3.6 Geology, Soils, and Mineral Resources

This section provides an overview of geology, soils, faulting, and seismicity in the project region. Topics addressed include potential impacts to the project from seismic hazards, soil erosion, soil stability, and expansive soils. The analysis is based, in part, on review of published geologic maps and reports from federal, state, and local data and plans.

3.6.1 Environmental Setting

Regional Geology and Topography

The proposed project is located in the Perris 7.5-Minute Quadrangle in Western Riverside County. Perris Valley lies between the San Jacinto Mountains approximately 15 miles to the east and the Santa Ana Mountains approximately 20 miles to the west. The Perris Quadrangle is located in the northern part of the Peninsular Ranges Province between the Elsinore Fault Zone and San Jacinto Fault Zone, within the geologically complex region of Southern California referred to as the Peninsular Ranges geomorphic province, a large natural region dominated by similar rocks and geologic structures. The Peninsular Ranges province lies in the southwestern-most region of California and extends south 775 miles past the United States/Mexico border. It is bounded by the Transverse Ranges to the north, the Colorado Desert to the east, and the Pacific Ocean to the west. Included within the province is Orange County, as well as portions of Los Angeles, San Bernardino, Riverside, San Diego, and Imperial Counties.

The topography of the province is similar to the Coast Ranges, with northwest trending ranges and valleys, but the geology is more like that of the Sierra Nevada province, with granitic rock intruding the older metamorphic rocks (CGS, 2002a). The area is underlain by Cretaceous-age and older plutonic rocks that are part of the composite Peninsular Ranges batholiths. There is a wide variety of intermediate composition granitic rocks in the quad, mainly of tanalitic composition but ranging from monzogranite to diorite. Crossing the quad diagonally is the channel and floodplain of the ephemeral San Jacinto River, located southeast of the project site. Most of the alluviated area west of the San Jacinto River consists of Pleistocene age fluvial deposits, the upper part of which forms the Paloma surface (USGS, 2003).

The project site is located south of the northwest trending Perris Valley and Bernasconi Hills. The project area is underlain by weathered granitic bedrock of variable thickness overlain by alluvial deposits at lower elevations left by stream and slope wash. A majority of the project site is generally flat and composed of varying degrees of sandy to silty loam soils (USDA, 2013). The proposed project site elevation ranges from approximately 1,445 feet above mean sea level (amsl) to 1,495 feet amsl.

According to the Preliminary Geologic Map of the Perris 7.5-Minute Quadrangle published by U.S. Geological Survey (USGS) in 2003, the project area is covered by two distinct modern (Quaternary) surficial deposits. With the exception of the western-most area, soils in the project site are old arenaceous alluvial-fan deposits from the late to middle Pleistocene. In the western area are young surficial alluvial-fan deposits. These sedimentary units are slightly consolidated to cemented, and slightly to moderately dissected. Three major granitic bedrock extrusions can be

found in the immediate vicinity of the project area flanked by the aforementioned Quaternary alluvial-fan deposits. One is located at the southern-most reach of the Perris Dam in the Bernasconi Hills, and the other two are located at the front of the Perris Dam.

Seismicity

Southern California is a region of high seismic activity with numerous active and potentially active faults. Earthquakes along the San Andreas Fault relieve convergent plate stress in the form of right lateral strike slip offsets. The Transverse Ranges work as a block causing the San Andreas Fault to bend, producing compressional stresses that are manifested as reverse, thrust, and right lateral faults. Faulting associated with the compressional forces creates earthquakes and is primarily responsible for the mountain building, basin development, and regional upwarping found in this area.

Major earthquakes have affected the region in the past and can be expected to occur again in the near future on one of the principal active faults in the San Andreas Fault system. The principal active faults in the region include the San Andreas, San Jacinto and Elsinore faults. Over the last 100 years, there have been approximately eight significant seismic events, or earthquakes, in the Perris region according to the Southern California Earthquake Data Center (SCEC) (SCEC, 2013).

Earthquake Magnitude

Richter magnitude (M) is a measure of the size of an earthquake as recorded by a seismograph, the standard instrument that records ground shaking. The reported Richter magnitude for 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. Earthquake magnitudes are also measured by their moment magnitude (Mw), which is related to the physical characteristics of a fault, including the rigidity of the rock, the size of fault rupture, and the movement or displacement across a fault (CGS, 2002b). **Table 3.6-1** lists the correlation magnitude and intensity, and describes the character of ground shaking felt during earthquakes.

Faults

A fault is a fracture or line of weakness in the earth's crust, along which rocks on one side of the fault are offset relative to the same rocks on the other side of the fault. Based on criteria established by the California Geological Survey (CGS), faults can be categorized as active, potentially active, or inactive. Active faults are those that show evidence of surface displacement within the last 11,000 years (Holocene age). Potentially active faults are those that show evidence of displacement within the last 1.6 million years (Quaternary age). Faults showing no evidence of displacement within the last 1.6 million years are considered inactive (CGS, 2002c).

Table 3.6-2 lists the location of regionally active faults and potentially active faults significant to the project area due to proximity, activity status, date of most recent motion, and maximum moment magnitude (M_{max}). The M_{max} is the strongest earthquake that is likely to be generated along a fault and is based on empirical relationships of surface rupture length, rupture area, and fault type, which are all related to the physical size of fault rupture and displacement across a fault.

TABLE 3.6-1
MODIFIED MERCALLI INTENSITY SCALE

Magnitude	Intensity	Description	
1.0-3.0	I	I.	Not felt except by a very few.
3.0-3.9	II-III	II.	Felt only by a few persons at rest, especially on upper floors of buildings.
		III.	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Vibrations similar to the passing of a truck.
4.0-4.9	IV-V	IV.	Felt indoors by many, outdoors by few during the day. Dishes, windows, doors disturbed. Sensation like heavy truck striking building.
		V.	Felt by nearly everyone. Some windows broken. Pendulum clocks may stop.
5.0-5.9	VI-VII	VI.	Felt by all, many frightened. Some heavy furniture moved. Damage slight.
		VII.	Damage negligible in buildings of good design and construction; considerable damage in poorly built or badly designed structures.
6.0-6.9	VII-IX	VIII.	Damage slight in specifically designed structures. Damage great in poorly built structures. Fall of chimneys and walls. Heavy furniture overturned.
		IX.	Damage considerable in specifically designed structures; Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and Higher	VIII or Higher	X.	Most masonry and frame structures destroyed with foundations. Rails bent.
		XI.	Few structures remain standing. Bridges destroyed. Rails bent greatly.
		XII.	Damage total. Lines of sight and level are distorted. Objects airborne.

SOURCE: U.S. Geological Survey, *The Modified Mercalli Intensity Scale,* http://earthquake.usgs.gov/learn/topics/mercalli.php, accessed January 23, 2013.

TABLE 3.6-2
ACTIVE FAULTS IN THE PROJECT VICINITY

Fault	Location and Direction from Project Site	Recency of Movement	Fault Classification[a]	Historical Seismicity[b]	Maximum Moment Magnitude Earthquake (M_{max})[c]
San Jacinto (including the Casa Loma Segment)	5 miles northeast	Historic (historic rupture)	Active	M 6.6 1987 M 6.6 1968 Many >M 6.0	7.2
San Andreas	17 miles northeast	Historic (1906N, 1989N, 1857S ruptures)	Active	M 7.9 1857 M 7.1, 1989 M 7.9, 1906 M 7.0, 1838 Many >M 6.0	8.0
Elsinore	14 miles southeast	Historic (1861 rupture) Holocene	Active	M 6.0, 1910	7.1

a. Jennings, 1994, and Hart, 1997. An active fault is defined by the California Geological Survey as one that has had surface displacement within approximately the last 11,000 years. A potentially active fault is defined as a fault that has showed evidence of surface displacement during approximately the last 1.6 million years.
b. Richter magnitude (M) and year for recent and/or large events. Richter magnitude scale reflects the maximum amplitude of a seismic wave measured at a distance of 100 kilometers from the epicenter.
c. Moment magnitude is related to the physical size of a fault rupture and movement across a fault. The maximum moment magnitude (Mmax) is the strongest earthquake that is likely to be generated along a fault and is based on empirical relationships of surface rupture length, rupture area, and fault type.
N=Northern
S=Southern

SOURCES: Jennings, 1994; Hart, 1997; DWR, 2005, Treiman, 2007a and 2007b.

The San Jacinto fault is the most seismically active fault in Southern California (Treiman, 1999). This fault is approximately 5 miles northeast of the project site. Significant earthquakes have occurred on various segments of the fault, which is over 100 miles long, in 1987 (M 6.6) and 1967 (M 6.6) (Treiman, 1999).

The largest historic earthquake in the project area occurred at the San Andreas fault, located approximately 17 miles northeast from the project site. The 1857 Fort Tejon earthquake was estimated at magnitude 7.9 and caused surface rupture along the fault for 225 miles. The 1857 earthquake represents one of the two largest fault ruptures in historic time. The southernmost fault rupture associated with the 1857 event occurred within 35 to 40 miles of the project site near the Cajon Pass (DWR, 2005).

The Elsinore fault is located approximately 14 miles southwest of the project site. Multiple earthquake events have been identified only on the northern segments of the fault so the interactions of the various strands are not well known (Black and Hecker, 1999). Historical record indicates that a large earthquake occurred on the Elsinore fault in 1910 at an estimated magnitude of 6.0 (DWR, 2005). However, compared to the San Jacinto fault, the historic activity on the Elsinore fault has been relatively low.

The project site is located seismically within what is known as the Perris structural block. The Perris structural block is bound by the San Jacinto fault to the east, and the Elsinore fault to the west (DWR, 2005) (**Figure 3.6-1**).

No other active faults are present in the vicinity of the project site. Old bedrock shear zones have been observed within the project area; however, these are thought to be the result of granitic intrusion rather than seismic activity (DWR, 2005). Otherwise, the Perris block is virtually devoid of significant seismicity when compared to other surrounding areas (DWR, 2005).

Seismic Hazards

Most of Southern California is located within Seismic Zone 4, which is defined by the Uniform Building Code (UBC) as the zone with the highest potential for seismic hazards to occur. Seismic zones are based on a statistical compilation of the number and the magnitude of past earthquakes.

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 and nature of fault rupture can vary for different faults, or even along different strands of the same fault. Ground rupture is considered most likely along active faults.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in California in 1972 following the 1971 San Fernando earthquake to mitigate the hazard of surface faulting to structures for human occupancy. The law requires that the State Geologist establish Earthquake Fault Zones around the surface traces of active faults and issue corresponding maps that mark regulatory zones. The project site is not located within an Alquist-Priolo Earthquake Fault Zone and no mapped active faults are known to pass through the immediate project region. Therefore, the risk of ground rupture at the project site is extremely low.

SOURCE: Riverside County GIS.

Perris Dam Emergency Release Facility . 120083.02

Figure 3.6-1

Major faults near the Project Area

Ground Shaking

Earthquakes in the Southern California region could produce strong ground shaking in the project vicinity and could present the most severe loading that most dams could experience (Fraser, 2001). Ground shaking intensity is partly related to the size of an earthquake, the distance to the site, and the response of the geologic materials that underlie a site. As a rule, the greater the earthquake magnitude and the closer the fault rupture to a site, the greater the intensity of ground shaking. Violent ground shaking is generally expected at and near the epicenter of a large earthquake; however, different types of geologic materials respond differently to earthquake waves. For instance, deep unconsolidated materials can amplify earthquake waves and cause longer periods of ground shaking.

Ground motion during an earthquake can be described using the motion parameters of acceleration, velocity, and duration of shaking. A common measure of ground motion is the peak ground acceleration (PGA). The PGA for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. PGA is expressed as the percentage of the acceleration due to gravity (g), which is approximately 9.8 meters per second squared. An earthquake on the San Jacinto fault could produce severe ground shaking at the project site.

According to estimates made by the CGS, the PGA at the site could reach up to 0.70 g, which is severe (CGS, 2007b).[1] This calculation is based on what was determined to be the maximum credible earthquake (MCE)[2] on the San Jacinto fault, with an M_{max} of 7.2 at a distance of approximately 5 miles from the site (DWR, 2005). A deterministic analysis of potential groundshaking at the project site concluded that the PGA at the crest of Perris Dam could reach 0.78 g, which is severe (DWR, 2005).[3]

Secondary Earthquake Hazards

Secondary earthquake hazards at the project site include earthquake-induced land sliding, settlement, and liquefaction. Strong ground motions that occur during earthquakes are capable of inducing landslides and related forms of ground failure. Settlement is the gradual downward movement of an engineered structure (such as a building) due to the compaction of unconsolidated material below the foundation. Settlement accelerated by earthquakes can result in vertical or horizontal separations of structures or portions of one structure; cracked foundations,

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1 A probabilistic seismic hazard map shows the predicted level of hazard from earthquakes that seismologists and geologist believe could occur. The map's analysis takes into consideration uncertainties in the size and location of earthquakes and the resulting ground motions that can affect a particular site. The maps are typically expressed in terms of probability of exceeding a certain ground motion. These maps depict a 10% probability of being exceeded in 50 years. There is a 90% chance that these ground motions will NOT be exceeded. This probability level allows engineers to design buildings for larger ground motions than seismologists think will occur during a 50-year interval, making buildings safer than if they were only designed for the ground motions that are expected to occur in the 50 years. Seismic shaking maps are prepared using consensus information on historical earthquakes and faults. These levels of ground shaking are used primarily for formulating building codes and for designing buildings (CGS, 2007a).

2 The MCE is the largest earthquake reasonably capable of occurring based on current geological knowledge. The MCE is used for design purposes in a deterministic seismic hazard assessment.

3 This PGA value was determined using what is known as a deterministic seismic hazard assessment approach. First, the faults nearest a site are identified and assessed for activity; then for each seismic source, an earthquake scenario consisting of the maximum magnitude a fault is capable of generating at the closest distance to the site is used to determine the ground motion estimate. A deterministic seismic hazard analysis is time-independent and does not represent the likelihood of such an event occurring within a given time frame (Fraser, 2001).

roads, sidewalks, and walls; and (in severe situations) building collapse and bending or breaking of underground utility lines. Soil liquefaction, a phenomenon in which soils lose significant strength as a result of cyclic shaking, can result in ground failure. The soils most susceptible to liquefaction are clean, loose, uniformly graded, saturated sands and silts. In general, upland areas have a low liquefaction potential, except where significant alluvium is present in creek bottoms or swales.

The potential for excessive embankment deformations at the Perris Dam as a result of seismically induced liquefaction of the foundation soils were found to be present at the project site prior to the implementation of the Perris Dam Remediation Project. As a result, the Department of Water Resources (DWR) is implementing the Perris Dam Remediation Project to reduce the potential vulnerability to liquefaction. The emergency release facility would be located in an area identified by Riverside County as having high levels of liquefaction potential (RCLIS, 2013).

Other Geologic Hazards

Landslides and Slope Failure

Ground failure is dependent on the slope and geology as well as the amount of rainfall, human activities such as excavation, or seismic activity. A slope failure is a mass of rock, soil, and debris displaced downslope by sliding, flowing, or falling. Landslide-susceptible areas are characterized by steep slopes and downslope creep of surface materials. Debris flows consist of a loose mass of rocks and other granular material that, if saturated and present on a slope, can move downslope.

The rate of rock and soil movements can vary from a slow creep over many years to a sudden mass movement. Landslides occur throughout California, but the density of incidents increases in zones of active faulting. At the project site, there is a potential for slope failures occurring mainly as rockfalls within the surrounding upland areas.

Soils

Soil Erosion

Factors contributing to potential soil erosion include climate, the physical characteristics of soils, topography, land use, and the amount of soil disturbance. In general, the loss of ground cover caused by construction activities is a primary factor contributing to an increase in soil erosion potential. Erosion potential is also directly related to the terrain’s steepness. Although the terrain is fairly flat along the proposed alignment, its overall downhill slope from the emergency release structure through the basin to the Perris Valley Channel creates the potential for erosion and soil loss during construction. The California Building Code (CBC) regulates grading, excavations, landfill, and other construction activities that might cause or be impacted by erosion in the project area. Riverside County relies on the 2010 edition of the CBC in unincorporated areas, and the City of Perris relies on an amended version of the 2010 edition of the CBC (Perris Municipal Code, 2011).

Unstable Soils

Under certain circumstances, densification or compaction of soils can result in settlement that can cause damage to foundations and structures, as well as water and sewer lines. Recently deposited

alluvial sediments, such as those along the Perris Valley Channel, could be subject to settlement. Low-angle land sliding that is associated with liquefaction and occurs on mildly sloping surfaces such as drainage channels or stream banks is a condition called lateral spreading. Subsidence occurs when land collapses upon itself and is a result of excessive pumping of either groundwater or oil in certain types of sediments. A previous geotechnical study conducted by DWR found that the soils providing the Perris Dam foundation may be highly susceptible to liquefaction (DWR, 2005), and the Perris General Plan lists the project area as being "shallow groundwater susceptible sediments" at risk for liquefaction (City of Perris, 2005). The emergency release facility would be located in an area identified by Riverside County as having high levels of liquefaction potential (RCLIS, 2013).

Expansive Soils

Expansive soils are typically associated with fine-grained clayey soils that have the potential to shrink and swell with repeated changes in the moisture content. The ability of clayey soil to change volume can result in uplift or cracking to foundation elements or other rigid structures such as slabs-on-grade, rigid pavements, sidewalks, or other slabs or hardscape founded on these soils.

3.6.2 Regulatory Framework

Federal

Uniform Building Code

The UBC is published by the International Conference of Building Officials and forms the basis for the CBC, as well as approximately 50 percent of the other state building codes in the United States. It has been adopted by the California Legislature to address the specific building conditions and structural requirements for California, and provide guidance on foundation design and structural engineering for different soil types. The UBC defines and ranks the regions of the United States according to their seismic hazard potential. There are four types of regions defined by Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest. The project area is located within Seismic Zone 4.

State

Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act)

The Alquist-Priolo Act was passed in 1972 to provide a mechanism for reducing losses from surface fault rupture on a Statewide basis. The main intent of the Alquist-Priolo Act is to ensure public safety by preventing the construction of buildings used for human occupancy on the surface trace of active faults. The Alquist Priolo Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The law requires the State Geologist to establish regulatory zones, known as Earthquake Fault Zones, around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies must regulate most development projects within the zones.

California Building Code

The CBC has been codified in the California Code of Regulations (CCR) as Title 24, Part 2, Volume 1, which is a portion of the California Building Standards Code. The California Building Standards Commission is responsible for coordinating building standards under Title 24. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the CBC is to provide minimum standards to safeguard property and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of building and structures within its jurisdiction. The UBC, published by the International Conference of Building Officials, is a widely adopted building code in the United States. The 2013 CBC will remain in effect through 2016, and is based on the 2012 International Building Code with necessary California amendments. These amendments include significant building design criteria that have been tailored for California earthquake conditions.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 was passed in the State of California to address the effects of strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events. Under the Seismic Hazards Mapping Act, the State Geologist is required to delineate "seismic hazard zones." Cities and counties must regulate certain development projects within these zones until the geologic and soil conditions of the project area are investigated and appropriate mitigation measures, if any, are incorporated into development plans. The State Mining and Geology Board provides additional regulations and policies to assist municipalities in preparing the Safety Element of their General Plan and encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. Under Section 2697 of the Public Resources Code, cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard. Each city or county shall submit one copy of each geotechnical report, including mitigation measures, to the State Geologist within 30 days of its approval. No Seismic Hazard Maps have been published for the project area under the Seismic Hazard Mapping Act.

Local

County of Riverside General Plan Land Use and Safety Elements

The County of Riverside Land Use element addresses the development of natural hillsides and slopes. The development, grading, and landscaping of these areas has the potential to cause public safety concerns relating to landslides and slope failures.

City of Perris General Plan Safety Element

The City of Perris General Plan Safety Element addresses the issue of protecting people from unreasonable risks associated with natural disasters, fire, floods, earthquakes, and other geologic events. The Safety Element provides a contextual framework for understanding the relationship between hazard mitigation, response to a natural disaster and initial recovery from a natural disaster.

3.6.3 Impacts and Mitigation Measures

Significance Criteria

In accordance with Appendix G of the CEQA Guidelines, a geologic or seismic impact is considered significant if it would:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - 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 project, and potentially result in on-site or offsite landslide, lateral spreading, subsidence (i.e., settlement), liquefaction, or collapse
- 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
- 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
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan

Methodology

Potential significant impacts associated with the proposed project were identified based on a review of existing literature. The following section discusses impacts and the measures that would be incorporated to mitigate significant impacts.

Impact Analysis

Impact 3.6-1: The project could have a significant impact if it would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault, strong seismic ground shaking, seismic-related ground failure, including liquefaction, or landslides.

Implementation of the proposed project (including the emergency release structure and all three segments) would not expose people or structures to potential substantial adverse impacts, including the risk of loss, injury, or death resulting from seismically induced fault rupture, ground shaking, liquefaction, or landslides. The objective of the project is to reduce the existing risk of flooding that would arise in the advent of a dam release. The following bullets discuss seismic hazards and their relevance to the project:

- **Fault Rupture.** The faults most susceptible to earthquake rupture are active faults, which are faults that have experienced surface displacement within the last 11,000 years. The project site is not located within an Alquist-Priolo Earthquake Fault Zone and no mapped active faults are known to pass through the immediate project region. The nearest Alquist-Priolo Earthquake Fault Zone (Casa Loma strand of the San Jacinto) is approximately 5 miles away. Therefore, the potential for fault rupture to affect the proposed project is negligible.
- **Ground Shaking.** The purpose of the project is to convey emergency flow from Lake Perris over state-owned property. The levees and channels would be designed to withstand ground shaking from the MCE. Therefore, the project itself would significantly reduce the potential for injury and damage from impacts related to ground shaking.
- **Liquefaction.** The emergency release facility would be located in an area identified as having high levels of liquefaction potential (RCLIS, 2013). However, the levees and channel would be designed to withstand seismically induced liquefaction through soil treatment, including excavation and compaction and through levee design, side slope, and foundation. The project description includes development of a levee design that would withstand localized ground shaking and liquefaction. The project itself would significantly reduce the potential for injury and damage from liquefaction impacts. No additional analysis or mitigation is necessary.
- **Landslides.** Landslide-susceptible areas are characterized by steep slopes and downslope creep of surface materials. The emergency release facility would be located on relatively flat topography. Seismically induced landslides would not adversely affect the project.

Significance Determination: No Impact.

Impact 3.6-2: The project could have a significant impact if it would result in substantial soil erosion or the loss of topsoil.

It is anticipated that approximately 177,000 cubic yards of soil would be excavated from the project site and would be recompacted and used to construct the levees, as well as other structures for the project. If unmanaged, erosion could cause the loss of topsoil or undermine access roads. In order to function properly for the life of the project, the levees and channel (including all three segments) would be designed to ensure the integrity of the side slopes.

The proposed project construction would disturb more than 1 acre and would be required by state and federal laws to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP). As part of standard Best Management Practices (BMPs) and contract specifications, DWR would

require contractors to develop and implement an erosion control plan, in addition to implementing the storm water pollution prevention requirements of the SWPPP. These requirements include developing and implementing erosion control measures for all construction activities, including the following:

- Slope stabilization measures
- Haul road surface maintenance
- Wind erosion protection measures for stockpiled soil
- Stormwater runoff control for all construction areas
- Post-construction restoration plans

Therefore, because of the incorporation of BMPs and adherence to local, state, and federal laws, the proposed project impacts related to soil erosion or loss of topsoil are considered less than significant.

Significance Determination: Less than Significant.

Impact 3.6-3: The project could have a significant impact if it would 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.

The proposed project would require significant earthwork and grading activities during construction to build the levees and excavate the channel. The project final designs (including the emergency release structure and all three segments) will consider slope stability and subsurface foundation integrity as integral to the designs. During the final design phase of the project, DWR will perform a design-level geotechnical evaluation to ensure the stability of the levees and channel walls. The geotechnical evaluation will prescribe measures to mitigate hazards associated with unstable foundation soils. Slope and foundation stabilization measures may be identified including slope inclination, fill compaction, soil reinforcement, surface and subsurface drainage facilities, temporary shoring, and erosion control measures. The final designs for the levees and channel will incorporate the stability measures identified in the geotechnical evaluation to minimize the potential for landslides, excessive erosion, lateral spreading, or liquefaction.

The project would not promote subsidence. The levees would be compacted and engineered to function as water conveyance facilities for the life of the dam. Temporary stockpiles located within the project footprint may compact surface soils slightly, but would not be of sufficient size to result in general subsidence that would alter surface elevations within the construction zone.

With implementation of geotechnical evaluation results and adherence to standard practices, the proposed project impacts related to risks associated with landslide, lateral spreading, subsidence, liquefaction, or collapse are considered less than significant.

Significance Determination: Less than Significant.

Impact 3.6-4: The project could have a significant impact if it would 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.

Based on the geologic environment in the project area, the emergency release structure would not result in impacts due to expansive soil, subsidence, wastewater disposal, or mineral resources. The creation of levees on the Lake Perris State Recreation Area of the project would be constructed from local dirt and rock that is not high in clays or subject to expansive qualities. A majority of the project site is generally flat and composed of varying degrees of sandy to silty loam soils (USDA, 2013). The fill used for the levees would be compacted and engineered to comply with design requirements that include low expansive qualities. By adhering to the engineering specifications outlined in the project description, the effects of expansive soils would be minimized. Therefore, there is no impact associated with expansive soils.

Significance Determination: No Impact.

Impact 3.6-5: The project could have a significant impact if it would include 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.

The proposed project consists of an emergency release structure and water conveyance facility and would not require the use of septic or other alternative disposal wastewater systems. Therefore, no impact would occur.

Significance Determination: No Impact.

Impact 3.6-6: The project could have a significant impact if it would result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

According to the Riverside County General Plan, no designated Mineral Resource Zones would be affected by the proposed project. No active mineral or hydro-carbon extraction occurs within the project site. In addition, the emergency release facility would not affect access to designated mineral resources and would not conflict with mineral extraction interests. The proposed project would extract approximately 30,000 cubic yards of rock from the Bernasconi Hills quarry which is less than one percent of the available rock in the quarry. The additional rock required for the proposed project would not deplete the resource available at the quarry and would not result in the loss of availability of a known mineral resource. Therefore, no impact would occur.

Significance Determination: No Impact.

Impact 3.6-7: The project could have a significant impact if it would result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

See the discussion under Impact 3.6-6 above, no mineral resource recovery site occurs within the proposed project site. Therefore, no impact would occur.

Significance Determination: No Impact.

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