4.4—GEOLOGY AND SOILS

BENCHMARK RESOURCES

4.4—GEOLOGY AND SOILS

This section of the subsequent environmental impact report (SEIR) describes the local and regional geologic, soils, and seismic conditions that occur in the vicinity of the project site. These conditions are described and evaluated to ensure that project facilities or personnel would not be significantly affected by seismic hazards, such as ground rupture or ground shaking caused by seismic activity, and that quarry slopes would not present physical hazards as a result of ground shaking or landslides.

The information in this section is based on applicant-prepared studies and publicly available sources. The applicant-prepared studies used are:

- *Geotechnical Investigation SMP-23 Reclamation, Alameda County California* (Geocon 2019a) (Appendix E-1, "Geotechnical Investigation SMP-23 Reclamation," of this SEIR) and
- *Geotechnical Investigation/Slope Stability Analysis, Cemex Eliot—Arroyo Del Valle Realignment at Lake B, Alameda, California* (Geocon 2019b) (Appendix E-2, "Geotechnical Investigation/Slope Stability Analysis for ADV," of this SEIR).

Questa Engineering Corporation (Questa) was retained by the County to peer review the two Geocon reports. Questa peer reviewed the reports in April 2019, requesting revisions and additional information, to which Geocon responded by preparing "Response to Comments for Geotechnical Investigations, CEMEX Eliot Quarry (SMP 23)" and revised reports (see Appendix E) dated December 31, 2019. In March of 2020, Questa found that the Response to Comments provided adequate information, and the revised reports addressed comments as presented in the April 2019 memorandum.

4.4.1 Geological and Soil Conditions at the Time of the LAVQAR EIR

The *Livermore-Amador Valley Quarry Area Reclamation Specific Plan Environmental Impact Report* (LAVQAR EIR) describes quarrying at the project site as limited to the upper layer of gravel deposits, the first (uppermost) aquifer, to protect groundwater in the lower aquifers. In most of the area north of Stanley Boulevard, a deep mantle of sedimentary soils known as overburden must be removed to reach the sand and gravel deposit. South of Stanley Boulevard, little overburden and no substantial clay layers were present at the time of the certification of the LAVQAR EIR.

The LAVQAR EIR also describes sedimentary soils overlying the Quarry Area as generally deep, well-drained, and gently sloping. In the project area, the undisturbed land surface elevation increased from 350 feet on the west to 400 feet on the east. Furthermore, about 1,750 acres of the 3,820-acre Quarry Area were considered prime agricultural soils. About 500 acres, mostly along Arroyo del Valle (ADV), were classified as Riverwash, coarse gravelly material not suited to cultivation. Another 970 acres were gravel pits, most of which were formerly covered with prime agricultural soils. The remaining 500 acres consisted of various types of nonprime soils. Most of these non-prime soils (about 400 acres) were of the Livermore Series, uniquely suited for growing grapes for the production of white wine (Alameda County 1980: 7-8, 18).

4.4.2 Environmental Setting

Eliot Quarry is located in Alameda County, California, at latitude 37E39'19" north, longitude 121E48'20" west in the U.S. Geological Survey (USGS) 7.5-minute Altamont quadrangle map. Surface elevations along Lakes A, B, and the North Reclamation Area vary between approximately 380 feet and 450 feet mean sea level (msl). Mining has occurred below these elevations down to approximately elevation 251 feet msl in the Lake J area (CEMEX 2019). The pit slopes are generally bare and partially covered with light vegetation.

4.4.2.1 Site Lithology

The original surficial soil mapping was completed by the U.S. Soil Conservation Service (SCS) in 1957, which determined that the site consisted of mostly Holocene with some Pleistocene and Pliocene Alluvium (see Figure 4.4-1, "Site Geology Map"). The Holocene and Pleistocene epochs are the most recent geologic time periods.

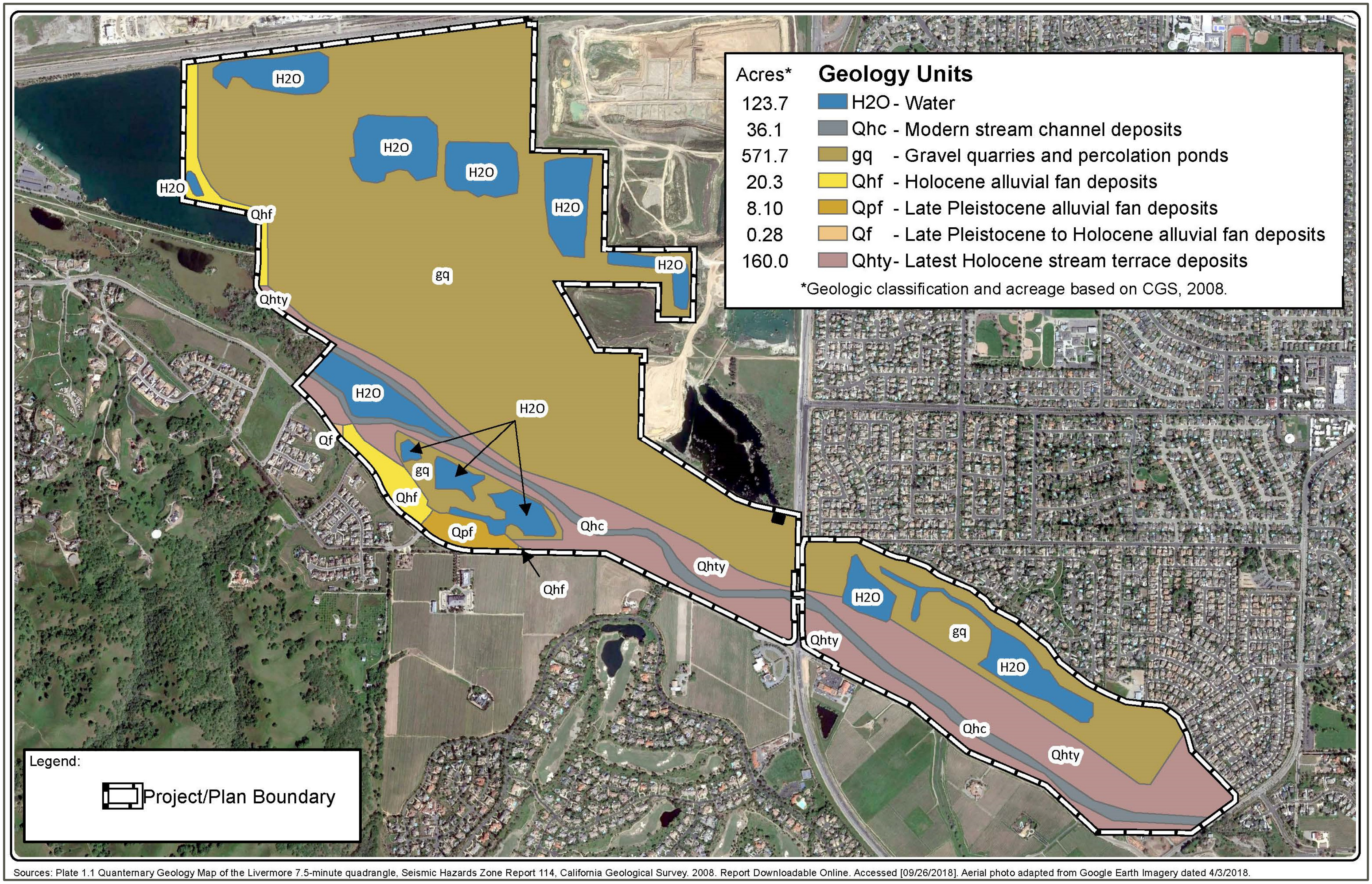
Alluvium is a geologic term for material that has been deposited by flowing water, usually caused by large storm events, and often contains clay, silt, sand, and gravel. Flowing water transports the sediment from high to low topographic areas, where the stream energy is dissipated, depositing the sediment. Geologic deposits are described by their age relative to surrounding earth materials.

The California Department of Water Resources (DWR) (1966) performed a detailed investigation of groundwater in the Livermore and Sunol Valleys. The report notes that the site contains Upper and Lower Livermore gravels and an overlying Quaternary Alluvium. A high percentage of the alluvium was eroded and transported to the Upper Livermore sediment, which is why it was often difficult to differentiate between the two.

More recent studies conducted in the Livermore Valley identified three units within the Livermore Formation: the Lower Livermore, Upper Livermore, and Quaternary Alluvium. At the Eliot Quarry, CEMEX is mining Quaternary Alluvium and possibly the Upper Livermore gravels that underlie much of the Livermore Valley.

The Lower Livermore unit contains deposits ranging in age from middle Pliocene to lower Pleistocene, with measured surface stratigraphy containing approximately 50 percent sand, 40 percent silt and mud, and 10 percent pebble- to cobble-sized gravel. Tuff-bearing beds are also interlayered throughout (USGS 1989a, cited in EMKO 2020). These beds are well defined by their grain size, indicating a change in energy of the depositional environment, and in this case, a stream. The type of stream present at the time of deposition was a Platte-type braided stream flowing from the southwest, with the gravel source generally being the Altamont area (USGS 1989a, cited in EMKO 2020).). This braided stream was the cause of the repeating, discontinuous, sedimentary beds, which lead to lenses of silt, sand, clay, and gravel. During the constant deposition and erosion of the Lower Livermore, there was volcanic activity to the north, which resulted in discontinuous ash deposits. Subsequently, a gentle uplifting developed in the Livermore Valley caused by regional tectonics. This uplifting caused the stream flow to change direction, with the source in the Coast Range, south of the Altamont area. This change in provenance marks the base of the Upper Livermore bed, which is marked by an abrupt change in lithology accompanied by an erosional unconformity at the top of the Lower Livermore bed.

The Upper and Lower Livermore units were deposited during the early Pleistocene by braided streams of various energy levels. The source area for the Upper Livermore is believed to be the Franciscan Complex to the south and east of the Livermore Valley. The clasts present in the strata consist of a high percentage of greywacke (USGS 1989a, cited in EMKO 2020). Repeating and discontinuous clay, silt, sand, and gravel beds present within the unit provide the evidence of a braided stream depositional environment. These features are similar to those in the Lower Livermore, but less clay and silt is present in the Upper Livermore. Although it may appear superficially gravelly, close examination reveals an abundance of impermeable fines.



SOURCE: CEMEX 2019, Reclamation Plan, Figure 8; modified by Benchmark Resources in 2020.

NOTE: Figure is not printed to scale.

BENCHMARK RESOURCES

Site Geology Map

ELIOT QUARRY SMP-23 SEIR

Figure 4.4-1

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The USGS investigators used the gravels around Livermore to construct a geologic history of the area. USGS reviewed previous geological maps and studies, conducted field work, and compiled results in an open-file USGS report (USGS 1989b). The report detailed braided stream depositional environments, tuff deposits, discontinuities by means of erosional surfaces, an unconformity seen by an abrupt lithology change between the Upper and Lower Livermore units, and overbank deposits. No mention of lacustrine deposits was included in the report.

4.4.2.2 Site Hydrogeology

The information presented in this section has been summarized primarily from Alameda County Flood Control and Water Conservation District, Zone 7 (2011), Jones and Stokes (2005, cited in EMKO 2020), and other Zone 7 data. Additional interpretation is also provided based on borehole data obtained by CEMEX in coordination with Zone 7 in 2018. An overview of the project site geology is provided in Figure 4.4-1.

The project site is located within the Livermore-Amador Valley, an east-west trending inland alluvial basin located in northeastern Alameda County. An alluvial basin is a valley that has been filled with sediments deposited predominantly by streams and rivers. The basin is surrounded primarily by north-south trending faults and hills of the Diablo Range. The Livermore-Amador Valley encompasses approximately 42,000 acres, is about 14 miles long (east to west), and varies from 3 to 6 miles wide (north to south). The Livermore Valley Groundwater Basin is located in the central part of the Livermore-Amador Valley. The Main Basin is a part of the Livermore Valley Groundwater Basin that contains the highest yielding aquifers and the best groundwater quality. Lake A and Lake B are located within the southeast corner of the Main Basin.

The Livermore-Amador Valley is partially filled with alluvial fan, stream, and lake deposits, collectively referred to as alluvium. The alluvium in the valley consists of unconsolidated gravel, sand, silt, and clay. Alluvial fans occur where streams and rivers from hilly or mountainous areas enter a valley and deposit very coarse sediment, primarily sand and gravel. The silt and clay were deposited in floodplain areas or lakes that developed at different times across the basin. The alluvium is relatively young from a geologic perspective, being deposited during the Pleistocene and Holocene geologic epochs (younger than 1.6 million years old). In the west-central area of the basin, the alluvium is up to 800 feet thick, but thins along the margins of the valley.

The southeastern and central parts of the Main Basin area contain the coarsest alluvial fan deposits. These alluvial fan deposits were formed by the ancestral and present ADV and Arroyo Mocho. The coarse alluvial fan deposits are economically important aggregate deposits, which has resulted in the widespread aggregate mining in the Main Basin area. Recent investigations conducted on behalf of Zone 7 (2011) have been used to refine the interpretation of subsurface conditions based on specific stratigraphic depositional sequences, or the specific layering of the sediments that occur from changes in the conditions at the time the aggregate material was deposited. Drill-hole data and aquifer pumping tests conducted by Zone 7 (2011) show that in parts of Lake B and in the Lake J area, clay layers are generally not present, consistent with the alluvial fan depositional environment.

The aggregate materials present in the southeastern part of the Amador subbasin were deposited by ancestral streams that flowed in the same areas from which the ADV and Arroyo Mocho currently originate within the Livermore highlands to the south (DWR 1966). While lakes formed intermittently in the central and western parts of the basin, the area south of Stanley Boulevard, in the current area of

Lakes B, C, and D of the Chain of Lakes, and Lake J, was part of a large alluvial fan system emanating from the hills to the south (Alameda County 1980).

The ancestral stream channels for the ADV and Arroyo Mocho were identified by DWR (1966). In the area south of Stanley Boulevard and west of Isabel Avenue, the ancestral channel of the ADV deposited approximately 90 feet of coarse-grained aquifer material within the 100-foot interval between 100 to 200 feet below ground surface (bgs). The ancestral ADV channel is located along the northern and northeastern sides of Lake B. The Quaternary Alluvium is not present in this depth interval east of Isabel Avenue and south of Alden Lane, in the area of Lake A.

Deposition associated with the ancestral ADV channel within the depth interval down to 100 feet bgs extends east of Vallecitos Road. In the western part of Lake A, the eastern part of Lake B, along the north side of Lake B, and through Lake J, the coarse-grained aquifer deposits comprise over 90 percent of the material deposited by the ancestral ADV. It is also important to note that, while the ancestral stream channel follows the current stream channel in the Lake A area, the ancestral channel turned to the north in the Lake B area and then paralleled the current location of Stanley Boulevard.

See Appendices E-1 and E-2 for details on the drill hole data.

4.4.2.3 Surface Fault Rupture

The project site is not located within a State-designated Alquist-Priolo Earthquake Fault Zone designated by the California Geological Survey (CGS). The nearest fault is the Las Positas Fault, located approximately 3 miles to the southeast. The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards (Geocon 2019a).

4.4.2.4 Liquefaction Potential

Soil liquefaction is a phenomenon that occurs when saturated, cohesionless soil layers lose strength during cyclic loading, as caused by earthquakes. During the loss of strength, the soil acquires "mobility" sufficient to permit both horizontal and vertical movements. Soils that are most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands that lie below the groundwater table within a depth usually considered to be about 50 feet. The factors known to influence liquefaction potential include soil type and depth, grain size, density, groundwater level, degree of saturation, and both the intensity and duration of ground shaking. The portion of the project site located east of Isabel Avenue (the Lake A area) and a southern portion of Lake B is mapped as having the potential for liquefaction (Parrish 2008).

4.4.2.5 Ground Lurching and Seismically Induced Landsliding

Ground lurching is the horizontal movement of ground located adjacent to slope faces caused by seismic forces exerted during an earthquake. It can occur in areas underlain by soft or weak deposits and often results in permanent displacement and longitudinal cracking parallel to the slope face at some distance setback from the top of the slope. In steep slope areas, significant ground shaking may cause landslides or rock slope failures. The northwestern portion of the side is mostly flat; however, the sloped areas of the mined excavations on-site are mapped as areas mapped as having the potential for landslides (see Figure 4.4-1) (Parrish 2008).

4.4.2.6 Lateral Spreading

Seismically induced lateral spreading involves lateral movement of earth materials due to ground shaking. Lateral spreading is characterized by near-vertical cracks with predominantly horizontal movement of the soil mass involved along potentially liquefiable layers. The potential for lateral spread on the project site is low because no faults are on-site.

4.4.2.7 Soils and Soil Hazards

Multiple soil types occur on the project site; they are described below (see Figure 4.4-2, "Soils") (SCS 1966):

Gravel pit: The land type consists of deep excavations that have water in the bottom in most places. They are usually clear of plant growth.

Livermore gravelly loam: The soil is finer textured throughout and has less gravel than Livermore very gravelly course sandy loam. Most areas of this soil are nearly level and have slopes of 3 percent or less. Some areas, however, are gently sloping and have slopes as much as 7 percent. The available water holding capacity is low. The soil is somewhat excessively drained.

Livermore very gravelly coarse sandy loam: This soil is mostly in large bodies and is nearly level to gently sloping (0 to 7 percent). A few areas are moderately steep. The texture of the surface soil ranges from very gravelly coarse sandy loam to very gravelly loam or gravelly loam. The soil is somewhat excessively drained and has rapid permeability. Runoff is very slow to slow, and the available water holding capacity is very low. The soil has low fertility. The erosion hazard is slight when the soil is cultivated.

Pleasanton gravelly loam, 0 to 3 percent slopes: Most of this soil is in large bodies on nearly level terraces or fans. The color of the surface soil is light brownish gray, grayish brown, pale brown, or yellowish brown. The texture ranges from gravelly loam or loam to light clay loam. In areas transitional to the Rincon soils, substratum is slightly calcareous. The permeability of the subsoil is moderately slow. Runoff is slow, and the available water holding capacity is moderate. If the soil is cultivated, the erosion hazard is slight.

Pleasanton gravelly loam, 3 to 12 percent slopes: Except for steeper slopes, this soil is similar to Pleasanton gravelly loam, 0 to 3 percent slopes. It is generally gently sloping to rolling, but in places it is moderately steep. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Positas gravelly loam, 2 to 20 percent slopes: This soil primarily consists of deep and very deep, moderately well drained soils that formed in alluvial material from mixed rock sources. The surface soil is brown, medium acid gravelly loam. It is underlain by reddish-brown, medium acid to mildly alkaline clay subsoil. Most of this soil is in large bodies on smooth, gently sloping to strongly sloping high terraces. Runoff is slow to medium, and the available water holding capacity is low. The erosion hazard is slight to moderate on cultivated areas.

Riverwash: This land type occurs throughout the valleys. The areas are typically very gravelly or stony. The vegetation consists mainly of patches of annual grasses and scattered oaks.

Yolo loam, 0 to 3 percent slopes: This soil occurs mostly in large bodies on nearly level valley floors. The color of the surface soil ranges from dark grayish brown or grayish brown to brown. The texture ranges from fine sandy loam to light clay loam. The depth to lime ranges from 24 inches to 5 feet or more. A small area of this soil has a dark-gray, clayey substratum at 24 to 36 inches. Also, some small areas are gravelly throughout the profile. In a few places an intermittent water table is within a depth of 5 fret, and the substratum has common, fine, distinct, rust-colored mottles. This soil is well drained and moderately permeable. Runoff is very slow to slow and the available water holding capacity is high. The erosion hazard is slight in cultivated areas.

Yolo sandy loam, 0 to 3 percent slopes: Except for coarser texture, this soil is similar to Yolo loam, 0 to 3 percent slopes. Permeability is moderately rapid, and the available water holding capacity is moderate.

Yolo loam over gravel, 0 to 3 percent slopes: This soil occurs in narrow stringers on nearly level valley floors. It is underlain by loose, porous gravelly sand at a depth of 24 to 36 inches. The available water holding capacity is moderate to low. A few small areas have a gravelly loam surface layer.

Zamora silt loam, 0 to 4 percent slopes: Except for coarser texture, this soil is similar to Zamora silty clay loam, 0 to 3 percent slopes, which is described as occurring mostly in large bodies on nearly level floodplains. The surface soil ranges from grayish brown or dark grayish brown to dark brown. The texture ranges from heavy silt loam or silty clay loam to clay loam. In areas transitional to Rincon series, the subsoil is more distinct and slightly finer textured. The substratum ranges from brown to yellowish brown in color. In some areas it is noncalcareous. This soil is well drained. Permeability is moderately slow. Runoff is slow, and the available water holding capacity is high.

Geologic hazards associated with soil characteristics include erosion, expansion ("shrink-swell" patterns), and settlement and subsidence, as described below.

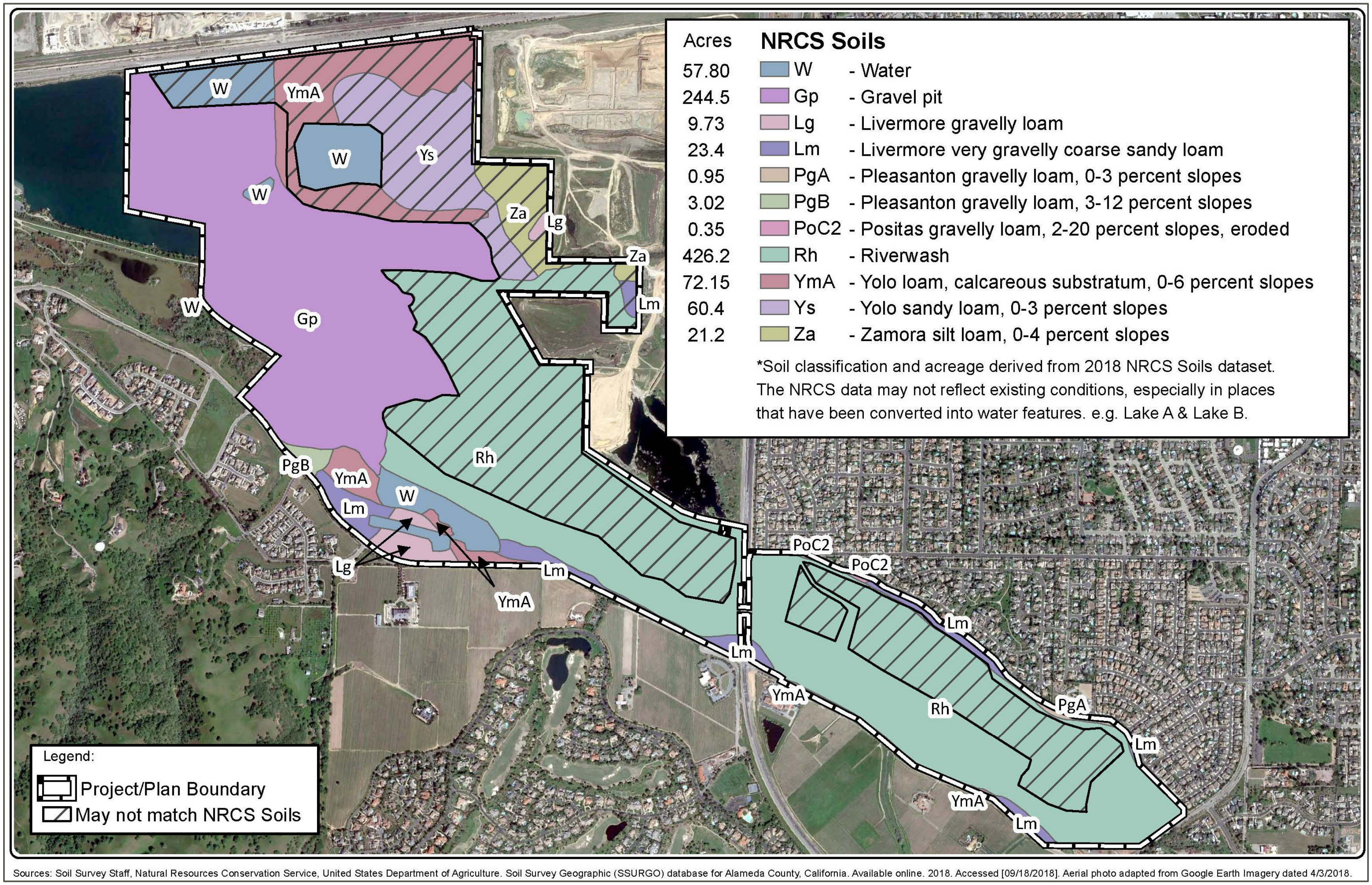
Erosion: Soil erosion occurs when surface materials are worn away from the earth's surface because of land disturbance and/or natural factors such as wind and precipitation. The potential for soil erosion is determined by characteristics including texture and content, surface roughness, vegetation cover, and slope grade and length. Wind erosion typically occurs when fine-grained noncohesive soils are exposed to high-velocity winds. Water erosion tends to occur when loose soils on moderate to steep slopes are exposed to high-intensity storm events. Surface soils on the project site generally comprise gravel, sand, clay, and silt.

Within the project site, erosion is an ongoing process that will continue primarily within the ADV and washes where periodic flooding and sedimentation (transport) occur during and following periods of intense rainfall.

Expansion: Soils that expand and contract in volume ("shrink-swell" pattern) are considered expansive and may cause damage to infrastructure as a result of density changes that shift overlying materials. Fine-grain clay sediments are most likely to exhibit shrink-swell patterns in response to changing moisture levels.

Seismically Induced Settlement and Subsidence: Earthquake-induced settlement is compression of the underlying loose soils caused by liquefaction or densification that occur during strong ground shaking and causes uneven settlement of the ground surface. The potential for soil liquefaction exists on portions of the site, and accordingly, the potential for liquefaction-induced settlement exists on those portions of the site (see Figure 4.4-1).

The risk of settlement caused by earthquakes from densification of the dry alluvium material is considered to be low to medium. The Quaternary Alluvium consists of stream- and lake-deposited sediments including various mixtures of gravel, sand, silt, and clay. It is largely unconsolidated and overlies the Livermore Formation in the valleys. The Quaternary Alluvium has been eroded and redeposited in some areas within the site location.



SOURCE: CEMEX 2019, Reclamation Plan, Figure 10; modified by Benchmark Resources in 2020.

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BENCHMARK RESOURCES

Soils

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In areas of Quaternary Alluvium the risk of settlement is medium. The Livermore Formation consists of unconsolidated to semi-consolidated beds of gravel, sand, silt, and clay. Limey concretions are fairly common in the Livermore Formation's lower portion, and tuffaceous beds are present at its base. Thus, the risk of settlement related to the Livermore Formation is considered to be low.

4.4.2.8 Paleontological Resources

Paleontological sensitivity is a qualitative assessment based on the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and other factors relevant to fossil preservation and potential yield. According to the Society of Vertebrate Paleontology (SVP) (2010), standard guidelines for sensitivity are (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or to yield a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data. Definitions of SVP paleontological sensitivity ratings are provided below.

- **High Sensitivity**. Indicates fossils are currently observed on site, localities are recorded within the study area, and/or the unit has a history of producing numerous significant fossil remains.
- **Moderate Sensitivity**. Fossils within the unit are generally not unique, or are so poorly preserved as to have only moderate scientific significance.
- **Low Sensitivity**. Indicates significant fossils are not likely to be found because of a random fossil distribution pattern, extreme youth of the rock unit, and/or the method of rock formation, such as alteration by heat and pressure.
- **Marginal Sensitivity**. Indicates the limited probability of the geologic unit composed of either pyroclastic or metasedimentary rocks conducive to the existence and/or preservation of fossils.
- **Zero Sensitivity**. Origin of the geologic unit renders it not conducive to the existence of organisms and/or preservation of fossils, such as high-grade metamorphic rocks, intrusive igneous rocks, and most volcanic rocks.
- **Indeterminate Sensitivity**. Unknown or undetermined sensitivity indicates that the geologic unit has not been sufficiently studied, or lacks good exposures to warrant a definitive rating. An experienced, professional paleontologist can often determine whether the stratigraphic unit should be categorized as having high or low sensitivity after reconnaissance surveys, including observations of road cuts, stream banks, and possible subsurface testing, such as augering or trenching.

4.4.3 Regulatory Setting

The following sections discuss federal, state, and local regulations pertaining to geology and soils.

4.4.3.1 Federal

U.S. Geological Survey Landslide Hazard Program

To fulfill the requirements of Public Law 106-113, USGS created the National Landslide Hazards Program to reduce long-term losses from landslide hazards by improving understanding of the causes of ground failure and suggesting mitigation strategies. The Federal Emergency Management Agency is the responsible agency for the long-term management of natural hazards.

4.4.3.2 State

Alquist-Priolo Earthquake Fault Zone Act

The project site is not located within a State-designated Alquist-Priolo Earthquake Fault Zone (Geocon 2019a). The State Alquist-Priolo Earthquake Fault Zoning Act of 1972 (Alquist-Priolo Act) was passed to mitigate the hazards associated with surface faulting in California. Administered by the California Department of Conservation (DOC), the Alquist-Priolo Act prevents construction of buildings used for human occupancy on the surface traces of active faults. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults.

Seismic Hazards Mapping Act

The 1990 Seismic Hazards Mapping Act and related regulations establish a statewide minimum public safety standard for mitigation of earthquake hazards. The purpose of this act is to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure as well as other hazards caused by earthquakes. This act provides the minimum level of mitigation needed to reduce the risk of a building collapse. Under this act, the lead agency can withhold permits until geologic investigations are conducted and mitigation measures are incorporated into building plans. In addition, the act addresses not only seismically induced hazards but also expansive soils, settlement, and slope stability. The program and actions mandated by this act closely resemble those of the Alquist-Priolo Act by requiring:

- the State Geologist to delineate various "seismic hazard zones" and
- cities, counties, and/or other local permitting authority to regulate certain development "projects" within these zones by withholding the development permits for a site until the geologic and soil conditions are investigated and appropriate mitigation measures (if required) are incorporated into development plans.

California Building Code

The California Building Code (CBC), known as Title 24, CCR, Part 2, specifies the acceptable design and construction requirements associated with various facilities or structures. The CBC is administered and updated by the California Building Standards Commission. The CBC specifies criteria for open excavation, seismic design, and load-bearing capacity directly related to construction in the State. The CBC augments the International Building Code (IBC) and provides information for specific changes to various sections in it. The seismic building requirements under the CBC are more stringent than the IBC. The design and construction of engineered facilities in the state of California must comply with the requirements of the IBC (International Code Council 2018) and the adoptions to that code by the CBC.

Surface Mining and Reclamation Act

Mineral Resource Zones

California's Surface Mining and Reclamation Act of 1975 (SMARA) requires the State Geologist to classify land into Mineral Resource Zones (MRZs) based on the known or inferred mineral resource potential of that land. The process is based solely on geology, without regard to existing land use or land ownership. The primary goal of mineral land classification is to help ensure that the mineral resource potential of lands is recognized and considered in the land-use planning process. The project site is classified as MRZ-2, which is defined as "Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood of their presences exists" (Stinson et al 1982).

Slope Stability

SMARA is flexible with respect to addressing geotechnical slope stability for final reclamation slopes. SMARA does not specify a minimum factor of safety for slope stability. However, CCR Section 3502(b)(3) indicates that final reclaimed slopes shall be flatter than the critical gradient, which implies that static factors of safety should be greater than 1.0. The section further states:

> Whenever final slopes approach the critical gradient for the type of material involved, regulatory agencies shall require an engineering analysis of the slope stability. Special emphasis on slope stability and design shall be necessary when public safety or adjacent property may be affected.

CCR Section 3502(b)(4) states that:

> Areas mined to produce additional materials for backfilling and grading, as well as settlement of filled areas, shall be considered in the reclamation plan. Where ultimate site uses include roads, building sites, or other improvements sensitive to settlement, the reclamation plans shall include compaction of the fill materials in conformance with good engineering practice.

CCR Section 3704(d) states that:

> Final reclaimed fill slopes, including permanent piles or dumps of mine waste rock and overburden, shall not exceed 2:1 (horizontal:vertical), except when site-specific geologic and engineering analysis demonstrate that the proposed final slope will have a minimum slope stability factor of safety that is suitable for the proposed end use, and when the proposed final slope can be successfully revegetated.

CCR Section 3704(f) states that:

> Cut slopes, including final highwalls and quarry faces, shall have a minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use.

4.4.3.3 Local

East County Area Plan

The site is located in a portion of the County where the *East County Area Plan* serves as the applicable general plan document. The following goals and policies contained within the *East County Area Plan* and pertain to geology and soils. The project's consistency with the goals and policies is evaluated in Section 4.7, "Land Use and Planning," of this SEIR.

Soil and Slope Stability

Goal: To minimize the risks to lives and property due to soil and slope instability hazards.

Goal: To minimize the risks to lives and property due to seismic and geologic hazards.

Alameda County Specific Plan for the Livermore-Amador Valley Quarry Area Reclamation (1981)

As part of LAVQAR (Alameda County 1981), quarry operators in the Livermore-Amador Valley are required to excavate basins for future use by Zone 7 for groundwater storage, conveyance, and recharge facilities collectively and commonly known as the "Chain of Lakes." LAVQAR requires the mining operators to dedicate to Zone 7 all excavated basins within the LAVQAR area. The following aspects of LAVQAR relate to geology and soils:

Policy 17: Final side slopes of pits shall be governed by provisions of the Alameda County Surface Mining Ordinance.

Alameda County Code of Ordinances

The Alameda County Surface Mining Ordinance (Chapter 6.80) includes the following provisions related to geology and soils:

6.80.210—Mining

A. Slopes.

1. Finished slopes shall conform to the requirements of Section 6.80.240E.
2. Temporary slopes steeper than the finished slopes, in areas where finished slopes are to occur, shall be constructed and maintained in accordance with the recommendations, as approved by the director of community development or the deputy director designee, of a soil engineer or a civil engineer registered in the state or an engineering geologist registered and certified in the state. Temporary slopes shall not be created or maintained in a manner that will interfere with the construction of finished slopes conforming to subsection (A)(1) of this section, and the soil engineer or engineering geologist shall make specific recommendations for the conversion of such temporary slopes to finished slopes.

H. Erosion, Sedimentation and Pollutant Discharge.

1. During the period mining operations are being conducted, and prior to final reclamation of mined lands, the operator shall take measures to prevent erosion of adjacent lands from water discharged from the site of mining operations and the off-site discharge of sediment. Such measures may include the construction of properly designed retarding basins, settling ponds and other water treatment facilities, ditches, diking and revegetation of slopes. No discharge of sediment to off-site bodies of water shall be permitted that will result in higher concentrations of silt than existed in off-site waters prior to mining operations.
2. Stockpiles of overburden and minerals shall be managed to minimize water and wind erosion.
3. The removal of vegetation and overburden in advance of surface mining shall be kept to a minimum.

J. Salvage of Topsoil

Topsoil suitable for use in revegetation shall be stockpiled at the site of mining operations in an amount up to that necessary for future reclamation.

6.80.240—Reclamation and Reclamation Plans

C. Drainage, Erosion and Sediment Control.

1. Any temporary stream or watershed diversion shall be restored in final reclamation unless determined unnecessary by the planning commission based on recommendation of the county flood control and water conservation district and/or public works agency.
2. Regrading and revegetation shall be designed and carried out to minimize erosion, provide for drainage to natural outlets or interior basins designed for water storage, and to eliminate potholes and similar catchments that could serve as breeding areas for mosquitoes.
3. Silt basins which will store water during periods of surface runoff shall be equipped with sediment control and removal facilities and protected spillways designed to minimize erosion when such basins have outlet to lower ground.

4. Final grading and drainage shall be designed in a manner to prevent discharge of sediment above natural levels existent prior to mining operations.
5. Upon reclamation, no condition shall remain that will or could lead to the degradation of water quality below applicable standards of the regional water quality control board or any other agency with authority over water quality.

E. Final Slope Gradient.

Final slopes shall be of such gradient as necessary to provide for slope stability, maintenance of required vegetation, public safety, and the control of drainage, as may be determined by engineering analysis of soils and geologic conditions and by taking into account probable future uses of the site. Final slopes shall not be steeper than two feet horizontal to one foot vertical (2:1) unless the applicant can demonstrate to the satisfaction of the planning commission that any such steeper slope will not:

1. Be incompatible with the alternate future uses approved for the site;
2. Be hazardous to persons that may utilize the site under the alternate future uses approved for the site; and
3. Reduce the effectiveness of revegetation and erosion control measures where such are necessary.

In no event shall the steepness of slopes exceed the critical gradient as determined by an engineering analysis of the slope stability.

F. Backfilling and Grading.

Backfilled and graded areas shall be compacted to avoid excessive settlement and to the degree necessary to accommodate anticipated future uses. If future use of the site contemplates structures for human occupancy, fill placement shall conform to the Uniform Building Code except that alternate methods of backfilling and grading may be utilized when incorporated in the approved reclamation plan. Material used in refilling shall be of a quality suitable to prevent contamination and pollution of groundwater.

G. Resoiling.

Resoiling shall be accomplished in the following manner: coarse, hard material shall be graded and covered with a layer of finer material or weathered waste and a soil layer then placed on this prepared surface. Where quantities of available soils are inadequate to provide cover, native materials should be upgraded to the extent feasible for this purpose.

4.4.4 Significance Thresholds and Analysis Methodology

4.4.4.1 Significance Criteria

Based on Appendix G of the CEQA Guidelines, the proposed project would have a significant impact to geology and soils if it would:

a) directly or indirectly cause potential substantial adverse effects, involving the risk of loss, injury, or death involving;
   - rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zone Map issued by the State Geologist for the area or based on other substantial evidence of known fault (Refer to Division of Mines and Geology Special Publication 42),

- strong seismic ground shaking,
- seismic-related ground failure, including liquefaction, or
- landslides;

b) result in substantial soil erosion or the loss of topsoil;

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

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

e) have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater; or

f) directly or indirectly destroy a unique paleontological resource or site or unique geological feature.

Regarding threshold e, as described in Appendix A-1, "Initial Study," the project would not include supporting the use of septic tanks or changes to the existing waste water disposal systems; therefore, this issue requires no further consideration.

4.4.4.2 Analysis Methodology

Evaluation of the geology and soils impacts in this section is based on information from published maps, reports, and other documents that describe the geologic, seismic, and soil conditions of the project area, and on professional judgment. The analysis assumes that the project proponents will conform to the latest CBC standards, County General Plan, LAVQAR, *East County Area Plan*, seismic safety standards, county grading ordinance, and National Pollutant Discharge Elimination System requirements.

Regarding the slope stability analysis for SMP-23 and the ADV realignment (Geocon 2019a and 2019b), a Factor of Safety (FS) was used to determine the stability of a slope. FS is the ratio of the resistance that can be mobilized to the driving forces that would cause a failure. Rocks and soil have an inherent strength called shear strength to resist failure. Characteristics in slopes that govern the driving forces are the weight of the materials, slope and strata angles, the presence of water, and accelerations caused by a seismic event. For slope stability in general, a Factor of Safety of 1.5 for static and 1.0 for seismic conditions are accepted as standard-of-practice minimum values. A Factor of Safety higher than the minimum is not a guarantee that slope failure is impossible. However, it does indicate that the possibility has been found from experience to be negligible.

Geocon evaluated slope stability (see Appendix E-1) using the computer program SLOPE/W (Version 7.23 by Geo- Slope International). The analysis for the slope adjacent to the realigned ADV considered circular failure modes, which were determined in previous studies to be the most critical slope failure mode (versus polygonal or wedge failures) under static and seismic conditions. Geocon also analyzed the stability of block failure modes for the Lake B Southeast slope adjacent to Isabel Avenue (State Route 84). The analysis was performed in general accordance with CGS Special Publication 117A and an earlier, related guidance document published by the Southern California Earthquake Center (SCEC). Per the procedures recommended by SCEC, the analysis used Spencer's Method. Spencer's Method satisfies both force and moment equilibrium conditions and SCEC recommends it be used for the analysis of failure surfaces of any shape.

For seismic conditions, a pseudo-static approach is used in which the weight of the material is increased by a seismic coefficient to simulate the effects of additional ground acceleration. The standard of practice is described in *2008 Guidelines for Evaluating and Mitigating Seismic Hazards in California*, Special Publication 117A (CGS 2008, cited in Geocon 2019). A seismic coefficient of 0.21 was prescribed for Lake A and 0.16 for Lake B. Because of Lake J's proximity to Stanley Boulevard, the conservative 0.21 seismic coefficient was used for the analyses. For subsurface conditions pertinent to the ADV realignment and adjacent Lake B mining pit, Geocon reviewed selected exploratory borings performed as part of the 2015 KANE Slope Stability Evaluation (Kane 2015). The borings were performed in April 2013 using a Becker Hammer drill rig. Table 3.2A of Appendix E-1 summarizes the details of the borings. To supplement this subsurface information, Geocon excavated ten exploratory test pits (TP1 through TP10) on December 22, 2016 using Komatsu 240 and Caterpillar 325 excavators equipped with 36-inch-wide buckets. Geocon also performed a detailed site reconnaissance on December 22 and 23, 2016. In addition, Geocon performed two borings (Borings B3 and B4) as part of the 2019 geotechnical investigation for the SMP 23 Reclamation Plan Amendment project (see Appendix E-1).

Questa Engineering Corporation (Questa) was retained by the County to peer review the two Geocon reports. Questa peer reviewed the reports in April 2019, requesting revisions and additional information, to which Geocon responded by preparing "Response to Comments for Geotechnical Investigations, CEMEX Eliot Quarry (SMP 23)" and revised reports (see Appendix E) dated December 31, 2019. In March of 2020, Questa found that the Response to Comments provided adequate information and the revised reports addressed comments as presented in the April 2019 memorandum.

4.4.5 Project Impacts and Mitigation Measures

4.4.5.1 LAVQAR EIR Impact Analysis

Under the LAVQAR EIR, geology and soils impacts were determined to be less than significant with mitigation or less than significant without the need to incorporate mitigation; however, paleontological resources were not addressed. The approved 1981 project included disturbing and reclaiming significantly more surface area compared to the proposed project, due to the proposed ADV realignment and reduced Lake A and B surface area, as described in the project description. The 1981 project included "capped settling ponds," in which 5 to 10 feet of overburden material was proposed to be placed over water saturated fine sand and silt. (Alameda County 1980: 8)

The approved 1981 project includes the following mitigation of impacts to geology and soils:

- Ability of capped settling ponds to support structures should be clearly demonstrated through extensive soil and geotechnical investigations at the time such structures may be proposed. The Alameda County Surface Mining Ordinance requires that fill placement in backfilled and graded areas conforms to the Uniform Building Code "except. that alternate methods of backfilling and grading may be utilized when incorporated in the approved reclamation plan." It is not expected that the forthcoming detailed reclamation plans for each operator will propose specific structural uses for these areas, but if so, then methods as specified in the Surface Mining Ordinance should be detailed and subject to approval by the Building Official. A program for inspection of fill placement, which is often difficult due to the size and staging nature of quarry operations, should also be presented at that time. Until demonstrated otherwise, it should be assumed that the capped settling pond areas are not suitable for structures. Recreation and open space uses would remain as options. (Alameda County 1980: 8)

- A drainage system would need to be designed to ensure adequate drainage of below-grade filled areas. Loss of prime and unique agricultural soils is due to the quarrying operations and not the Reclamation Plan, but the Plan should be responsible for mitigation of this impact. The Plan does propose that a 5 to 10-foot layer of soil be used to cover settling ponds. This measure should be made a requirement in Reclamation Plan implementation, and it should be ensured that the top few feet of soil replaced consists of the richest topsoil. Uncapped settling ponds may also be viable for intensive agricultural use. Alameda County has recognized the loss of prime and unique agricultural soils as being an unavoidable adverse impact of quarrying but has determined that the sand and gravel resource is of sufficient economic importance to the County and region as to outweigh this impact. (Alameda County 1980: 9)
- The Alameda County Surface Mining Ordinance provides some mitigation in that it requires topsoil to be stockpiled at the site of mining operations in amounts necessary for future reclamation and also specifies how resoiling is to take place; however, it only applies to new permits and not existing operations. (Alameda County 1980: 9)
- Agricultural use of many of the reclaimed land areas is proposed by the Plan. If topsoil is required to be replaced, then all reclaimed land areas could probably support intensive agriculture if deemed more desirable than urban uses at the conclusion of quarrying in 2030. Agricultural use will continue over many undisturbed areas of the site while quarrying is still taking place and is compatible with adjacent or nearby mining use. (Alameda County 1980: 9)

Project Revisions

The LAVQAR EIR assessed the realigned ADV to flow through Lake B. The 1981 project also included a Lake A with a final surface area of 208 acres and Lake B with a surface area of 243 acres. Under the proposed project, approximately 5,800 linear feet of the ADV would be realigned to flow around, rather than through, Lake B. Reclamation of Lake A would involve limited earthmoving, with a reduction in final surface area from 208 acres to 81 acres. Reclamation of Lake B would also involve a reduction in final surface area from 243 acres to 208 acres. Furthermore, the proposed project will adjust reclamation boundaries and contours. These design changes would be substantial and may create a new or increased significant impact.

Changed Circumstances

Since 1981, new residential subdivisions have been developed to the north of Lake A (e.g., Pulte Oaks and Kristopher Ranch) and to the south of Lake B (e.g., Ruby Hills) These sensitive land uses are changed circumstances that could create a new or increased significant impact.

In 1989–1992, CEMEX's predecessor purchased four parcels of land from Pleasanton Gravel Co. and Jamieson Co., which parcels are herein collectively referred to as the Jamieson Parcels (see Figure 2-1, "Vested Mining Permits"). Jamieson Parcels 1 and 2 were within the scope of Q-76, while Jamieson Parcels 3 and 4 were within the scope of Q-4 initially granted to California Rock and Gravel Company in 1957. The Jamieson Parcels also have vested mining rights. The Jamieson Parcels were acquired by CEMEX's predecessors after the County had approved SMP-23 in 1987; therefore, those parcels were not included within the currently approved SMP-23 reclamation plan boundary.

As required by Condition No. 16 of the Planning Commission's 1992 5-Year Periodic Review, CEMEX (RMC Lonestar at the time) also submitted drawings prepared by Spinardi Associates to Alameda County in June 1993 entitled Lake A Grading Plan showing the specific mining plan for the Lake A area. The Spinardi Associates plan showed the proposed mining footprint, slopes, landscaping, berms, a trail system along the southern side, and a Zone 7 maintenance road along the northern side. These improvements were constructed, and the ADV reach within Lake A was realigned closer to Vineyard Avenue around 1994. Substantial mining began north of the ADV until 2005, at which time Cemex discontinued mining to address neighborhood concerns due to a potential subsurface slide. To remediate the potential slide issue, a Corrective Action Plan was developed by CEMEX and approved by the County. Construction activities under the Corrective Action Plan were completed in 2008. No further commercial mining is planned for Lake A, but some limited surface disturbances still need to occur to prepare the lake for installation of water conveyance facilities for future dedication to Zone 7.

New Information

Extensive new information of substantial importance is available that was not known and could not have been known with the exercise of reasonable diligence at the time the LAVQAR EIR was adopted. In addition to existing publicly-available data and reports, aerial photos, and field observations discussed above, there are two applicant-prepared studies that have been peer reviewed and incorporated into this SEIR as the following appendices:

- *Geotechnical Investigation SMP-23 Reclamation, Alameda County California* (Geocon 2019a) (Appendix E-1 of this SEIR) and
- *Geotechnical Investigation/Slope Stability Analysis, Cemex Eliot—Arroyo Del Valle Realignment at Lake B, Alameda, California* (Geocon 2019b) (Appendix E-2 of this SEIR).

Significance Determination

Based on project revisions and changed circumstances that may create a new or increased significant impacts, the County has amplified and augmented the analysis contained in the 1980 EIR. This evaluation is provided in the following impact analysis.

4.4.5.2 Subsequent Environmental Analysis

Impact 4.4-1: Exposure of People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death as a Result of Rupture of a Known Fault

The project site is not located within a State-designated Alquist-Priolo Earthquake Fault Zone (Geocon 2019a). No faults are on-site, and the nearest fault is 3 miles southeast of the site. The project area is in a seismically active area, with the potential for moderately strong ground shaking from sources such as the Greenville Fault. The project includes changes to the design of approved structures (e.g., spillways, underground conveyance pipes, berms). However, no new structures are proposed and no structures would be located on a fault; thus, no new risk would be introduced.

In addition, per the slope stability analysis (see Appendix E-1), the proposed slopes on-site would achieve the required factors of safety under static and seismic conditions (Geocon 2019a). Therefore, the project's potential to introduce substantial adverse effects as a result of rupture of a known fault is less than significant and no mitigation is required.

Level of Significance: Less than significant.

Mitigation Measures: None required.

Impact 4.4-2: Exposure of People or Structures to Potential Substantial Adverse Effects, Including the Risk of Loss, Injury, or Death as a Result of Strong Seismic Ground Shaking

As discussed in Impact 4.4-1, above, no new structures are proposed and the proposed slopes on-site would achieve the required factors of safety under static and seismic conditions (Geocon 2019a); thus, no new risk would be introduced. Therefore, this impact is considered less than significant, and no mitigation is required.

Level of Significance: Less than significant.

Mitigation Measures: None required.

Impact 4.4-3: Exposure of People or Structures to Seismic-Related Ground Failure, Including Liquefaction, or Landslides

Portions of the site are mapped as having either the potential for liquefaction or landslides. As described in Impact 4.4-1, the project includes no new structures, and the proposed slopes on-site would achieve the required factors of safety under static and seismic conditions (Geocon 2019a and Geocon 2019b). Therefore, this impact would be less than significant, and no mitigation is required.

Level of Significance: Less than significant.

Mitigation Measures: None required.

Impact 4.4-4: Result in Substantial Soil Erosion or the Loss of Topsoil

Slopes in the mining areas and along the project alignment of the ADV would be susceptible to erosion and surficial degradation when exposed to rain and surface runoff. Thus, soil erosion in the realigned ADV and at Lake B would be potentially significant.

Erosion on-site is controlled through compliance with the requirements of the County's stormwater quality management plan. In addition, the on-site mine excavations drain internally and, per the slope stability analyses (see Appendices E-1 and E-2), the proposed on-site slopes would be stable as designed (Geocon 2019a and 2019b).

Silt and fined-grained materials that are washed from the aggregate would be deposited in several areas of the project site, including Lake J, Pond C, and Pond D, which could affect the potential for increased stormwater runoff and therefore erosion and sediment transport. In addition, approximately 2.1 million cubic yards of dry silt and overburden may be placed in the east end of Lake B, as shown on Sheets R-2 and R-3 of Appendix B-1, "Proposed Reclamation Plan Amendment." The lowest elevation of silt would be at approximately 220 ft msl, whereas the top elevation would be 340 ft msl, which is 29 feet below the anticipated water surface elevation in Lake B of 369 ft msl. The width of the top silt elevation would be approximately 630 feet.

Furthermore, approximately 6.4 million cubic yards of backfill materials (silts and overburden) would be placed in Lake J, to an elevation of 360 ft msl to 380 ft msl, and be contoured in to the final reclaimed ground surface, as shown on Sheets R-1 and R-3. Silts and overburden may be blended as backfill occurs. The lowest elevation of silt would be at approximately 130 ft msl while the anticipated post-mining groundwater elevation at Lake J is anticipated to be 330 ft msl, coincident with the water level in the Shadow Cliffs Lake to the west. Thus, the silt backfill would extend 30 feet to 50 feet above the groundwater surface after reclamation. The width of the top of the silt backfill at the groundwater surface elevation would be approximately 1,450 feet, in the direction perpendicular to groundwater flow. The width of the silt at the bottom of Lake J, at 130 ft msl, would be about 200 feet.

This impact would be reduced to a less than significant level with implementation of Mitigation Measures 4.4-1, 4.4-2, 4.4-3, and 4.4-4. Mitigation Measure 4.4-1 implements an erosion control plan to prevent significant erosion or loss of topsoil relating to the realignment of the ADV. Mitigation Measure 4.4-2 calls for proper surface drainage facilities directing runoff away from slopes, vegetation, additional erosion control measures, and best management practice (BMP) devices to be maintained to reduce long-term slope degradation from erosion. Periodic inspections would be performed on a regular basis to identify and address maintenance needs under Mitigation Measure 4.4-2. Mitigation Measure 4.4-3 would require embankment fill slopes to be constructed with an inclination of 2:1 or flatter. Mitigation Measure 4.4-4 would require implementation of one of two options for cut slopes at Lake B adjacent to the ADV. Impacts to erosion and loss of topsoil as a result of the proposed project would be less than significant with mitigation incorporated.

Level of Significance before Mitigation: Potentially significant.

Mitigation Measures:

Mitigation Measure 4.4-1: *Erosion Control Plan*

The Applicant, and its contractors shall adhere to the Erosion Control Plan for the ADV realignment and Lake A diversion structure prepared by Brown and Caldwell, which shall be incorporated by reference into the conditions of approval for the project.

Mitigation Measure 4.4-2: *Berm and Embankment Grading*

The Applicant shall implement the following measures to control erosion related to berm and embankment grading:

a) *All earthwork operations shall be observed, and all fills tested for recommended compaction and moisture content by a representative from a County-approved geotechnical specialist.*
b) *Prior to commencing grading, a pre-construction conference with representatives from the Permittee, its grading contractor, if applicable, and a County-approved geotechnical specialist shall be held at the site. Site preparation, soil handling and/or the grading plans shall be discussed at the pre-construction conference.*
c) *Prior to commencing grading within embankment and slope areas, surface vegetation shall be removed by stripping to a sufficient depth (2 to 4 inches) to remove roots and organic-rich topsoil. Material generated during stripping that is not suitable for use as embankment or reclamation slope fill shall be stockpiled for future use as topsoil. Any existing trees and associated root systems shall be removed. Roots larger than 1 inch in diameter shall be completely removed. Smaller roots may be left in-place as conditions warrant and at the discretion of on-site field monitor.*
d) *To increase stability and to provide a stable foundation for the berm embankments, the full length of the embankments shall be provided with embankment-width keyways. The keyways shall have a minimum embedment depth of 3 feet into firm, competent, undisturbed soil. The actual depth of the keyway shall be evaluated during construction by*

a County-approved geotechnical specialist. Keyway back-slopes shall be no flatter than 1 horizontal (H):1 vertical (V).

e) *Where fill is placed on sloping ground steeper than 5H:1V, the fill shall be benched into the adjacent native materials as the fill is placed. Benches shall roughly parallel slope contours and extend at least 2 feet into competent material. In addition, a keyway shall be cut into the slope at the base of the fill. Keyways shall be at least 15 feet wide and extend at least 2 feet into competent material. Bench and keyway criteria may need revision during construction based on the actual materials encountered and grading performed in the field.*

f) *Pipe penetrations through the planned berms and embankments shall be avoided, if feasible. If pipe penetrations are unavoidable, the Permittee shall provide concrete cut-off collars at the penetration point to reduce potential for seepage. Reinforced concrete cut-off collars shall completely encircle the pipe and should be sized such that they are 12 to 18 inches larger than the nominal outside diameter of the pipe. Thickness shall be at least 6 inches. Water-tight filler shall be used between collars and pipes.*

g) *Bottoms of keyways and areas to receive fill shall be scarified 12 inches, uniformly moisture conditioned at or above optimum moisture content and compacted to at least 90% relative compaction. Scarification and recompaction operations shall be performed in the presence of a County-approved geotechnical specialist to evaluate performance of the subgrade under compaction equipment loading.*

h) *Engineered fill consisting of onsite or approved import materials shall be compacted in horizontal lifts not exceeding 8 inches (loose thickness) and brought to final subgrade elevations. Each lift shall be moisture-conditioned at or above optimum and compacted to at least 90% relative compaction at least 2% above optimum moisture content. Fills for the eastern Lake B fill embankments and Pond C/D separation shall be compacted to at least 95% relative compaction above optimum moisture content.*

i) *Fill slopes shall be built such that soils are uniformly compacted to at least 90% relative compaction at least 2% above optimum moisture content to the finished face of the completed slope. Fill slopes for the eastern Lake B fill embankments and Pond C/D separation shall be compacted to at least 95% relative compaction above optimum moisture content.*

The Alameda County Community Development Agency shall be responsible for ensuring compliance.

Mitigation Measure 4.4-3: *Embankment Fill Slope Geometry*

Fill slopes for the proposed embankment between Silt Pond C and Silt Pond D, the embankment for overburden and silt storage at the east end of Lake B, and the "shark's fin" embankment of Lake B should be constructed at an inclination of 2:1 or flatter. Mid-height bench(es) should be considered for fill slopes exceeding 50 feet in height to provide access for slope maintenance.

Mitigation Measure 4.4-4: *Cut Slope of Lake B Adjacent to Realigned ADV*

The Permittee, or its contractor, shall implement one of the following two configurations for the cut slope of Lake B below and adjacent to the realigned ADV:

1) *2.25:1 slope; or*
2) *40-foot horizontal bench at elevation 260 feet msl within a 2:1 slope.*

Significance after Mitigation: Less than significant.

Impact 4.4-5: Be Located on a Geologic Unit or Soil That Is Unstable, or That Would Become Unstable as a Result of the Project, and Potentially Result in On- or Off-Site Landslide, Lateral Spreading, Subsidence, Liquefaction, or Collapse

Impact 4.4-3, above, discusses the potential for the project to result in impacts associated with liquefaction and landslides and concludes that these potential impacts are less than significant. Further, the risk of settlement caused by earthquakes by densification of dry alluvium material at the site is considered to be low because the existing alluvial materials are generally dense, consolidated, and somewhat cemented. As discussed at Impact 4.4-1, the proposed slopes on-site would achieve the required factors of safety under static and seismic conditions (Geocon 2019a and Geocon 2019b). Therefore, this impact would be less than significant.

Level of Significance: Less than significant.

Mitigation Measures: None required.

Impact 4.4-6: Be Located on Expansive Soil, as Defined in Table 18-1-B of the Uniform Building Code (1994), Creating Substantial Risks to Life or Property

The soil at the project site contains a small amount of clay (Figure 4.4-1), which is an expansive soil; however, the end use includes water management because the soil is considered porous and beneficial to recharging groundwater. The end use also does not include buildings; thus, no structures on-site would create a substantial risk to life or property. In addition, this project does not differ from the approved reclamation plan in any way that would increase risks related to expansive soil. Therefore, this impact would be less than significant.

Level of Significance: Less than significant.

Mitigation Measures: None required.

Impact 4.4-7: Directly or indirectly destroy a unique paleontological resource or site or unique geological feature

Reclamation activities proposed in the reclamation plan amendment would be less intensive than the mining activities that immediately precede reclamation and would not disturb more acreage (laterally or vertically) than those areas of the site that will be mined under existing approvals. Therefore, no new impacts to paleontological resources associated with reclamation activities would occur under the reclamation plan amendment. CEMEX would be required to adhere to the existing conditions of approval and mitigation measures related to protection of archaeological resources, which would apply to paleontological resources as well:

- "If, however, archaeological finds are made during excavation, work in the area should halt pending consultation of a qualified archaeologist, whose recommendations should be followed. Work could continue in other areas not near the site" (Alameda County 1980).
- "Operations shall cease in the vicinity of any suspected archaeological resource until an archaeologist is consulted and his or her recommendations followed, subject to approval by the Planning Director" (Resolution No. 87-18, Condition of Approval 13).

Therefore, impacts to paleontological resources would be less than significant.

Level of Significance: Less than significant.

Mitigation Measures: None required.