

5.4 GEOLOGY AND SOILS

This section of the Draft Environmental Impact Report (DEIR) evaluates the potential for impacts associated with the implementation of the 109th Street Pool and Bathhouse Replacement project on geology and soil resources at the project site. The analysis in this section is based in part on the following technical report:

- *Geotechnical Engineering Report, 109th Street Pool & Bathhouse Replacement*, City of Los Angeles Department of Public Works, Bureau of Engineering, February 26, 2007

A copy of this study is included in Appendix F of this Draft EIR.

5.4.1 Environmental Setting

Geologic Setting

The proposed site is within the South Gate 7.5-minute quadrangle in Los Angeles County, California. The project area is underlain with young alluvial materials and consists of deposits of loose to medium dense sand, gravel, and silt that interfinger and grade laterally into each other. The project site is relatively flat to gently sloping and is approximately 101 feet above mean sea level. Drainage of the site is generally toward the southeast.

Earthquake Faults

Earthquakes are common to southern California, and geologic evidence is used to determine the likelihood of future ruptures along a fault. Faults are described as active, potentially active, or inactive, based on their potential for activity. Those faults that have evidence of surface displacement within the Holocene epoch (the last 11,000 years) have the highest potential of generating earthquakes and are described as active. Distinct landforms suggesting movement within the last 11,000 years include sag ponds, drainages, linear valleys, and springs. Special study zones, known as Alquist-Priolo Zones, have been established along known active faults in California in accordance with the Alquist-Priolo Earthquake Fault Zoning Act. Faults with evidence of surface displacement in Pleistocene time, that is, approximately 11,000 to 1.8 million years ago, are classified as potentially active faults. No active faults are mapped or known to cross the site. The amplitudes of earthquake waves are measured on the Richter Scale. Each 1-point increase in magnitude represents a 10-fold increase in wave amplitude and a 32-fold increase in energy. That is, a magnitude 7 earthquake produces 100 times (10 x 10) the ground motion amplitude of a magnitude 5 earthquake, and releases approximately 1,000 times (32 x 32) more energy.

The known regional active and potentially active faults that could produce the most significant ground shaking at the site include the Newport-Inglewood and Elysian Park Thrust Faults, approximately two and five miles from the site, respectively. Other known regional faults that could produce significant ground shaking at the site include the Compton Thrust, Palos Verdes, Hollywood, and Raymond Faults.

Seismicity

Historic earthquakes that have caused substantial ground shaking in the project area include the 1857 Fort Tejon earthquake (magnitude 7.9) on the San Andreas Fault, the 1933 Long Beach earthquake (magnitude 6.3) along the Newport-Inglewood Fault Zone, the 1987 Whittier Narrows earthquake (magnitude 5.9) on the Elysian Thrust Fault, the 1992 Yucca Valley earthquake (magnitude 7.4), and the 1994 Northridge earthquake (magnitude 6.6).



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Peak ground acceleration (PGA) is generally used to measure the amplitude of a particular ground motion. The PGA values for the site were estimated using probabilistic seismic hazard analyses, based on currently available earthquake and fault information.

A probabilistic seismic hazard analysis was performed using the computer program FRISKSP to estimate the PGA for the site. Various probabilistic density functions were used in the analysis to assess the uncertainty inherent in the calculation with respect to magnitude, distance, and ground motion. The results of the analysis suggest that the PGA in alluvial conditions, such as those on the site, have a 10 percent probability of exceedance in 50 years (that is, a recurrence interval of 475 years), which is approximately 38 percent of the acceleration of gravity (0.38g). Additionally, the Upper Bound Earthquake (UBE) has a 10 percent probability of exceedance in 100 years (a recurrence interval of 950 years).

Liquefaction

Liquefaction is a process whereby strong ground shaking causes sediment layers that are saturated with groundwater to lose strength and behave as a fluid. This subsurface process can lead to near-surface or surface ground failure that can result in property damage and structural failure. If surface ground failure does occur, it is usually expressed as lateral spreading, flow failures, ground oscillation, and/or general loss of bearing strength. Sand boils (injections of fluidized sediment) can commonly accompany these different types of failure.

In order to determine a region's susceptibility to liquefaction, three major factors must be analyzed:

- The intensity and duration of ground shaking.
- The age and textural characteristic of the alluvial sediments. Generally, the younger, less compacted sediments tend to have a higher susceptibility to liquefaction. Soil particle size also plays a dominant role in determining liquefaction susceptibility. Sand and silty sands deposited in river channels and floodplains tend to be more susceptible to liquefaction than coarser or finer grained alluvial materials.
- The depth to the groundwater. Groundwater saturation of sediments is required in order for earthquake-induced liquefaction to occur. In general, groundwater depths shallower than 10 feet to the surface can cause the highest liquefaction susceptibility.

Research and historical data indicate that loose, granular materials at depths of less than 50 feet with silt and clay contents less than 30 percent saturated by relatively shallow groundwater table are most susceptible to liquefaction. These geological conditions are typical in parts of Southern California, including southeast Los Angeles and the project site. The site is shown on the State of California Seismic Hazard Zones map within an area that has the potential for liquefaction.

Other Seismic Hazards

In addition to surface fault rupture, ground shaking, and liquefaction, other effects of seismic activity include landsliding, lateral spreading, earthquake-induced flooding, seiches, and tsunamis. Results of a site-specific evaluation of the potential for these effects affecting the project site are presented below:

- Landslides: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The project site and surrounding area is relatively flat. In the absence of

significant ground slopes, the potential for seismically induced landslides affecting the proposed site is negligible.

- **Lateral spreading:** Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. Based on the materials encountered during soil borings and the topography of the site area, the potential for lateral spreading of the project area is considered very low.
- **Earthquake-induced flooding:** This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The potential of earthquake-induced flooding of the site is considered to be low.
- **Seiches:** Seiches are large waves generated in enclosed bodies of water in response to ground shaking. The site is not adjacent to any enclosed large bodies of water that could experience seiches during an earthquake. Thus, the potential for seiches impacting the site is considered very low.
- **Tsunamis:** Tsunamis are tidal waves generated in large bodies of water by fault displacement or major ground movement. Based on the location of the site, tsunamis do not pose a significant hazard to the project site.

Regulatory Framework

California Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was signed into state law in 1972, as amended, with the primary purpose to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault. The act requires the State Geologist to delineate earthquake fault zones along faults that are sufficiently active and well defined. The act also requires that cities and counties withhold development permits for sites within an earthquake fault zone until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Pursuant to this act, structures for human occupancy are not allowed within 50 feet of the trace of an active fault.

Seismic Hazard Mapping Act

The Seismic Hazard Mapping Act was adopted by the state in 1990 for the purpose of protecting the public from the effects of nonsurface fault rupture earthquake hazards, such as strong ground shaking, liquefaction, seismically induced landslides, or other ground failure caused by earthquakes. The goal of the act is to minimize loss of life and property by identifying and mitigating seismic hazards. The California Geological Survey (CGS) prepares and provides local governments with seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. The seismic hazard zones delineated by the CGS are referred to as Zones of Required Investigation because site-specific geological investigations are required for construction projects within these areas. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault (generally 50 feet). In addition, sellers



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(and their agents) of real property within a mapped Seismic Hazard Zone must disclose that the property lies within such a zone at the time of sale.

Uniform Building Code and California Building Code

Current law states that every local agency enforcing building regulations, such as cities and counties, must adopt the provisions of the California Building Code (CBC) within 180 days of its publication. The publication date of the CBC is established by the California Building Standards Commission and the code is also known as Title 24 of the California Code of Regulations. The most recent building standard adopted by the legislature and used throughout the state is the January 2008 version of the CBC, often with local, more restrictive amendments that are based upon local geographic, topographic, or climatic conditions. The 2008 CBC is based on the 2006 International Building Code. These codes provide the minimum standards to protect property and the public welfare by regulating the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The procedures and limitations for the design of structures are based on site characteristics, occupancy type, configuration, structural system height, and seismic zoning for Seismic Zone 4. Seismic ratings are derived from Uniform Building Code specifications, which divide the United States into five geographical zones (zero through 4), of which Seismic Zone 4—comprising most of central, coastal, and southern California—is the most prone to earthquake activity. In some cases these building code requirements may not be adequate to protect health and safety, particularly in regard to faulting and seismology, where the pool of knowledge is growing and evolving rapidly.

Natural Hazards Disclosure Act

This act requires that sellers of real property and their agents provide prospective buyers with a Natural Hazard Disclosure Statement when the property being sold lies within one or more state-mapped hazard areas. If a property is in a Seismic Hazard Zone, as shown on a map issued by the State Geologist, the seller or the seller's agent must disclose this fact to potential buyers. California law also requires that when houses built before 1960 are sold, the seller must give the buyer a completed earthquake hazards disclosure report and a booklet titled "The Homeowners Guide to Earthquake Safety." This publication was written and adopted by the California Seismic Safety Commission.

5.4.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

- G-1 Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
 - i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. (Refer to Division of Mines and Geology Special Publication 42.)
 - ii) Strong seismic ground shaking.
 - iii) Seismic-related ground failure, including liquefaction.
 - iv) Landslides.

- G-2 Result in substantial soil erosion or the loss of topsoil.
- G-3 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.
- G-4 Be located on expansive soil, as defined in Table 18-1B of the Uniform building Code (1994), creating substantial risks to life or property.
- G-5 Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

The Initial Study, included as Appendix A, substantiates that impacts associated with the following thresholds would be less than significant:

- Threshold G-1 (i), (ii) and (iv)
- Threshold G-2
- Threshold G-5

These impacts will not be addressed in the following analysis.

5.4.3 Environmental Impacts

The following impact analysis addresses thresholds of significance for which the Initial Study disclosed potentially significant impacts. The applicable thresholds are identified in brackets after the impact statement.

IMPACT 5.4-1: PROJECT STRUCTURES COULD BE SUBJECT TO ADVERSE EFFECTS ASSOCIATED WITH LIQUEFACTION. [THRESHOLD G-1.iii]

Impact Analysis: Groundwater seepage was found in borings done as part of the geotechnical investigation in three zones of depth under the site. One zone was approximately 20 feet below ground surface (bgs), the second was 24 feet bgs, and the third was at 32 feet bgs. Also, the shallowest depth of groundwater, historically, was reported at 8 feet bgs. Site-specific testing performed in accordance with Section 1804.5 of the 2001 CBC estimated maximum probable earthquake (MPE), ground acceleration of 0.55 g. Based on the data, it is estimated that the potential liquefaction-induced settlements for the site would be in the order of up to 2.5 inches, and project structures, including both the pool and bathhouse, could be subject to liquefaction impacts.

IMPACT 5.4-2: THE PROPOSED STRUCTURES COULD BE SUSCEPTIBLE TO SOME DIFFERENTIAL FOUNDATION SETTLEMENT AS A RESULT OF A SIGNIFICANT EARTHQUAKE ON A NEARBY FAULT. [THRESHOLD G-3]

Impact Analysis: The primary geotechnical considerations with respect to construction of the proposed structural improvements are the potential for fill soils within the site, the relatively high moisture content of the shallow site soils, the compressibility characteristics of the shallow natural soils, and the potential for seismically induced settlement. Structures founded on mat foundations at the subject site would be potentially susceptible to seismically induced settlements. Total and differential seismic settlements on the



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order of 2.5 inches and 1.75 inches or less, respectively, could occur at the site as a result of earthquake-induced ground acceleration equivalent to the MPE ground acceleration.

IMPACT 5.4-3: SOIL CONDITIONS WOULD NOT RESULT IN RISKS TO LIFE OR PROPERTY. [THRESHOLDS G-4]

Impact Analysis: An expansion index (EI) test was performed as a part of the geotechnical analysis on near-surface soils to evaluate their expansion potential. The test was performed in accordance with American Society of Testing and Materials Test Method D-4829. The EI was 39, which is classified Low Potential.

5.4.4 Cumulative Impacts

Impacts relating to soils and geologic influences are site-specific and generally cannot be considered in cumulative terms. Mitigation of geologic, seismic, and soil impacts of development projects would be specific to each site. Modern building standards serve to reduce seismic-related risks to less than significant levels. In addition, the proposed project, as well as foreseeable projects, would be required to comply with the applicable State and local requirements, including the City of Los Angeles Building Code. Therefore, the project-specific impacts and impacts associated with other projects would be reduced to a less than significant level, and the proposed project would have a less than considerable contribution to cumulative impacts related to geology and soils.

5.4.5 Existing Regulations and Standard Conditions

- Alquist-Priolo Earthquake Fault Zoning Act
- California Building Code. California Code of Regulations, Title 24, Part 2
- Uniform Building Code. Published by the International Conference of Building Officials
- Seismic Hazard Mapping Act
- City of Los Angeles Building Code

5.4.6 Level of Significance Before Mitigation

Upon implementation of regulatory requirements and standard conditions of approval, the following impact would be less than significant:

- Impact 5.4-3 Soil conditions would not result in risks to life or property.

Without mitigation, the following impacts would be **potentially significant**:

- Impact 5.4-1 Development of the proposed structures and pool would occur within an area that has the potential for liquefaction.
- Impact 5.4-2 Structures at the project site would be potentially susceptible to seismically induced settlements.

5.4.7 Mitigation Measures

Impacts 5.4-1 and 5.4-2

- 5-1 All grading operations shall be conducted in conformance with the applicable City of Los Angeles Building Code, the most recent version of the California Building Code and/or Uniform

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Building Code for Seismic Zone 4 applicable at the time of grading, and consistent with the recommendations included in the Geotechnical Engineering Report, 109th Street Pool & Bathhouse Replacement, City of Los Angeles Department of Public Works/Geotechnical Engineering Division, February 26, 2007, as well as consistent with any subsequent geotechnical investigations completed for the proposed project that have been approved by the City.

5.4.8 Level of Significance After Mitigation

The mitigation measure identified above would reduce potential impacts associated with geology and soils to a level that is less than significant. Therefore, no significant unavoidable adverse impacts relating to geology and soils have been identified.



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