3.5 GEOLOGY, SOILS, AND MINERAL RESOURCES

This section describes the geology, soils, and mineral resources of the Irwindale Olive Pit Mine project area and the greater southern California region. Included within these categories, this section discusses other geological issues including seismicity/ground shaking, slope stability, liquefaction, subsidence, geotechnical characteristics, and expansive soils that could be associated with mining operations at Olive Pit Mine (**Figure 3.5-1**). This section identifies applicable laws, ordinances, regulations, and standards related to mining operations and reclamation planning. Recommended actions (i.e., mitigation measures) designed to avoid, eliminate, or reduce potential impacts have been identified.

3.5.1 EXISTING ENVIRONMENT

Regional Geology and Physiography

Geologically, California is separated into 11 general geomorphic provinces or regions. These geomorphic provinces are naturally defined geologic regions that display a distinct or unique landscape or landform. The City of Irwindale is located near the junction of the Transverse Ranges and the Peninsular Ranges Physiographic Provinces of southern California; for simplicity, this junction can be thought of as lying just north of the I-210. These two provinces are quite different in their tectonic fabric but are interrelated as seismotectonic activity continues in both regions as the North American and Pacific Tectonic Plates move past one another. California is tectonically active. The San Andreas Fault system (northeast of the City) forms the boundary between the North American and Pacific Plates, and the City lies within the Pacific Plate. Continued structural deformation in the form of faulting, mountain building (e.g., San Gabriel Mountains), basin development (e.g., San Gabriel Valley basin), earthquakes, and regional uplift and subsidence are the resulting effects of the two interacting zones.

The Los Angeles Basin lies south of the Transverse Ranges underlying the City of Irwindale, which is located on the alluvial fan of the San Gabriel River approximately one to five miles south of the San Gabriel Mountain front. **Figure 3.5-2** shows the City and the Olive Pit Mine project site with respect to 1925-vintage topography (USGS Azusa Quadrangle, 1928) defining the steeper mountains (upper right), the lower foothills, and the relatively flat, southward sloping valley floor. For the past several million years, uplift in the mountains has encouraged streams and debris flows to transport sand, gravel, cobbles, and boulders into the valley. Surface and groundwater moves readily through these deposits feeding the potable water aquifers and producing standing water where mine excavations have gone below the local water table elevations. Underlying these basin deposits at depths of 100- to nearly 1000-feet are primarily the crystalline granitic and metamorphic rocks basement rocks (“bedrock”) containing granite, granodiorite, diorite, quartz diorite, gneiss, schist, pegmatite, gabbro, anorthosite, and vein quartz. Lesser amounts of Cretaceous to Miocene age sedimentary rock, composed primarily of

sandstone, conglomerate, and shale, are found. It is the basement rocks exposed in the San Gabriel River drainage to the north that make up the sand and gravel aggregates mined for use in concrete, asphalt, and other construction activities.

Local Geology and Topography

Figure 3.5-2 shows the regional and local (see the inset) topography of the Irwindale area in 1924-25 prior to significant development. The shape and extent of the historical alluvial fan formed by the San Gabriel River is evident from the slight southerly arc of the contour lines on the main map. Overall, the alluvial fan slopes approximately 50- to 60-feet per mile toward the south. The surface area in the region has been dissected by a braided stream network with local relief of a few feet to a few tens of feet. This was the most evident along the San Gabriel River prior to the construction of channels and the Santa Fe Dam to control flooding.

Elevation within the City ranges from approximately 625-feet above mean sea level (MSL) in the northern part of the City to approximately 310-feet above MSL in the southern part of the City. The topography around the Olive Pit Mine site is relatively flat, at an elevation of approximately 455-feet above mean sea level (MSL) on the southwest and 475-feet MSL on the northeast. Lowest elevations within the Olive Pit Mine are in the 225-feet to 230-feet MSL range, and reach 250-feet to 320-feet at the base of the steep side slopes. It is understood that mining began in 1925 and it appears that the site has been in the current configuration since the early 1970s (GeoLogic Associates, 2008, their Figure 1).

Geology maps by the California Division of Mines and Geology (CDMG, 1998—now CGS for the California Geological Survey), Dibblee (1999), and Morton and Miller (2006; **Figure 3.5-3**) show that alluvial fan deposits blanket the entire City except where man-made fill has been placed, or where younger streams have reworked the fan materials to form young alluvium. CDMG maps the units as Quaternary gravel-rich alluvial fan deposit (map symbol Qfg), Dibblee maps the unit at the Olive Pit Mine as Quaternary gravel (map symbol Qg), and Morton and Miller map it as a Quaternary young alluvial fan deposit (Qyf). No basement or bedrock is exposed in the City or in the shallow subsurface near the mine; the nearest rock outcrops are located in the San Gabriel Mountains to the north (e.g., map symbols Ksgr, Kgl, Ksgr, Kssg, and Pgn). All three authors describe the deposits as sand and gravel in composition. More specifically from Morton and Miller "Unconsolidated to moderately consolidated silt, sand, pebbly cobbly sand, and bouldery alluvial-fan deposits having slightly to moderately dissected surfaces." Artificial fill (Qaf) is shown in the Olive Pit Mine.

Figure 3.5-1 Olive Pit Mine Project Location Irwindale

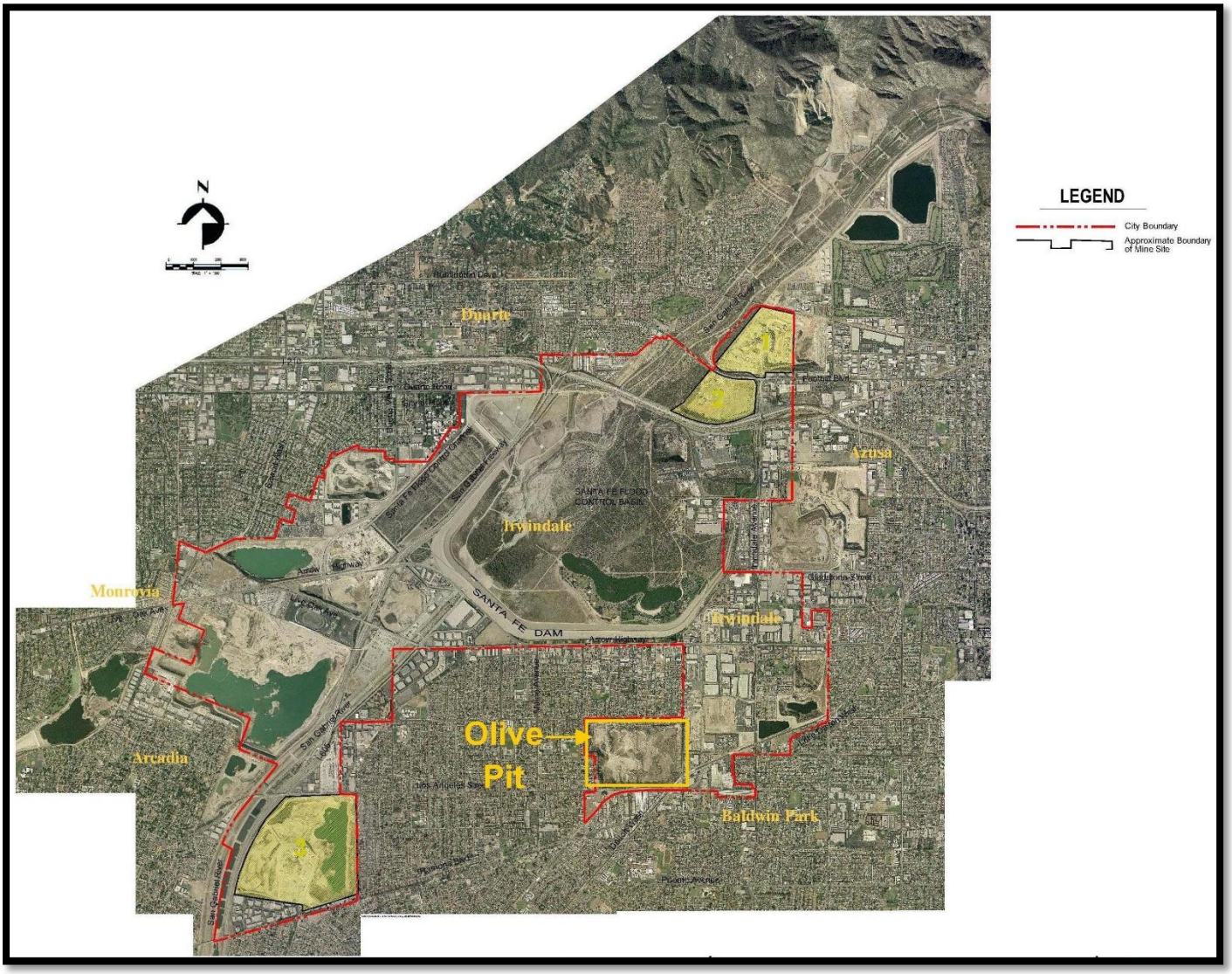


Figure 3.5-2 – 1924-25 Topography at the Olive Pit

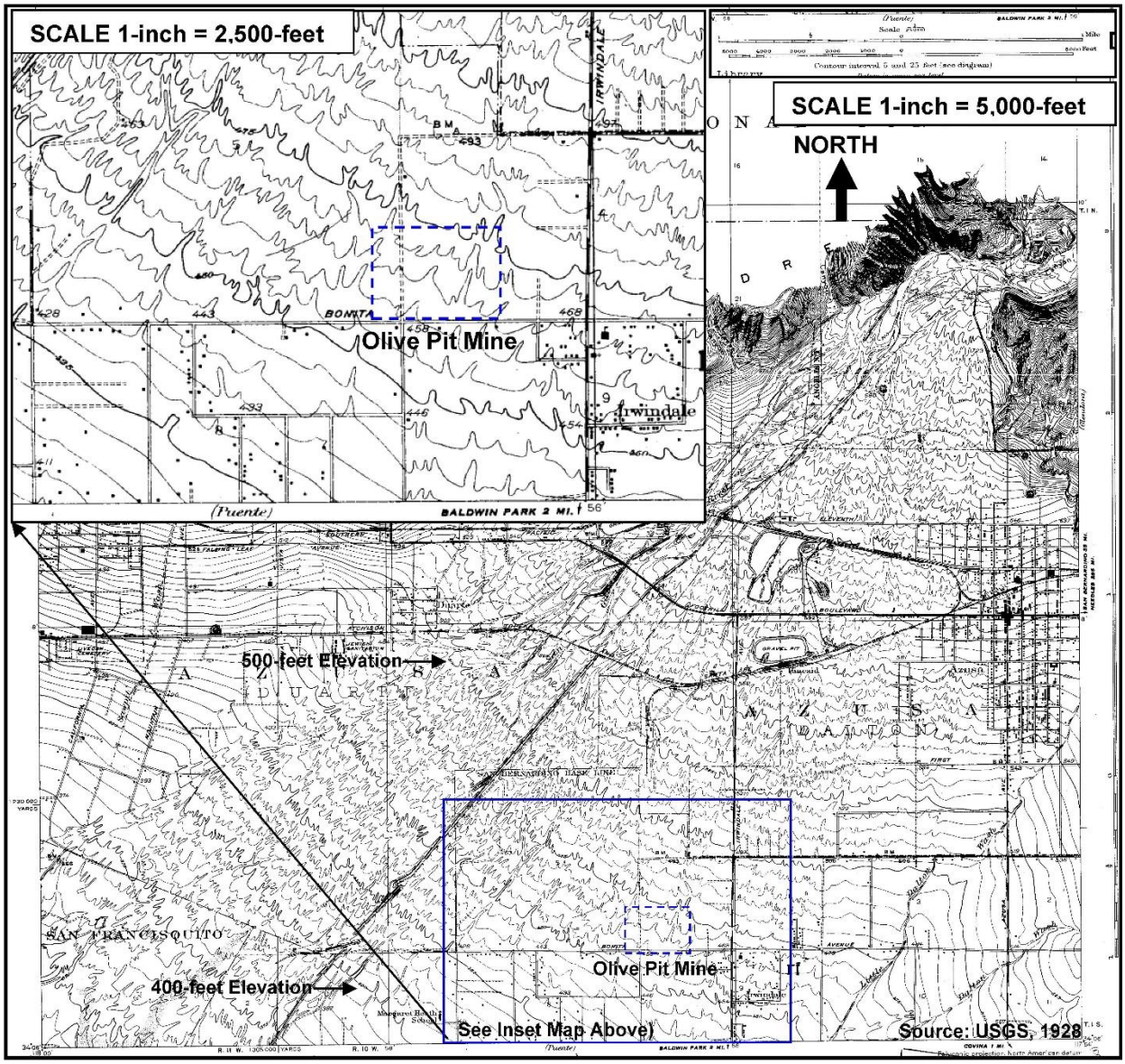
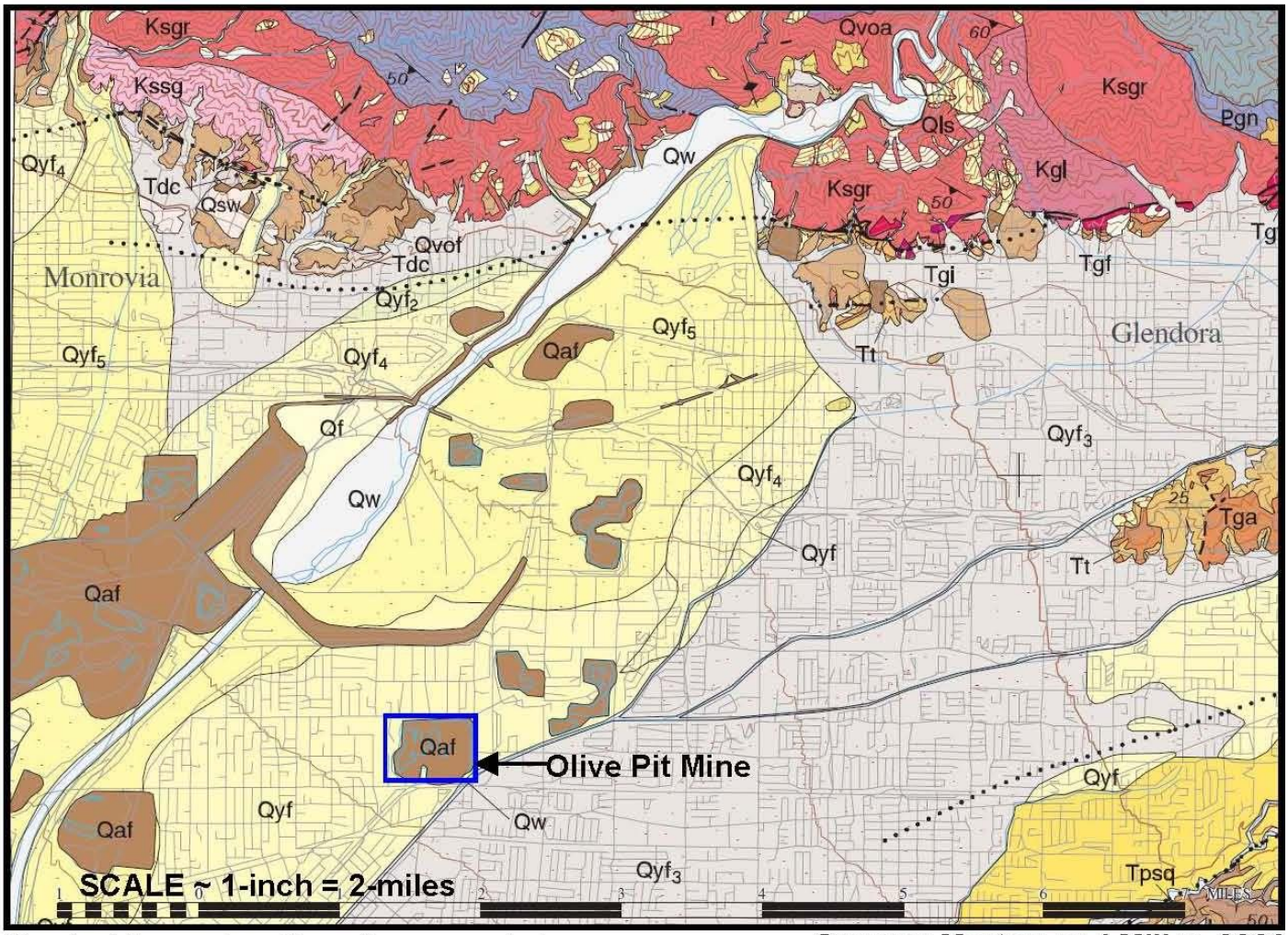


Figure 3.5-3 – Regional and Site Area Geology Map for the Olive Pit



See text for explanation of map symbols. Source: Morton and Miller, 2006

Site-specific reports by GeoLogic Associates (GLA; 2003 and 2008) and Brian Stirrat and Associates (BAS; 2001a, 2001b, and 2001c) are understood to describe the specific geologic materials in the mine (quarry). GLA describes six samples (Olive #1-#6) as almost uniformly large cobbles to very fine sand, with one sample having up to 10-percent silt and clay. They characterize the unit overall as randomly packed into a rather homogeneous fabric with an in-situ density of 140 pounds per cubic foot based on similarity to United Rock Products Pit #2.

Seismic and Other Geologic Hazards

Geologic hazards associated with the region include earthquake-induced hazards (e.g., ground shaking, surface fault ruptures, soil liquefaction, and seismically-induced landslides), slope instability, ground subsidence, and soil erosion. These hazards are further defined as:

- **Ground Shaking** – Ground shaking refers to the vertical and horizontal vibrations or movement of the ground during an earthquake.
- **Surface Faulting** – Surface faulting is a displacement of the ground surface (horizontal and/or vertical) resulting from differential movement of two sides of a fault (fracture) at the earth's surface.
- **Liquefaction** – Liquefaction is a process by which water-saturated sediments temporarily lose strength and act as a liquid. Liquefaction can cause three types of conditions – lateral spread (landslide-type movements of blocks of soil), flow failures (material moving over a layer of liquefied soil), and loss of soil bearing strength.
- **Slope Instability or Landslides** – There are several types of earthquake-induced landslides, the most common being rock falls and slides of rock fragments from a steep slope. Earth-flow landslides can also be caused by water-saturated soils on steep slopes.
- **Ground Subsidence** – Subsidence is a decrease in relative elevation of the ground surface as a result of various natural or man-induced phenomena that cause densification of the subsurface materials. Natural induced phenomena include tectonic shaking, long-term consolidation, hydrocompaction, or the after-effects of rapid sedimentation. Human activities that can cause subsidence are withdrawal of water or petroleum hydrocarbons in subsurface deposits.
- **Erosion** – Erosion is the removal of surface soil as a result of wind, gravity, or water flow (e.g., rain or irrigation runoff).

Seismicity

Seismic hazards in California are generally considered to be high in most areas. The seismic activity in California is the result of plate tectonic movements between the North American and Pacific plates. As a result, a number of large fault systems and earthquakes have occurred historically in both northern and southern California. For southern California, the last great

earthquake occurred in the Fort Tejon area (near present day Bakersfield) on January 9, 1857. This earthquake had a magnitude of 7.9. More frequent smaller earthquakes have occurred regularly in the southern California region. These earthquakes include the 1933 Long Beach, 1971 San Fernando, the 1987 Whittier Narrows, and the 1994 Northridge earthquakes. These earthquakes had magnitudes of 6.4, 6.6, 5.9, and 6.7, respectively. The intensity of shaking from these events caused significant damage in southern California cities.

Seismologists use magnitude scales to express the seismic energy released by an earthquake. Since Charles Richter developed the original magnitude scale (designated M_L for Local Magnitude) in 1935, there have been other magnitude scales developed for measuring the size of earthquakes occurring in southern California. Because of the limitations of other magnitude scales, as the moment magnitude (M_w) was developed based on energy release and generally gives the most reliable estimate of earthquake size, especially for large earthquakes.

A scale used by many geologists is the Modified Mercalli Scale (MM), which describes the intensity of an earthquake based on the effect of an earthquake on the surface of the earth as well as the effects it has on humans, natural features, and man-made structures. The lower portion of the MM Scale generally determines the effects of an earthquake on humans; while, the upper scale observes the effect the earthquake has on objects. A general representation of the MM scale is provided in **Table 3.5-1**.

Earthquakes have occurred on numerous faults in southern California and some have been felt in the City, but none has caused serious damage or injury within the City of Irwindale. A search radius of 100-kilometers (62-miles) for active faults (e.g., faults capable of causing the highest estimated ground motions in the City) conducted for a previous report is provided with this study since it is generally representative of the Olive Pit Mine site as well. The 100-kilometers (km) radius is a conservative distance for potentially high magnitude events (**Table 3.5-1**). Events beyond the 100-km radius are not considered to pose a significant threat to the City. Those faults posing the most significant threat are within approximately 25-miles of the City (**Table 3.5-2**) from the same previous report. As seen in **Table 3.5-1**, the faults near the City may be strike-slip faults (right- or left-lateral), dip-slip (normal or reverse), or a combination (oblique slip). In addition, a number of blind-thrust faults are located in the Los Angeles region. These types of faults generally do not have surface displacement features to identify them, but studies have determined their location in the subsurface in some localities. The intensity of an earthquake at the Olive Pit Mine site is most dependent upon the magnitude, the distance from the earthquake epicenter, the characteristics of the surficial/alluvial deposits, the depth to groundwater, and the topography.

Table 3.5-2 provides the fault name, location, distance to the respective faults within 25-miles of the City, the estimated maximum earthquake magnitude for each fault, and the estimated peak horizontal ground acceleration (PHGA) and Modified Mercalli Intensity (MMI). The PHGA and

MMI are presented for the median case and the more conservative one-sigma (one standard deviation) case.

An analysis was also performed for a previous report to determine the number and size of historic earthquake patterns which have occurred within 100-miles of the City of Irwindale and surrounding area. The reference point selected is the central part of the City of Irwindale. These results of this analysis are presented in **Table 3.7-3**. Historical earthquake data from 1800 to 2014 were evaluated, with the number of times earthquakes with varying magnitudes were exceeded and the return period of each magnitude.

Table 3.5-1 Abridged Version of the Modified Mercalli Intensity Scale

Magnitude	Shaking Severity	Summary of Damage	Average Peak Velocity (cm/sec)	Average Peak Acceleration (% gravity)	Intensity Value and Description
I	-	-	<0.1	<0.17	Not felt except by a very few under especially favorable circumstances (I Rossi-Forel scale). Damage potential: None.
II	-	-	0.1 – 1.1	0.17 – 1.4	Felt only by a few persons at rest, especially on upper floors of high-rise buildings. Delicately suspended objects may swing. (I to II Rossi-Forel scale). Damage potential: None.
III	-	-	0.1 – 1.1	0.17 – 1.4	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck. Duration estimated. (III Rossi-Forel scale). Damage potential: None.
IV	-	-	1.1 – 3.4	1.4 – 3.9	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like a heavy truck striking building. Standing automobiles rocked noticeably. (IV to V Rossi-Forel scale). Damage potential: None. Perceived shaking: Light.
V	Light	Pictures Move	3.4 – 8.1	3.9 – 9.2	Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI Rossi-Forel scale). Damage potential: Very light. Perceived shaking: Moderate.
VI	Moderate	Objects Fall	8.1 - 16	9.2 – 18	Felt by all, many frightened and run outdoors. Some heavy furniture moved, few instances of fallen plaster and damaged chimneys. Damage slight. (VI to VII Rossi-Forel scale). Damage potential: Light. Perceived shaking: Strong.
VII	Strong	Nonstructural Damage	16 - 31	18 – 34	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars. (VIII Rossi-Forel scale). Damage potential: Moderate. Perceived shaking: Very strong.

Magnitude	Shaking Severity	Summary of Damage	Average Peak Velocity (cm/sec)	Average Peak Acceleration (% gravity)	Intensity Value and Description
VIII	Very Strong	Moderate Damage	31 - 60	34 – 65	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed. (VIII+ to IX Rossi-Forel scale). Damage potential: Moderate to heavy. Perceived shaking: Severe.
IX	Violent	Heavy Damage	60 - 116	65 – 124	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken. (IX+ Rossi-Forel scale). Damage potential: Heavy. Perceived shaking: Violent.
X	Very Violent	Extreme Damage	> 116	> 124	Some well-built wooden structures destroyed; most masonry and frame structures destroyed; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks. (X Rossi-Forel scale). Damage potential: Very heavy. Perceived shaking: Extreme.
XI	-	-			Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	-	-			Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into air.

Source: California Department of Conservation 2004 and Modified from Bolt (1993) and Wald et al. (1999)

Table 3.5-2 Major Faults within a 25-Mile Radius of the City Of Irwindale

Fault	Approximate Distance from Project Site (miles)	Estimated Maximum Earthquake Event				
		Maximum Earthquake Magnitude (Mw)	Peak Horizontal Site Acceleration (g)		Estimated Modified Mercalli Intensity	
			Median	One-Sigma	Median	One-Sigma
Sierra Madre	3.7	7.2	0.68	1.02	XI	XI
Raymond	6.5	6.5	0.45	0.74	X	XI
Clamshell-Sawpit	7.2	6.5	0.42	0.68	X	XI
San Jose	9.9	6.4	0.30	0.49	IX	X
Puente Hills Blind Thrust	11.7	7.1	0.35	0.52	IX	X
Upper Elysian Park Blind Thrust	13.6	6.4	0.22	0.35	VIII	IX
Cucamonga	13.9	6.9	0.27	0.42	IX	X
San Andreas – Whole	24.0	8.0	0.21	0.32	VIII	IX

Source: Blake, 2002

Table 3.5-3 Historical Earthquake Pattern within 100-miles of the City Of Irwindale

Earthquake Magnitude	Number of Times Exceeded	Return Period-Years
4.0	1290	<1
4.5	486	<1
5.0	165	1
5.5	55	4
6.0	27	8
6.5	12	17
7.0	6	34
7.5	2	102

Source: Blake, 2002

The California Geological Survey Probabilistic Seismic Hazards Ground Motion Interpolator uses a 2008 (Wills and others, 2008) data base to allow estimates for various levels of potential ground motion (g = force of gravity) based on expected return period (a 2- or 10-percent chance of exceedance in 50 years [975 years and 475 years, respectively]) combined with peak ground acceleration or spectral amplitude (SA) periods of 0.2- and 1.0-second. Table 3.5-4 shows the values obtained for the project site, assuming a site shear wave velocity in the upper 30 meters of 270 meters per second (m/s).

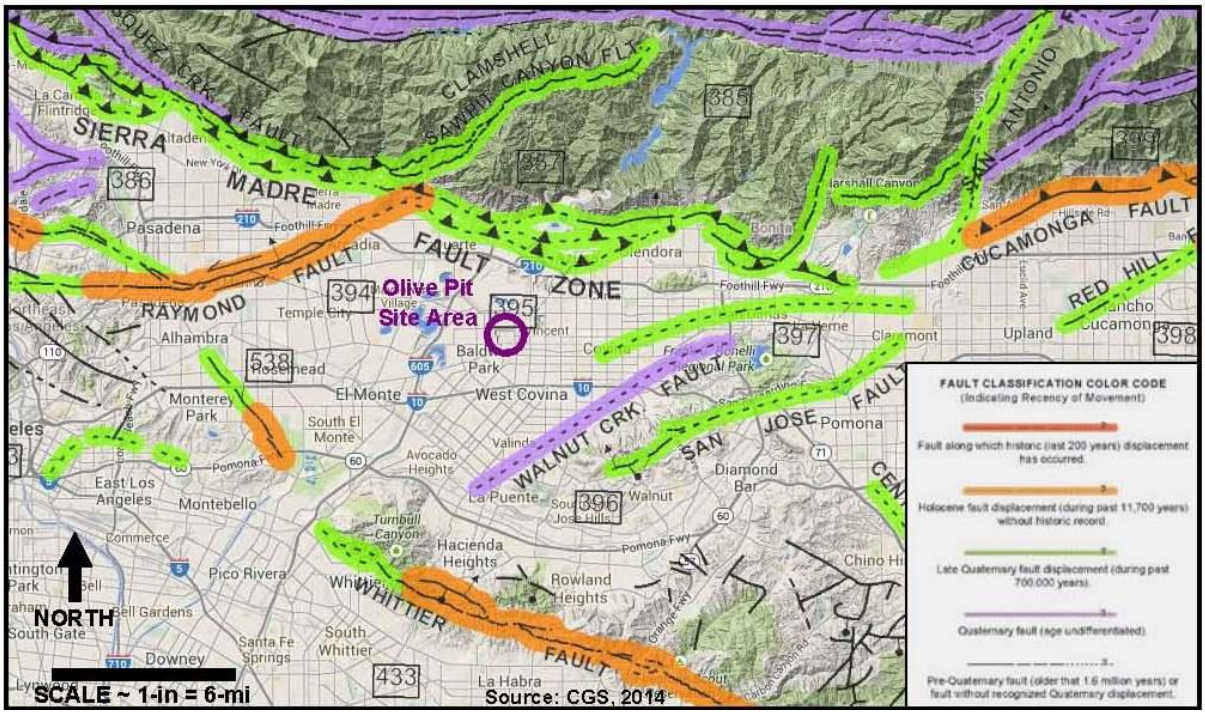
Table 3.5-4 - Generalized (Not For Design) Probabilistic Seismic Hazard Ground Motions

Ground Motion (g = Force of Gravity)	2% in 50 years	10% in 50 years
Peak Ground Acceleration (PGA)	0.78 g	0.49 g
Spectral Acceleration (Sa) - 0.2 sec. Period	1.71 g	1.08 g
Spectral Acceleration (Sa) - 1.0 sec. Period	1.06 g	0.62 g

Source: CGS, 2014.

The following fault discussions concentrate on those faults that are capable of causing strong earthquake shaking in the City (assumed to be greater than 0.40g as referenced in Table 3.5-4). The most significant near-field faults are the Sierra Madre (including the Upper Duarte/Duarte), Clamshell-Sawpit, and Raymond faults (Figure 3.5-4). The San Andreas Fault is the most significant distant fault. There are no Alquist-Priolo Special Study Zones within the City.

Figure 3.5-4 – Regional Fault Map for the Olive Pit Mine



Source: CGS, 2014

The **Sierra Madre fault** is the longest fault within or very near the City, and would produce the highest amplitude ground shaking within the City in the event of a major earthquake. The surface fault is located about 4-miles north of the Olive Pit Mine site. The Sierra Madre Fault is a reverse fault with a maximum credible magnitude of approximately 7.2, assuming that the entire length of the fault ruptures (Petersen et al., 1996). The Upper Duarte, Duarte, and associated smaller faults discussed above are considered to be part of the Sierra Madre fault system that bounds the edge of the southern foothills of the San Gabriel Mountains. Treiman (2014) has recently designated these faults as part of a new APEFZ north of the City.

The surface expression of the **Raymond fault** lies about 6.5-miles northwest of the Olive Pit Mine sites. The maximum magnitude of the fault estimated by the California Geological Survey (Wills and others, 2008) is approximately 6.3 compared to a magnitude of 6.7 estimated by the Southern California Earthquake Center (SCEC, 2014). There has not been a significant earthquake on this section of the fault in historic time.

The **Clamshell-Sawpit fault** surface expression is approximately 7-miles northwest of the Olive Pit Mine area. The maximum magnitude of the Clamshell-Sawpit fault estimated by the CGS (Wills and others, 2008) is about 6.5. The Clamshell-Sawpit fault was the source for the June 28, 1991 the M5.6 Sierra Madre earthquake and occurred on what is now believed to be a branch fault trending northeast from the Sierra Madre fault zone north in the San Gabriel Mountains. Because the magnitude was moderate and the hypocenter was relatively deep there was no surface rupture and damage was overall not significant compared to, for example, the Whittier Narrows events.

Surface Fault Ruptures

Surface fault rupture occurs when displacement along a fault plane propagates to the earth's surface, causing some measure of offset and disturbance. Sufficient offset along the dip of a dip-slip fault can create a discrete step or fault scarp. Slippage along the strike of a strike-slip fault (e.g., San Andreas Fault) may manifest significant shearing along a single fault line. Alternatively, it can manifest as a zone of fracturing and ground cracking. The location of potential surface fault rupture sites are identified in Alquist-Priolo Earthquake Fault Zones (APEFZ). There are no APEFZ locations within the City of Irwindale (Hart and Bryant, 2007). Therefore, the potential for surface rupture due to fault plane displacement propagating to the Olive Pit Mine structure during the design life of project is considered low.

Slope Stability and Landslides

Landslides, rock falls, and debris flows are all forms of mass wasting, the movement of soils and rock under the influence of gravity. A landslide may occur if source material on a slope is triggered by some mechanism. Source materials include fractured and weathered bedrock and loose soils. Triggering mechanisms include earthquakes, saturation from rainfall, and erosion. Catastrophic slides may result in the destruction of foundations, offset of roads, and breaking of

underground pipes within and along the margins of a landslide. Additionally, landslides can override property and affect structures up-slope and down-slope of the slide.

The site was mined the site up to the early 1970s and left the site in the current condition. In some areas, slopes are oversteepened and have a greater potential for failure. Specifically, these areas are found around on the eastern and southern perimeter of the previously mined pit. In addition, there are isolated areas of potential instability. GLA (2008) contains a figure (Figure 1 Slope Stability Section Location Plan, which identifies the areas of instability and where a minimum recommended limit for slope remediation is advised (see Figure 3.5-5). These areas lie along the eastern slope, and portions of the southern and northern slopes.

Figure 3.5-5 – Geotechnical Monitoring Olive Pit

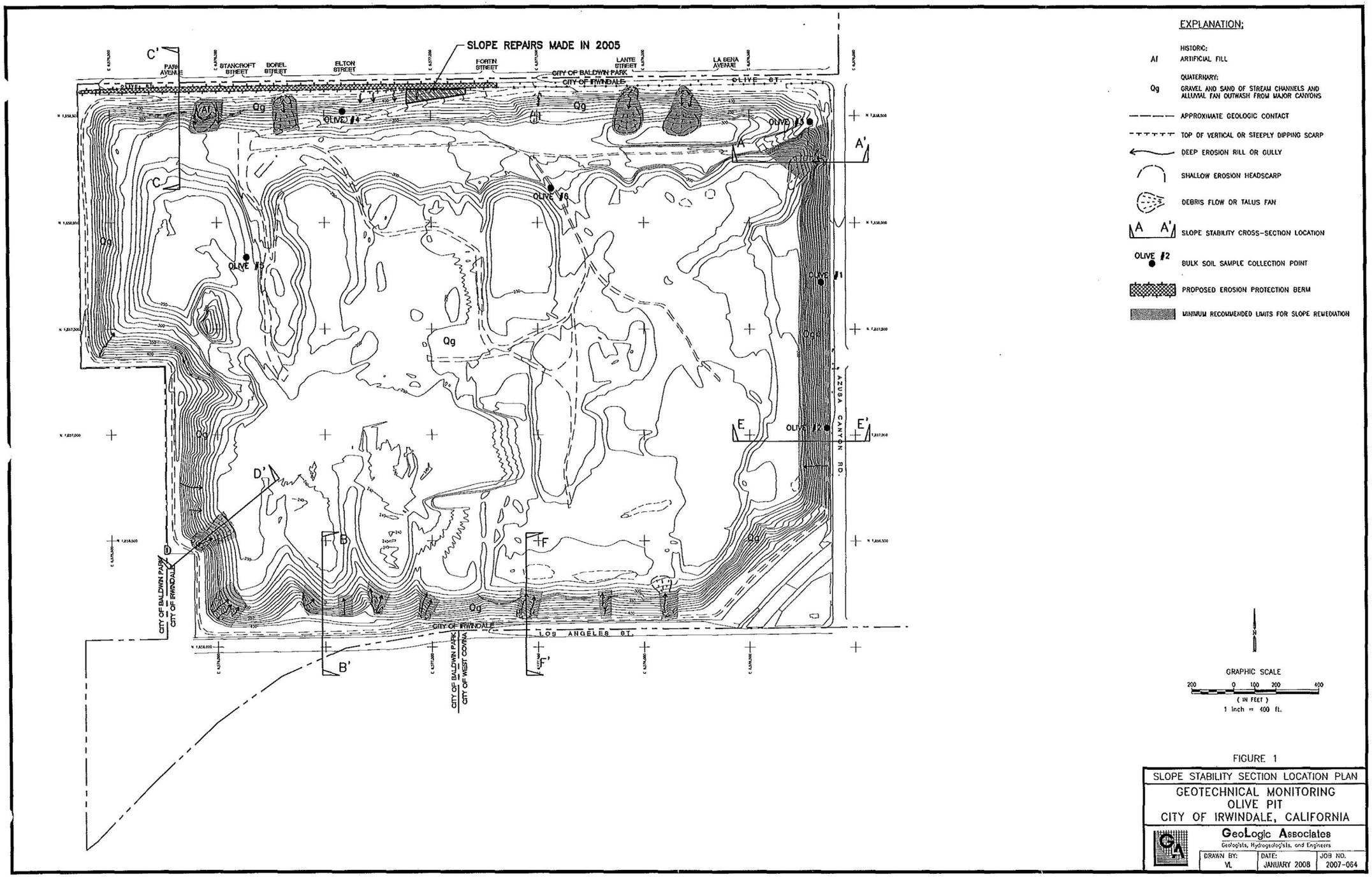


FIGURE 3.5.5

The CDMG (1999) indicates that all steep side slopes of the Olive Pit Mine have a potential for earthquake induced landslide occurrence. The field reconnaissance and Google Earth Imagery (2013) indicate smaller scale slumps have affected the debris slopes at the base of the steep side slopes. GLA (2008) performed a slope stability analysis for the Olive Pit Mine and determined that most slopes are stable with factors-of-safety (FS) of greater than 1.5 and that some oversteepened perimeter slopes (e.g., the northern portion of the east slope) have a greater potential for failure in an earthquake. Considering areas with small setback distances to the property from the top of slope, the stability is inadequate.

Liquefaction

Liquefaction is a phenomenon in which saturated soils lose strength and cohesion when subjected to dynamic forces, such as shaking during an earthquake. Liquefaction can also occur in unsaturated soils with low cohesion, such as sand. Liquefaction and related phenomena have been responsible for a tremendous amount of damage during historical earthquakes. This damage occurs when soil cohesion is lost which directly affects the support that it normally supplies to building foundations. Ground failure resulting from liquefaction can include sand boils, ground settlement, ground cracking, lateral spreading, slope toe failure, and ground warping.

Generally, liquefaction occurs where groundwater is within 30-feet of the surface. Groundwater elevations within the City can vary significantly depending upon rainfall and groundwater recharge. Reported groundwater elevations in the City usually range from 50- to 150-feet below the ground surface (bgs). Liquefaction areas have been identified in the southwestern corner of the City and in locations within Baldwin Park. The Olive Pit Mine area is not within an identified as a liquefaction area.

Tsunami and Seiche

Most tsunamis are ocean waves triggered by earthquake ruptures along subduction zones (e.g., a tectonic fault rupture on the bottom of the ocean). Due to the site elevation and distance to the ocean, tsunamis are not a threat at the Olive Pit Mine. A seiche is a periodic oscillation or “sloshing” of water in an enclosed basin (e.g., lake or reservoir) caused by an earthquake. The period of oscillation is dependent upon the size and configuration of the water body and may range from minutes to hours. Although unlikely, water trapped with the Mine could be subject to a seiche.

The nearest potential large basin of water near the Olive Pit Mine site are the United States Army Corp of Engineers (USACE) Santa Fe Control Basin site used to control flood waters from the San Gabriel River. However, the only time large volumes of water are in this Basin is during heavy rain periods when flood control of the San Gabriel River is necessary. The water that accumulates within this Basin is used for groundwater recharge. The Santa Fe Control Basin is adjacent to the Olive Pit Mine site. It is unlikely the Santa Fe Control Basin would result in a

seiche due to maintenance control of it by the USACE and Los Angeles County Flood Control District, and the unlikely coincidence of high water with a major earthquake.

Subsidence

Surface subsidence has not been reported in large areas within Irwindale. Natural phenomena that may induce subsidence, such as seismically induced settlement (liquefaction), soil consolidation (hydrocompaction), oxidation or dewatering of organic-rich soils, and collapse of subsurface cavities are unlikely considering the characteristics of the alluvial fan deposits and the depth of groundwater. Human activities that could induce subsidence, oil field, and groundwater pumping either do not exist (oil field) or have shown not impact over decades (groundwater pumping). Therefore, the likelihood of significant subsidence at the Olive Pit Mine is considered low.

Mineral Resources

As shown by the nature of the geologic deposits (Qyf, alluvial fans; Figure 3.5-3), and by the past development of sand and gravel mines in Irwindale and surrounding areas (highlighted by Qaf on Figure 3.5-3), the materials at the Olive Pit Mine are considered a significant mineral resource. Construction aggregate is the sand, gravel, and crushed rock used in most construction projects and is an essential mineral resource in California. The availability of aggregate deposits and their proximity to markets are critical factors affecting resource development and urban development. In order to protect mineral resources from expanding development, the Surface Mining and Reclamation Act of 1975 (SMARA) created the classification and designation process.

Classification of minerals is the first step in the process of identifying resources that are suitable for extraction. An area classified as a Mineral Resource Zone 2 (MRZ-2) indicates the site contains proven high quality aggregate resources. The second step in the mineral resource conservation process is to designate a site as Regionally Significant for Construction Aggregate. Resources within the Olive Pit were first classified as MRZ-2 in 1982, and were later designated as regionally significant in 1984. The area was further incorporated into the California Administrative Code as Section 3550.5 (Title 14, Div. 2, Chapter 8, Subchapter 1).

3.5.2 REGULATORY SETTING

The Olive Pit Mine surface mine project would be regulated by a variety of State, regional and local laws, ordinances, regulations and standards related to mining and reclamation operations. The proposed project consists of two phases of mining and two phases of reclamation. Each phase has regulatory controls in order to assure public safety and environmental protection. A brief discussion regarding the regulations pertinent to the proposed project is provided below.

Federal

There are no specific federal regulations addressing geology, soils, and mineral issues that are not addressed by the more stringent state or local requirements.

State of California

Surface Mining and Reclamation Act of 1975 (SMARA): The Surface Mining and Reclamation Act (SMARA) of 1975 is administered by the California Department of Conservation, Office of Mine Reclamation (OMR). SMARA mandated that aggregate resources throughout the state be mapped so that local governments could make land use decisions in light of the presence of aggregate resources and the need to preserve access to those resources. A primary objective of SMARA is to protect mineral resources of regional and statewide significance. The California Department of Conservation, Division of Mines and Geology (CDMG, now the California Geological Survey—CGS) is the state agency responsible for identifying and protecting Mineral Resource Zones (MRZs) per SMARA. The Division of Mines and Geology has prepared Mineral Land Classification Maps for aggregate resources that designate four different types of MRZs as follows:

- **MRZ-1:** Areas where available geologic information indicates that little likelihood exists for the presence of significant mineral resources.
- **MRZ-2:** Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists. This zone shall be applied to known mineral deposits or where well-developed lines of reasoning, based upon economic-geologic principles and adequate data, demonstrate that the likelihood for occurrence of significant mineral deposits is high.
- **MRZ-3:** Areas containing known or inferred mineral occurrences of undetermined mineral resource significance.
- **MRZ-4:** Areas where available information is inadequate to assign any other classification.

The Olive Pit Mine is within the MRZ-2 mineral resource zone identified by CGS (2010) as Sector E and is shown in the City of Irwindale's General Plan.

SMARA Section 2711 and 2712 provide general policy background for environmental impact assessment, 2772.5, which requires a detailed description of the geology of the mine site, 2773(b)(2), which requires establishment of regulations for slope stability, and the in the reclamation standards (CCR Title 14, Article 9) §3704 Performance Standards for Backfilling, Regrading, Slope Stability, and Recontouring.

SMARA requires mine owners to develop Reclamation Plans for use of the land after mining and to post Financial Assurances sufficient to perform the requirements specified in the site specific

Reclamation Plan. SMARA also requires mine operators to obtain all necessary permits and approvals. Under SMARA the OMR works primarily with the City of Irwindale on issues of slope stability and other geotechnical surface issues (e.g., foundations and erosion). Mining permit requirements (e.g., slopes, depths, setback distances, fencing, and operation hours) are specified in the mine's Conditional Use Permit (CUP).

Normally, local "lead agencies" (e.g., city or county governments) are given the responsibility for "lead agency" oversight of SMARA compliance in their jurisdiction. The City of Irwindale is the Lead Agency under both CEQA and SMARA for the proposed project. As the lead agency, the City is responsible for enforcing SMARA provisions and conditions of approval for the proposed project. The City General Plan encourages the protection of City mineral resource areas, as well as the development of compatible land uses in surrounding areas.

To protect designated resources, SMARA Section 2763 requires a lead agency to make certain findings prior to approving a development project that would eliminate access to, or the ability to extract, those resources. Prior to approving a project that would conflict with aggregate resource recovery at the Olive Pit, the City is considering the extraction of mineral resources at the site. The Olive Pit project, as proposed, would comply with SMARA by allowing for the extraction of regionally significant aggregate resources prior to approving development for commercial or other purposes.

Alquist-Priolo Earthquake Fault Zones: The California Geological Survey has delineated special study zones along known active and potentially active faults in California pursuant to the Alquist-Priolo Earthquake Fault (formerly Special Studies) Zones (APEFZ) Act of 1972. The State designates the authority to local government to regulate development within APEFZ. Construction of habitable structures is not permitted over, or within 50 feet of, an active fault in a potential rupture zone. There are no APEFZs within or near the Olive Pit Mine site.

Seismic Hazards Mapping Act: The CGS has also identified Seismic Hazard Zones that are delineated in accordance with the Seismic Hazard Mapping Program (SHMP) of the Seismic Hazards Act of 1990. The Act is "to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes."

The State CGS identifies several earth resource issues that should be taken into consideration in evaluating whether proposed projects are likely to be subject to geologic hazards, particularly related to earthquake damage. These considerations include both the potential for existing conditions to pose a risk to the project and the potential for the project to result in an impact on the existing conditions for geology or soils. The program and actions mandated by this Act closely resemble those of the APEFZ Act by requiring the State Mining and Geology Board

(SMGB) to develop regulations, policies, and criteria in guiding cities and counties in their implementation of the law.

The State CGS enacts established regulations related to geologic hazards (e.g., faulting, liquefaction, subsidence, ground shaking) as they affect persons and structures. Projects located within special studies (active or potentially active faults) or designated hazards (liquefaction or seismically induced landslide) zones as delineated by the APEFZ and SHMP may be subject to review and comment as part of State regulatory control. The State designates this control to local governments to regulate development within special studies and hazards zones. Potential earthquake-induced landslide areas are identified coincident with the steep Olive Pit Mine side slopes.

California Department of Conservation and California Geological Survey Guidelines: The CGS also issues guidelines for the evaluation of geologic and seismic factors that may impact a project, or that a project may affect. The applicable guidelines are as follows:

- CDMG Note 42, Guidelines to Geologic/Seismic Reports;
- CDMG Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports;
- CDMG Note 48, Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings; and
- CDMG Note 49, Guidelines for Evaluating the Hazard of Surface Fault Rupture.

Each guideline provides checklists and outlines to help insure a comprehensive report of geologic/seismic conditions. Although not mandatory in all their detail, these guidelines provide assistance in assuring completeness of geologic/seismic studies conducted for a project.

Local

City of Irwindale General Plan and Natural Hazard Mitigation Plan (NHMP). The City of Irwindale 2008 General Plan Safety Element (City of Irwindale, 2008) contains goals and policies that are intended to ensure, among other things, the safety of the residents, commercial and industrial entities, and visitors in the event of a major earthquake or other geologic hazards. Their NHMP (City of Irwindale, 2012) provides a risk assessment that identifies risks posed by a hazard and the corresponding impacts to the community through a five step process: 1) identify hazards, 2) profile hazards, 3) inventory critical assets, 4) assess risks, and 5) assess vulnerability of future development. In addition, the General Plan Resource Management Element addresses mineral resources policies and programs. The Safety and Resource Management Elements must be considered when approving mining, reclamation, and development/ infrastructure projects. Each has associated technical discussions and small-scale maps that cover the City, including the Olive Pit Mine site.

The City of Irwindale is also the Lead Agency for CEQA, and is responsible for enforcing all State, and local provisions and conditions of approval as required in the applicant's Conditional Use Permit and Zoning Code Amendment applications. Furthermore, the City is responsible for planning and zoning and addresses the general current and future land uses (e.g., residential, commercial, or industrial) of property within its jurisdictional area. Zoning is intended to provide a uniform plan for the development of compatible facilities within given areas.

City of Irwindale Guidelines for Open-pit Mines. The proposed mine and reclamation plan for the Olive Pit will be in accordance with all then-current City guidelines for open-pit mines. These existing guidelines include:

- Guidelines for Stability Analyses of Open-Pit Mine Slopes, Irwindale, California; Irwindale Slope Stability Committee, December 23, 2003.
- Guidelines for Drainage and Erosion Control for Open-Pit Mines, Irwindale, California; Irwindale Drainage and Erosion Control Committee, July 6, 2004.
- Guidelines for Underwater Backfilling of Open-Pit Mines, Irwindale, California; Irwindale Backfilling Committee, May 20, 2005.
- Guidelines for Above Water Backfilling of Open-Pit Mines, Irwindale, California; Irwindale Backfilling Committee, November 2005.

3.5.3 IMPACT ANALYSIS AND MITIGATION

The analysis of potential geologic, seismic, soils, and mineral resource impacts associated with the implementation of the Olive Pit Mine assesses the degree to which the Project's mining- and reclamation-related activities would alter the existing soil and slope stability conditions on-site, and whether the resources are adequate to support the Proposed Project or would otherwise adversely affect the Project.

The applicant proposes to extract all economically available construction aggregate resources from the Olive Pit in compliance with State and City regulations. The first phase will include construction of a new access road and extraction of the eastern portion of the site. Phase 1 extraction will be followed by reclamation of this area to create an approximate 32-acre pad suitable for development. Reclamation will involve filling the extraction void with inert fill materials. The second phase will include mining the remainder of the site utilizing both dry and underwater mining processes.

Threshold of Significance

The significance of the potential geology, soils, and mineral resources impacts is determined based on relevant State CEQA Guidelines, Appendix G, and other relevant considerations

including State and local development policies and requirements. Using these thresholds, the Olive Pit Mine would be considered to have a significant impact if it were to:

A. Expose people or structures to a potential substantial adverse effect, including the risk of loss, injury or death involving
    1. Rupture of a known earthquake fault or based on other substantial evidence of a known fault?
    2. Strong seismic ground shaking?
    3. Seismic-related ground failure, including liquefaction?
    4. 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 soils, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?
E. Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are unavailable for the disposal of waste water.
F. Would the project 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?
G. Would the project 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?

Analysis

THRESHOLD GEO-1

Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault or based on other substantial evidence of a known fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides?

Less than Significant Impact

Slope stability analyses were performed for the existing perimeter slopes at the Olive Pit in January 2008. Based on the results of the static slope stability analyses, most slopes were found to be stable with a factor of safety greater than 1.5 at the property line. Seismic stability calculations indicate some over-steepened slopes near the perimeter could experience permanent deformation that would not be in compliance with the City's Guidelines for Slope Stability Analyses of Open-Pit Mines (2003) at, or beyond, the property line during an earthquake event.

The proposed mining operation will immediately construct an access road into the existing pit along Los Angeles Street. The new access road will be constructed with a combination of on-site materials and fill materials. It will ascend from the bottom of the pit along the southern edge of the property to the southeastern corner of the site where it will exit at Los Angeles Street. The new access road will be constructed with a 45-foot wide road bed. In addition, an approximate 5-acre pad (loading area) will be created at the southeastern corner of the property for loading trucks with extracted materials. Construction of the access road will result in fill placement adjacent to the existing southern cut slope. Fill placement will extend up to 45-feet to the north of the southern cut slope and will stabilize existing slope instabilities along the southern perimeter of the site.

The first operational phase will include extraction of the eastern portion of the site, followed by reclamation of this area. Reclamation of this area will require backfilling of the eastern one third of the site to create an approximate 32-acre pad suitable for development. This pad will be at street level and will provide stability to the entire eastern slope and the two north eastern areas of concern.

Upon completion of Phase 1, a 4.7-acre pad will be developed at the base of the pit within the southwest corner of the site. In this area of the site, an area of instability is noted at the southwest corner of the pit. This pad will help provide stability by filling the base of the area of instability.

There are two debris flows of concern located in the northwestern corner of the site. An erosion protection berm has been proposed at the top of these slopes. The erosion protection berm will reduce the risk of failure at this location by intercepting runoff and preventing uncontrolled discharge over the slope. The proposed berm will extend 2,000 linear feet from the edge of the block wall on the north perimeter of the pit, to the curb and gutter at the northwest corner of the pit. The berm will have a minimum height of 18-inches and 1.5:1 (horizontal to vertical) side slopes.

Reclamation measures require revegetation of all final fill slopes and cut slopes resulting from the proposed project. These measures will prevent slope instabilities and erosion on newly created slopes.

The proposed project's design features eliminate many of the existing instability onsite. Conditions of Approval for the Conditional Use Permit will include annual slope stability monitoring and reporting to the City as an ongoing element of Project implementation.

The Project would be in full compliance with existing geotechnical and engineering geology regulations. Although there are existing slope stability concerns onsite, and earthquake-related site characteristics discussed above under existing conditions, the Project design features would minimize slope stability risks including slope failures/landslides and earthquake risks to a level that is less than significant.

Active or potentially active faults do not pass directly through the Olive Pit Mine site. However, a number of known regional active faults are located at distances where they could produce substantial ground shaking at the Olive Pit Mine site. Similar to development throughout most of southern California, implementation of the Olive Pit Mine would result in exposure of persons and structures at the site to substantial ground shaking and thus a potentially significant degree of seismic hazard risk. As considerations of earthquake risk are routinely considered in these types of developments, Project design features were incorporated into the Project as proposed which would reduce impacts from ground shaking to levels that are less than significant and no mitigation is required.

There are no Alquist-Priolo Special Study Zones within the City of Irwindale. Therefore, the risk of ground ruptures would be less than significant and no mitigation is required.

Liquefaction is associated with seismic activity. Soils at the site are not susceptible to liquefaction based on CGS mapping and Guidelines for Evaluating and Mitigating Seismic Hazards in California (1997b). Although groundwater occurs at an estimated depth of over 50-feet bgs in the area surrounding the Olive Pit Mine site, CDMG (1998) shows historic high-groundwater levels at 120- to 150-feet deep, which is somewhat coincident with the bottom of the existing excavation. Groundwater levels in this area are subject to seasonal and year-to-year fluctuations (and the project will include some “wet” mining below the water table). A significant increase in groundwater levels above the historic high levels at the Olive Pit Mine site is considered a very low probability. Therefore, even with a shallow depth to groundwater under the Olive Pit Mine, the nature of alluvial deposits at the site (i.e., relatively dense and gravel-rich) indicate that liquefaction is not anticipated to be a potential problem. For these reasons, impacts associated with potential liquefaction would be less than significant and no mitigation is required.

Landslides, static or earthquake-induced, are possible around the perimeter of the Olive Pit Mine (CDMG, 1998). A slope stability analysis has been performed for the site (GLA, 2008) and while most slopes are stable in their current configuration, some areas are not. As this was anticipated at the outset, the Project incorporates specific project design features described above that are intended to remediate existing onsite slope stability issues. Based on the above, potential impacts of the Project would be less than significant.

Planned mining and reclamation will be required to adhere to slope stability regulations and to recommendations in the 2008 GLA report. For example, no slopes would be steeper than 2:1 horizontal:vertical. In addition, consideration of seismic-related ground failure in the form of earthquake-induced settlement and overburden load-induced settlement/consolidation of reclamation backfill were evaluated in the development of the Project design and the Project is designed to minimize further slope stability risks. For these reasons, impacts associated with seismic hazards will be reduced to the extent possible and to a level consistent with any other

Projects in the area. Therefore, it is concluded that for the mining and reclamation phases, seismic-related hazards risk would be less than significant.

THRESHOLD GEO-2

Would the Project result in substantial soil erosion or the loss of topsoil?

Less than Significant

Implementation of the Proposed Project will involve the construction of an access road into the existing pit along Los Angeles Street. Construction of the access road will result in fill placement adjacent to the existing southern cut slope. Fill placement will extend up to 45-feet to the north of the southern cut slope and will stabilize existing slope instabilities along the southern perimeter of the site.

Site reclamation will require backfilling of the eastern one third of the site to create an approximate 32-acre pad suitable for development. This pad will be at street level and will provide stability to the entire eastern slope and the two north eastern areas of concern.

Upon completion of Phase 1, a 4.7-acre pad will be developed at the base of the pit within the southwest corner of the site. In this area of the site, an area of instability is noted at the southwest corner of the pit. This pad will help provide stability by filling the base of the area of instability.

There are two debris flows of concern located in the northwestern corner of the site. An erosion protection berm has been proposed at the top of these slopes. The erosion protection berm will reduce the risk of failure at this location by intercepting runoff and preventing uncontrolled discharge over the slope. The proposed berm will extend 2,000 linear feet from the edge of the block wall on the north perimeter of the pit, to the curb and gutter at the northwest corner of the pit. The berm will have a minimum height of 18-inches and 1.5:1 (horizontal to vertical) side slopes.

Reclamation measures require revegetation of all final fill slopes and cut slopes resulting from the proposed project. These measures will prevent slope instabilities and erosion on newly created slopes.

The proposed project's as designed eliminates many of the existing instability onsite. Annual slope stability monitoring and reporting to the City will be an ongoing element of Project implementation and a condition of Project approval.

Based on the soil erosion characteristics discussed under existing conditions and existing slope stability issues onsite the Project may result in potential impacts related to (e.g., slope failures) and reclamation (e.g., slope failures and settlement). Considering the Project design features and that the Project would comply with existing geotechnical, engineering geology, and surface water regulations, the impacts are expected to be less than significant.

BMPs from the Reclamation Plan will be required and incorporated into the SWPPP, and may involve conditions regarding timing for practices during periods of precipitation; when earth moving activities are being conducted; and/or when soil has been exposed by earthmoving activities in order to eliminate or reduce erosion to the extent possible.

Implementation of soil erosion related BMPs during the above periods will ensure that the Olive Pit Mine will not result in substantial soil erosion. Therefore, it is concluded that for the mining and reclamation phases, erosion-related hazards would be less than significant considering adherence to current regulations.

THRESHOLD GEO-3

Would the Project 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?

Less than Significant Impact

THRESHOLD GEO 1 (above) discusses earthquake-induced landslide potential. Based on the geotechnical and geologic site characteristics discussed above, and the Project Design Features incorporated into the Project as developed for the project to address these typical issues, potential impacts to mining operations (e.g., slope failures), reclamation (e.g., slope failures and settlement Would be less than significant. Therefore, because the Project would be in full compliance with existing geotechnical and engineering geology regulations, which include specific Project Design Features, this impact would be less than significant.

The Olive Pit Mine is surrounded by relatively flat, gently sloping topography and away from steep terrain, its side slopes are very steep (ranging to near vertical). Based on the steepness of the side-slopes, the granular nature of the alluvial deposits the probability of landsliding or slope instability at the Olive Pit Mine site appears to be low to moderate depending on location around the mine perimeter. All portions of the Olive Pit Mine site are identified on the Baldwin Park Quadrangle official Seismic Hazard Zones Map as having earthquake-induced landsliding potential (CGS, 1999).

Furthermore, the Olive Pit Mine site is not susceptible to off-site landslides, lateral spread, subsidence, liquefaction, or collapse based on CGS mapping and Guidelines for Evaluating and Mitigating Seismic Hazards in California. Therefore, it is concluded that for the mining, and reclamation phases, risks from unstable geologic and soil units risk would be less than significant and no mitigation is required.

THRESHOLD GEO-4

Would the Project be located on expansive soils, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Less than Significant Impact

Based on the alluvial fan geologic unit characteristics discussed above under existing conditions and analyzed below, most of the soil at the site is composed of sand, gravel, and rock associated with Quaternary alluvial fan deposits. These geologic units do not have expansive soil qualities and therefore there is no risk to life or property from expansive soils and confirmed by slope stability laboratory testing (GLA, 2008) and field reconnaissance observations. Expansive soils could be used in the future reclamation (backfilling) phase. However, with Project design features incorporated, design specifications are built into the Project and will assure that the nature of inert landfill materials used in the reclamation phases to assure suitability for post-reclamation development and operations by minimizing seismic settlement and long term consolidation. Therefore, with potential risks from expansive soils would be less than significant.

THRESHOLD GEO-5

Would the Project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are unavailable for the disposal of waste water?

Less than Significant Impact

Based on the alluvial fan geologic unit characteristics discussed above under existing conditions and analyzed below, most of the soil at the site is composed of sand, gravel, and rock associated with Quaternary alluvial fan deposits, all of which have adequate seepage characteristics. During the mining and reclamation phases, the Olive Pit Mine will dispose of all of their municipal wastewater to the public sewer system, and will not utilize septic tanks. The perimeter of the site will be covered with vegetation landscaping and protected by a wall or berm; thus, preventing off-site runoff from entering the mined area during the mining and reclamation phases. Runoff or precipitation that may reach the bottom of the pit would be retained onsite.

The future surface materials (native or artificial fill) would consist mostly of sands, gravels, and cobbles that are and would be moderately to rapidly permeable and well-drained. These soils are highly suitable for the construction and operation of the proposed bioretention system.

The impact is less than significant and no mitigation is required.

THRESHOLD GEO-6

Would the project 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?

Less than Significant Impact

Based on the mineral resource-related site characteristics discussed with existing conditions and analyzed below, the Project may result in potentially significant impacts from mining operations (e.g., slope failures) and reclamation (e.g., slope failures and settlement). Considering the Project would be in full compliance with existing SMARA regulations, the mineral resources impacts are expected to be less than significant.

The proposed project provides for the extraction of aggregate (sand and gravel) mineral resources by re-activation and expansion of the existing Olive Pit aggregate mining site. The property on which the project would occur is within the MRZ-2 land classification "Areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists." This classification is intended to ensure access to identified mineral resources to supply future local and County-wide aggregate demand. Implementation of the proposed project would neither hamper no preclude the extraction of, or access to, these resources. Although the project would "consume" aggregate by extracting them for sale to others, it would be in the context of a permitted project providing a product to supply regional growth consistent with approved local and County General Plans. Therefore, the Project would not result in the loss of availability of a known mineral, and would have no adverse impact on aggregate resources and no mitigation is required.

THRESHOLD GEO-7

Would the project 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?

Less than Significant Impact

- See THRESHOLD GEO-6 discussion above.

No Mitigation Program pertaining to geology, soils, or mineral resources is warranted.

3.5.4 SIGNIFICANCE AFTER MITIGATION

No mitigation program is required.

3.5.5 CUMULATIVE IMPACTS

A list of all cumulative projects is provided in Chapter 3.0, *Environmental Setting and Impact Analysis*.

Would the Olive Pit Mine, combined with other related cumulative projects, have a substantial adverse impact on geology, seismic, soils, and mineral resources?

No, the Olive Pit Mine combined with other related cumulative projects, would not have a substantial adverse impact on geology, seismic, soils, and mineral resources. This is based on the cumulative project list; cumulative development may result in development of new residential, commercial, mining activities, industrial, recreational, and medical facilities in the cities of Irwindale, Azusa, Baldwin Park, Duarte, Glendora, and West Covina.

Geology, seismic, soils, and mineral resources impacts in this regard are less than significant. The geotechnical and mineral resource characteristics of each project site are site specific and would be evaluated on a project-by-project basis, and appropriate mitigation measures would be required, as necessary, in addition to federal, State and local regulations. Should multiple projects be constructed at the same time, project impacts would continue to be less than cumulatively considerable under CEQA due to project compliance with federal, State, and local regulations pertaining to geology, seismic, soils, and mineral resources consideration. Therefore, overall, the project would not contribute to cumulative impacts and impacts in this regard are not cumulatively considerable.