The SWPPPs would describe BMPs to control runoff and prevent erosion for each project. Through compliance with this requirement, the potential for erosion impacts would be reduced. The Construction General Permit has been developed to address cumulative conditions arising from construction throughout the state, and is intended to maintain cumulative effects of projects subject to this requirement below levels that would be considered significant. For example, two adjacent construction sites would be required to implement BMPs to reduce and control the release of sediment and/or other pollutants in any runoff leaving their respective sites. The runoff water from both sites would be required to achieve the same action levels, measured as a maximum amount of sediment or pollutant allowed per unit volume of runoff water. Thus, even if the runoff waters were to combine after leaving the sites, the sediments and/or pollutants in the combined runoff would still be at concentrations (amount of sediment or pollutants per volume of runoff water) below action levels and would be cumulatively less than significant. Similarly, the impacts of the MPWSP water conveyance pipelines combined with TAMC's Monterey Peninsula Light Rail Project, the Marina Station, the Main Gate Specific Plan, and/or Sanitary Sewer System Rehabilitation Program would not cause a significant cumulative impact related to soil erosion (Impact 4.2-1) and the proposed project's contribution to cumulative impacts on soil erosion would be less than significant.

Two of the MPWSP's water conveyance pipelines (Castroville and New Desalinated Water Pipelines) and TAMC's Monterey Peninsula Light Rail Project (No. 38) would be constructed adjacent to each other and within the same alignment adjacent to active farmland and potentially in areas of sensitive natural communities dependent on the topsoil. If the projects are constructed at the same time, the loss of topsoil impacts could be cumulatively significant, and the proposed project would have a significant contribution to this significant cumulative loss of topsoil. The proposed project's contribution to this impact would be reduced to a less-than-significant level with implementation of **Mitigation Measures 4.6-2b (Avoid, Minimize, and Compensate for Construction Impacts on Sensitive Communities Environmentally Sensitive Habitat Areas)** and **Measure 4.16-1 (Minimize Disturbance on Farmland**) because these measures require that topsoil be salvaged, stockpiled separately from subsoils, and returned to its appropriate location in the soil profile during backfilling activities. Thus, after mitigation, topsoil would be replaced and there would be no substantial residual contribution to a cumulative impact. It is unknown whether the TAMC's Monterey Peninsula Light Rail Project would implement similar mitigation measures, although it is likely that existing regulations would require mitigation measures for sensitive natural communities. In any case, with implementation of the mitigation measures for the proposed project, the proposed project's contribution to a significant cumulative impact would be reduced to a level that is less than significant.

Cumulative Impacts during Project Operations

With the exception of the existing Slant Test Well project (No. 47), which is assumed to become a component of the proposed project, and TAMC's Monterey Peninsula Light Rail Project (No. 38), none of the other projects listed in **Table 4.1-2** would have a footprint that overlaps with that of a proposed project component. The Test Slant Well and TAMC's Monterey Peninsula Light Rail Project are not located on known active faults. The Test Slant Well is not located on expansive soils. Because of the localized nature of the anticipated project impacts, the other projects listed in **Table 4.1-2** would not combine with those of the proposed project to cause or contribute to potential cumulative geologic, soil, or seismic impacts associated with fault rupture (Impact 4.2-2) or expansive soils (Impact 4.2-6) (*no impact*).

As described in Impacts 4.2-3, 4.2-4, and 4.2-7, seismically induced groundshaking, liquefaction and lateral spreading, and corrosive soils could cause pipeline leaks or ruptures. State and local building regulations and standards, described in Section 4.2.2, Regulatory Framework, have been established to address and reduce the potential for such impacts to occur. The proposed project and cumulative projects identified in **Table 4.1-2** would be required to comply with applicable provisions of these laws and regulations. Through compliance with these requirements, the potential for impacts such as pipeline leaks or ruptures would be reduced. As explained in Section 4.2.2, the purpose of the CBC is to regulate and control the design, construction, quality of materials, use/occupancy, location, and maintenance of all buildings and structures within its jurisdiction; by design, it is intended to reduce the cumulative risks from buildings and structures. Therefore, based on compliance with these requirements, the incremental impacts of the proposed project combined with impacts of other projects in the area would not cause a significant cumulative impact related to seismically induced groundshaking (Impact 4.2-3), liquefaction and lateral spreading (Impact 4.2-4), or corrosive soils (Impact 4.2-7) and the proposed project's contribution to cumulative effects would be less than significant.

As discussed in Impact 4.2-5, the Main System-Hidden Hills Interconnection Improvements are proposed for an area with high to moderate landslide susceptibility. As indicated on **Figure 4-1**, there are no cumulative projects in the vicinity of the Main System-Hidden Hills Interconnections Improvements site. Moreover, as discussed in Impact 4.2-5, upon completion of construction activities, the pipeline would be buried below the street, the surface would be restored to the approximate pre-construction paved condition (e.g., slope and drainage), and the risk of the proposed project initiating ground movement would be the same as pre-construction conditions. As a result, the proposed project would not cause or contribute to any potential cumulative effect related to landslide (Impact 4.2-5) (*no impact*).

As discussed in Impact 4.2-8, the proposed project would have no impact related to subsidence caused by the ASR injection/extraction wells or the subsurface slant wells. Because the Slant Test Well would become permanent and operated as part of the MPWSP seawater intake system during proposed project operations, its operational extraction of water is considered as part of the impact analysis for the proposed project and is not an additional extraction within the cumulative scenario. Therefore, the proposed project would not cause or contribute to a cumulative subsidence impact (*no impact*).

As discussed in Impact 4.2-9, the proposed project would have no impact related to exposing people or structures to substantial adverse effects related to alternative wastewater disposal systems. Therefore, the use of alternate wastewater disposal would not cause or contribute to a cumulative alternate wastewater disposal impact (*no impact*).

As discussed in Impact 4.2-10, coastal retreat due to sea level rise is anticipated to result in coastal erosion and bluff retreat. Over time, coastal retreat is anticipated to migrate beaches inland, and structures located within the areas of coastal retreat could become located on beaches. The presence of structures on beaches could exacerbate shoreline erosion and scour and/or be subject to damage or failure associated with severe storm events. Several cumulative projects are located at the coast, particularly the sandy beach areas of Monterey Bay: Fort Ord Dunes State Park Campground (No. 46), Monterey Bay Shores Resort (No. 19), The Collection at Monterey Bay Resort (No. 56), City of Seaside 90-inch Bay Avenue Outfall Phase 1 (No. 43), and City of Sand City Coastal Desalination Plant (No. 6). The exposure of structures on the beach from one or more of these sites could result in increased scour and erosion that could be cumulatively significant. Because over the project lifetime, the subsurface slant well casings, concrete well head vaults, electrical panels, and certain sections of conveyance pipelines could become located on the beach and therefore could exacerbate shoreline erosion and scour, the proposed project would have a significant contribution to this significant cumulative impact. The proposed project's contribution would be reduced to a less-than-significant level through implementation of **Mitigation Measure 4.2-10 (Slant Well Abandonment Plan)**, which would require CalAm to monitor coastal retreat rates and initiate well decommissioning before the subsurface slant wells become located on the active beach. Thus, after mitigation, no project structures would become located on the active beach, and the residual contribution to a cumulative impact related to coastal erosion would be negligible. One project, the CEMEX Removal Plan and Reclamation Plan (No. 63), would end sand mining at the CEMEX site, remove structures from the beach, and implement reclamation practices that may slow coastal retreat at this location compared to rates of retreat with sand mining, though to an unknown extent. It is unknown whether the other listed cumulative projects also have plans to remove structures from the beach prior to exposure or install protective structures in the event that coastal retreat reaches their structures. In any case, with implementation of the mitigation measure, the proposed project's contribution to a significant cumulative impact related to coastal erosion would be reduced to a level that is less than significant.

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