4.D  GEOLGY AND SOILS

1.  INTRODUCTION

This section evaluates potential geologic and soils hazards associated with the Project including fault rupture; seismic ground shaking; groundwater; liquefaction; expansive and compressible soils; tar sands and oil wells; erosion; and construction effects. This section is based, in part, on information and findings contained in the Geology and Soil Discipline Report, prepared for the Project by Shannon & Wilson Geotechnical and Environmental Consultants, Inc.;¹ the Water Resources Technical Report prepared by KPFF Consulting Engineers;² and the Methane Report prepared by Geosyntec Consultants.³ The Geology and Soil Discipline Report is provided in Appendix G of this Draft EIR; the Water Resources Technical Report is provided in Appendix I; and the Methane Report is provided in Appendix H-1. Related issues of methane and hydrogen sulfide gases, contaminated soil, and contaminated groundwater are further addressed in Section 4.E, Hazards and Hazardous Materials, and erosion and water quality are addressed in Section 4.F, Hydrology and Water Quality, of this Draft EIR.

2. ENVIRONMENTAL SETTING

a. Existing Conditions

(1) Geological Setting

The Project Site is located within the coastal Los Angeles Basin (“Basin”) of Southern California. The Basin includes the low-lying area between the San Gabriel Mountains and the Pacific Ocean. Mountain ranges and hills bordering the Basin include the Santa Monica Mountains to the north, the Hollywood Hills to the northeast, the Elysian and Repetto Hills to the northeast, the Peninsular Ranges to the southeast, and the Baldwin Hills to the south. The Project Site sits atop the western expanse of the La Brea Plain, a broad, slightly elevated plain extending south from the Santa Monica Mountains and comprising Quaternary-age alluvial fan and floodplain deposits. These alluvial sediments were deposited atop underlying Tertiary-age shallow marine sedimentary bedrock formations.

(a) Geologic Materials

Previous geotechnical investigations undertaken on portions of the LACMA Campus in recent years and cited in the Geology and Soil Discipline Report prepared for this Project indicate that the Project Site is underlain by a relatively thin layer of artificial fill to depths of between one and eight feet. The fill varies in composition but generally consists of clay, gravelly sand, clayey sand and silty sand. Below the fill, the Project Site is underlain by thick deposits of Pleistocene-age alluvial materials generally consisting of stiff to very stiff clays and dense tar-bearing sands. The fine-grained alluvial deposits are referred to as the Lakewood Formation, while the deeper sand beds are known as the San Pedro formation. Recent geotechnical explorations undertaken by Metro for the nearby Metro Westside Subway Extension indicate that alluvial sediments are

underlain by Tertiary-age sedimentary bedrock of the Fernando Formation. Sandy siltstone, corresponding to the Fernando Formation, was encountered at a depth of 80.5 feet below grade in the northern portion of the Project Site.\(^4\)

(b) Earthquake Faults

There are numerous faults in Southern California, including active, potentially active, and inactive faults. An active fault is one that has caused a surface rupture within the Holocene Epoch (i.e., the last 11,000 years) and continues to have the potential to cause surface rupture. Faults not active within the Holocene Epoch, but that still demonstrate movement within Quaternary geologic time (i.e., up to 2.6 million years ago), are considered to be potentially active but less likely to cause surface rupture. Inactive faults are those not active within the Quaternary geologic time. Distances between the Project Site and active faults in Southern California are listed in Table 4.D-1, Major Faults Considered to be Active in Southern California, and Table 4.D-2, Major Faults Considered to be Potentially Active in Southern California.

### Table 4.D-1

<table>
<thead>
<tr>
<th>Fault</th>
<th>Maximum Credible Earthquake (magnitude)</th>
<th>Slip Rate (mm/yr)</th>
<th>Distance from Project Site (miles)</th>
<th>Direction of Fault</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hollywood</td>
<td>7.0</td>
<td>1.5</td>
<td>2.7</td>
<td>North</td>
</tr>
<tr>
<td>Newport-Inglewood Fault Zone</td>
<td>7.0</td>
<td>1.0</td>
<td>3.0</td>
<td>Southwest</td>
</tr>
<tr>
<td>Santa Monica</td>
<td>7.2</td>
<td>4.0</td>
<td>3.8</td>
<td>West</td>
</tr>
<tr>
<td>Elysian Park Fold and Thrust Belt</td>
<td>7.1</td>
<td>1.7</td>
<td>4.5</td>
<td>East</td>
</tr>
<tr>
<td>Raymond</td>
<td>6.7</td>
<td>0.4</td>
<td>8.8</td>
<td>Northeast</td>
</tr>
<tr>
<td>Verdugo</td>
<td>6.75</td>
<td>0.5</td>
<td>9.6</td>
<td>Northeast</td>
</tr>
<tr>
<td>Sierra Madre – Sierra Madre Section</td>
<td>7.3</td>
<td>4.0</td>
<td>14</td>
<td>Northeast</td>
</tr>
<tr>
<td>Sierra Madre – San Fernando Section</td>
<td>6.8</td>
<td>5.0</td>
<td>14.7</td>
<td>North</td>
</tr>
<tr>
<td>Northridge</td>
<td>6.9</td>
<td>1.5</td>
<td>17</td>
<td>North/Northwest</td>
</tr>
<tr>
<td>Elsinore – Whittier Section</td>
<td>7.1</td>
<td>3.0</td>
<td>18</td>
<td>Southeast</td>
</tr>
<tr>
<td>Oak Ridge</td>
<td>6.7</td>
<td>4.0</td>
<td>31</td>
<td>Northwest</td>
</tr>
<tr>
<td>San Andreas – Mojave Section</td>
<td>8.2</td>
<td>30.0</td>
<td>36</td>
<td>Northeast</td>
</tr>
</tbody>
</table>

Note: Distances are based on U.S. Geological Survey 2008 National Seismic Hazards Maps.

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\(^4\) Geology and Soil Discipline Report, page 9, provided in Appendix G of this Draft EIR.
The nearest active fault systems to the Project Site are Santa Monica-Hollywood (considered branches of the same fault system) and Newport-Inglewood. As depicted in Table 4.D-1, the Project Site is located approximately 2.7 miles south of the Hollywood branch of the Santa Monica-Hollywood fault system and approximately 3.0 miles northeast of the Newport-Inglewood fault system. The level of ground shaking that would be experienced at the Project Site from active, potentially active, or blind thrust faults (i.e., no surface traces) in the region are a function of several factors including earthquake magnitude, type of faulting, rupture propagation path, distance from the epicenter, earthquake depth, duration of shaking, and Project Site topography and geology.

The Hollywood Fault zone, extends for a distance of approximately eight miles through Beverly Hills, West Hollywood, and Hollywood to the Los Angeles River and the Santa Ana Freeway (I-5). The fault was located through water well, oil well, and geophysical data, as well as surface trenching and drilling by numerous investigators. In Hollywood, the active fault is close to the Santa Monica Mountains range. Farther west, near the intersection of Sunset and La Cienega Boulevards in West Hollywood, the active fault lies near the base of an alluvial fan along the mountain front. No earthquakes have been produced along this fault in the documented history of the City. However, subsurface evidence for late Quaternary faulting has been found in Hollywood along Cahuenga Boulevard, La Brea Avenue, and other area roadways. The Santa Monica fault portion of the Santa Monica-Hollywood fault system extends east from the coastline in Pacific Palisades through Santa Monica and West Los Angeles and merges with the Hollywood fault in Beverly Hills, west of the intersection of Santa Monica Boulevard and Wilshire Boulevard.

The onshore portion of the Newport-Inglewood fault zone extends approximately 47 miles from Culver City to Newport Beach and has been the source of several earthquakes, including the 1933 Long Beach earthquake (magnitude 6.4) and smaller earthquakes in Inglewood (1920), Gardena (1941), and Torrance-
Gardena (1941). The fault zone is not a continuous surface fault, but is marked by a series of uplifts and anticlines, including Baldwin Hills.

The Elysian Park fault is located approximately 4.5 miles east of the Project Site and is an active blind fault that extends approximately 12 miles between Silver Lake and Whittier Narrows. The 1987 Whittier Narrows earthquake (magnitude 5.9) has been attributed to subsurface thrust faults, which are reflected at the earth's surface by a west-northwest trending anticline known as the Elysian Park anticline. The subsurface faults that create the structure are not exposed at the surface; however, as demonstrated by the 1987 earthquake and two smaller earthquakes on June 12, 1989, the faults are a source for future seismic activity. Accordingly, the Elysian Park fold and thrust belt is considered active and capable of generating future earthquakes and seismic shaking.

The active Mission Wells segment of the San Fernando fault zone, one of the four segments of the Sierra Madre fault zone, is located approximately 15 miles north-northeast of the Project Site. Surface rupture occurred along the Tujunga, Sylmar, and Mission Wells segments of the San Fernando fault zone during the February 9, 1971 San Fernando earthquake. The San Fernando fault zone comprises a number of left lateral/reverse frontal faults bounding the southern margin of the San Gabriel and Santa Susana Mountains. This fault slipped on February 9, 1971, causing a magnitude 6.4 earthquake.

The Northridge thrust fault is an inferred blind thrust fault that is considered the western extension of the Oak Ridge fault, and is believed to be the causative fault of the January 17, 1994 Northridge earthquake. The Northridge thrust underlies a large area of the San Fernando Valley, and while not exposed at the surface and does not present a potential surface fault rupture hazard, it is an active feature that can generate future earthquakes. The fault is located approximately 17 miles north and northwest of the Project Site.

The Oak Ridge fault is a blind thrust fault located beneath the Santa Susana Mountains approximately 31 miles northeast of the Project Site. The fault associated with the 1994 Northridge earthquake is probably part of the Oak Ridge fault system, as it shares many of the same characteristics. This blind thrust fault is known alternately as the Pico thrust and the Northridge thrust.

Active faults zones nearest the Project Site are illustrated in Figure 4.D-1, Alquist-Priolo Fault Zones and Figure 4.D-2, Active Fault Map. No active or potentially active faults are known to be located in the immediate vicinity (i.e., within one mile) of the Project Site. Regional earthquake fault systems are also illustrated in Figure 8 in the Geology and Soil Discipline Report (see Appendix G of this Draft EIR).

(c) Groundwater

The Project Site is located within the Central Basin of the Coastal Plain of the Los Angeles Groundwater Basin ("Central Basin"). The principal freshwater-bearing sediments of the Central Basin include the Holocene-age alluvial deposits, and the Pleistocene-age Lakewood and San Pedro Formations at depth. According to the Seismic Hazard Zone Report for the Hollywood 7.5-Minute Quadrangle, the historically shallowest depth to

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5 Geology and Soil Discipline Report, page 9, provided in Appendix G of this Draft EIR.
MAP EXPLANATION

Potentially Active Faults

Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture, solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.
NOTE
Map adapted from Fault Activity Map of California, 2010 by California Geological Survey.

FIGURE
Academic Museum of Motion Pictures Project

EXPLANATION
Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain.

FAULT CLASSIFICATION COLOR CODE
(Indicating Recency of Movement)

- Fault along which historic (last 200 years) displacement has occurred.
- Holocene fault displacement (during past 11,700 years) without historic record.
- Late Quaternary fault displacement (during past 700,000 years).
- Quaternary fault (age undifferentiated).
- Pre-Quaternary fault (older than 1.8 million years) or fault without recognized Quaternary displacement.

ADDITIONAL FAULT SYMBOLS
- Bar and ball on downthrown side (relative or apparent).
- Arrow on fault indicates direction of dip.
- Low angle fault (barb on upper plate).

NOTE
Map adapted from Fault Activity Map of California, 2010 by California Geological Survey.

See Detail Map below

PROJECT LOCATION

DETAIL MAP
groundwater in the Project area is approximately 10 feet below existing grade.\textsuperscript{6} Historic high groundwater contours for the Project area are illustrated in Figure 6 of the \textit{Geology and Soil Discipline Report} (see Appendix G of this Draft EIR).

The State Water Resources Control Board’s ("SWRCB’s") GeoTracker Groundwater Monitoring and Assessment Program website indicates that the depth to groundwater is variable in the Project vicinity but typically ranges between 10 and 15 feet below grade. Groundwater monitoring wells installed in conjunction with construction of the Broad Contemporary Art Museum on the LACMA Campus indicated that groundwater was at a depth of approximately 10 feet below grade between August and October of 2004.\textsuperscript{7} Readings taken in June 2011 from monitoring wells installed for the Metro Westside Subway Extension within Wilshire Boulevard, approximately 300 feet west and slightly south of the Project Site, encountered groundwater at depths of approximately 13.5 feet and 17.5 feet, respectively.\textsuperscript{8} The variations in reported estimates and monitored depth to groundwater may be attributed to seasonal fluctuations, rainfall levels, and boring well distance from the Project Site. A design groundwater depth of approximately 10 feet below grade (approximately 157 feet above mean sea level) was conservatively assumed by the Project geotechnical engineers at the Project Site, to reflect the historically shallowest groundwater depth encountered at the Project Site during prior monitoring and reported for the Project area by the California Geological Survey and the State Water Resources Control Board.\textsuperscript{9}

\textbf{(d) Liquefaction}

Liquefaction, the loss of strength that occurs in saturated, loose soils that are subject to stress such as ground shaking, has the greatest potential to occur in areas of shallow groundwater and where loose sands or silts occur within 50 feet or less of the surface. In general, liquefaction potential decreases as grain size and clay and gravel content increase. Geologic materials underlying the Project Site generally consist of a surficial deposit of stiff cohesive soils underlain by dense to very dense asphalt sands. Because of the stiff and dense nature of the soil, the risk of liquefaction occurring beneath the groundwater table underlying the Project Site during a severe earthquake is considered to be low. As shown on the California Seismic Hazard Zone Map for the Project area and the Safety Element, the Project Site is not located within a designated liquefaction hazard area or an area characterized by local geologic or groundwater conditions with the potential for permanent ground displacement.\textsuperscript{10} The closest areas to the Project Site that are known to be susceptible to liquefaction are north of Sixth Street and along the east and west sides of La Cienega Boulevard.\textsuperscript{11}

\begin{itemize}
\item \textsuperscript{6} \textit{Geology and Soil Discipline Report}, page 9, provided in Appendix G of this Draft EIR.
\item \textsuperscript{7} \textit{Geology and Soil Discipline Report}, page 9, provided in Appendix G of this Draft EIR.
\item \textsuperscript{8} \textit{Geology and Soil Discipline Report}, pages 9 and 10, provided in Appendix G of this Draft EIR.
\item \textsuperscript{9} \textit{Geology and Soil Discipline Report}, page 10, July 2014, provided in Appendix G of this Draft EIR.
\item \textsuperscript{10} \textit{Geology and Soil Discipline Report}, page 15, provided in Appendix G of this Draft EIR and Safety Element, op. cit., Exhibit B, Areas Susceptible to Liquefaction.
\item \textsuperscript{11} Safety Element, op. cit., Exhibit B, Areas Susceptible to Liquefaction.
\end{itemize}
(e) Expansive and Compressible Soils

The clay soils within the alluvium and some of the fill are subject to expansion and shrinkage resulting from changes in the moisture content. Tests previously performed on samples of these clays indicate fine-grained alluvial deposits, which have a medium expansion potential.\textsuperscript{12}

Prior soils studies performed on and adjacent to the Project Site, in connection with construction of the Broad Contemporary Art Museum on the LACMA Campus, indicate the presence of non-engineered fill and near-surface alluvial deposits.\textsuperscript{13} Areas with alluvial or non-engineered fill may be weak and compressible, particularly when saturated with water. Where present, these materials may be subject to settlement and are not considered suitable to support of foundations, slabs on grade, paving or new compacted fills. As shown in the representative geologic cross-sections of the Project Site shown in Figures 4.D-3, Geologic Cross Section A-A', and 4.D-4, Geologic Cross Section B-B', fill and near-surface alluvial deposits on the Project Site are relatively thin (i.e., less than 10 feet).\textsuperscript{14} The stiff and dense nature of the near-surface alluvial deposits underneath the non-engineered fill is likely not significantly compressible.

(f) Oil Fields and Tar Sands

In certain locations throughout the City faulting and folding of the bedrock beneath the Basin over millions of years have formed structural traps where petroleum deposits have accumulated in anticlinal folds and along fault blocks. Several oil and gas fields have developed in the Project area, including the Salt Lake and South Salt Lake fields, at depths of 1,000 feet or more below grade. The Project Site is located within the limits of the Salt Lake field, as shown in Figure 4.D-5, Oil Field and Oil Well Locations. Associated with the oil fields is historic oil production. As also depicted on Figure 4.D-5, the two oil wells located closest to the Project Site are Chevron Salt Lake 10 (approximately 200 feet to the west) and Chevron Salt Lake 27 (approximately 500 feet to the north). Both wells are identified as buried and idle.\textsuperscript{15} No idle, abandoned or active wells were identified on the Project Site. However, well locations, which were derived from Division of Oil and Gas and Geothermal Resources ("DOGGR") records, are approximate and location errors are possible.\textsuperscript{16}

Over time, crude oil and methane gas escaping from the accumulated petroleum deposits within the bedrock beneath the La Brea Plain have migrated toward the surface through fractures and faults in the bedrock. Upon reaching alluvium at relatively shallow depths, the lighter petroleum components undergo alteration as the result of evaporation and various biological processes, resulting in the creation of viscous tar deposits such as those exposed in the La Brea Tar Pits east of the Project Site. The tar-bearing sands within the alluvial deposits are saturated with hydrocarbons.

For additional discussion of the oil fields, oil wells, and tar sands in the Project area, refer to Section 4.E, Hazards and Hazardous Materials, of this Draft EIR.

\textsuperscript{12} Geology and Soil Discipline Report, page 16, provided in Appendix G of this Draft EIR.
\textsuperscript{13} Geology and Soil Discipline Report, pages 5 and 17, provided in Appendix G of this Draft EIR.
\textsuperscript{14} Geology and Soil Discipline Report, page 17, provided in Appendix G of this Draft EIR.
\textsuperscript{15} California Department of Conservation, Division of Oil, Gas and Geothermal Resources, Online Mapping System, http://www.conservation.ca.gov/dog/Pages/WellFinder.aspx and Geology and Soil Discipline Report, pages 17 and 18, provided in Appendix G of this Draft EIR.
\textsuperscript{16} Geology and Soil Discipline Report, page 18, provided in Appendix G of this Draft EIR.
Figure 4.D-3: Geologic Cross Section A-A'


Boiling Legend:
- **B-2** (VB&B, 2004) 6 ft West
- **B-1** (URS, 2003) 26 ft East

Approximate Elevation in Feet MSL:
- 180
- 160
- 140
- 120
- 100
- 80

Notes:
1. This subsurface cross section is generalized from materials observed in soil borings. Variations may exist between this cross section and actual conditions.
2. 2½-inch I.D. thick wall sampler driven by 300 lb Hammer and 18-inch Drop.
3. Boring Location Plan is shown in Figure 2.

Stratum Legend:
1. Medium dense, gray, silty SAND to poorly graded fine SAND (SF, SM)
2. Medium stiff, bluish gray, silty CLAY, clayey SILT to clayey SAND (CL, ML, SC)
3. Medium dense, bluish gray silty SAND to sandy SILT (SM, ML)
4. Very dense, black, poorly graded fine SAND with asphalt (SP)
5. Very dense, gray, sandy SILT (ML)
Academy Museum of Motion Pictures Project


STRATUM LEGEND

1. Medium dense, gray, silty SAND to poorly graded fine SAND (SP, SM)
2. Medium stiff, bluish gray, silty CLAY, clayey SILT to clayey SAND (CL, ML, SC)
3. Medium dense, bluish gray silty SAND to sandy SILT (SM, ML)
4. Very dense, black, poorly graded fine SAND with asphalt (SP)
5. Very dense, gray, sandy SILT (ML)

NOTES

1. This subsurface cross section is generalized from materials observed in soil borings. Variations may exist between this cross section and actual conditions.
2. 2½-inch I.D. thick wall sampler driven by 300 lb Hammer and 18-inch Drop.
3. Boring Location Plan is shown in Figure 2.
**LEGEND**

**Geologic Units**
- Qa Alluvium
- Qae Alluvium (Elevated)

**Oil Wells**
- Chevron Salt Lake 10
- Chevron Salt Lake 27

**NOTE**
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(g) Subsidence

Subsidence of the ground surface can be caused by the removal of groundwater and/or petroleum from the subsurface sources. If in sufficient volumes, the extraction can cause permanent collapse due to the consolidation of the extracted pore space and potentially result in structural damage. There is no known documentation of subsidence from oil or groundwater extraction in the vicinity of the Project Site.

b. Regulatory Framework Summary

The regulatory framework summarized below is described in detail in Appendix B, Regulatory Framework, Section 4.D, of this Draft EIR. Geological and soil conditions and risk factors for new development are governed by regulations set forth in State law and City codes and adopted plans. At the State level, the Alquist-Priolo Earthquake Fault Zoning Act of 1972 ("Alquist-Priolo Act") was enacted by the State of California to address the hazard of surface faulting to structures for human occupancy, as a direct result of the 1971 San Fernando Earthquake and associated surface fault ruptures that damaged homes, commercial buildings, and infrastructure. The Alquist-Priolo Act requires the State Geologist to establish regulatory zones, known as "earthquake fault zones", around the surface traces of active faults and to issue maps to assist jurisdictions with regulating planning, zoning, and development. The Seismic Hazards Mapping Act of 1990 requires the State Geologist to delineate "seismic hazard zones" based on the potential for strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events. Jurisdictions must regulate development within these zones, including requiring investigation into site-specific conditions and mitigation for potential project impacts. Finally, the California Building Code, Title 24 of the California Code of Regulations, is a compilation of building standards to be implemented Statewide, including seismic safety standards for new development.

At the local level, the City regulates seismic safety through its General Plan Safety Element, which maps areas of designated earthquake-related hazards, and regulates earthwork activities and new building standards through the Municipal Code, specifically the Los Angeles Building Code, which incorporates the California Building Code. The Department of Building and Safety is responsible for implementing the provisions of the Los Angeles Building Code.

3. ENVIRONMENTAL IMPACTS

a. Methodology

The Geology and Soil Discipline Report, provided in Appendix G of this Draft EIR, was prepared for the Project to evaluate existing geologic and soils conditions and to assess the potential effects of the Project with respect these conditions. The Report provides the basis for the evaluation of geologic and soils-related impacts in this Draft EIR section. The geotechnical investigation included Project Site reconnaissance, records review, hazards analyses, groundwater review, and recommended measures to address any potential geologic or soils hazards. The Report also evaluated explorations (borings) performed by Van Beveren & Butelo, Inc. in 2005 in connection with construction of the Broad Contemporary Art Museum. The Section also incorporates information from the Methane Report, provided in Appendix H-1 of this Draft EIR, and information regarding soil erosion contained in the Water Resources Technical Report, provided in

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17 Geology and Soil Discipline Report, pages 4 and 5 and Appendix A, provided in Appendix G of this Draft EIR.
Appendix I. Information provided in this section is additionally based on the Safety Element, applicable policies of the California Building Code and Municipal Code, American Society for Testing and Materials standards, and Southern California Earthquake Center earthquake zone reports.

b. Thresholds of Significance

Appendix G of the State CEQA Guidelines provides a set of screening questions that address impacts with regard to geology and soils. These questions are as follows:

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, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area based on other substantial evidence of a known fault;
  - Strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction; or
  - 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- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

- Be located on expansive soils, as defined by 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 waste water disposal systems where sewers are not available for the disposal of waste water?

(1) Geologic Hazards

The L.A. CEQA Thresholds Guide incorporates the screening questions contained in Appendix G. In accordance with the City's thresholds, the Project would normally have a significant geology and soils impact if it:

- Causes or accelerates geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Based on these factors, the Project would have a significant impact on geology and soils if it would:

**GS-1** Causes or accelerates geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.
(2) Erosion and Sedimentation

The *L.A. CEQA Thresholds Guide* incorporates the screening questions contained in Appendix G. In accordance with the City's thresholds, the Project would normally have a significant geology and soils impact if it:

- Constitutes a geologic hazard to other properties by causing or accelerating instability from erosion; or
- Accelerates natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition which would not be contained or controlled on the Project Site.

Based on these factors, the Project would have a significant impact on geology and soils if it would:

- **GS-2** Constitutes a geologic hazard to other properties by causing or accelerating instability from erosion; or
- **GS-3** Accelerates natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition which would not be contained or controlled on the Project Site.

c. Project Characteristics

The Original Building and 1946 Addition are both supported by 2.5-foot-thick concrete mat slab foundations that lie between one and four feet below four-inch-thick concrete basement topping slabs, or basement floors; the spaces between the concrete topping slabs and concrete mat slab foundations are backfilled with soil. The existing concrete mat slab foundation beneath the Original Building would remain, and micropiles, the recommended deep foundation support for seismic retrofit of the Original Building, would be installed to support new shear walls and elevator pits. The construction of shear walls and elevator pits, the installation of micropiles, and the installation of the new Gas Mitigation and Monitoring System would require demolition of the existing concrete topping slab in the Original Building basement and, in some cases, penetration through the underlying concrete mat slab foundation. The estimated maximum depth for each micropile is approximately 40 feet below the concrete basement topping slab of the Original Building.

The 1946 Addition, including the concrete basement topping slab, would be demolished to allow construction of the Sphere; the existing basement walls and underlying concrete mat slab foundation would remain. New building columns and a Gas Mitigation and Monitoring System would be installed in the 1946 Addition basement. The Sphere is proposed to be supported by a new concrete mat slab foundation. Augercast piles, which can be used in a variety of soil and bedrock materials, are currently the recommended deep foundation support for the Sphere. The estimated maximum depth of each augercast pile is approximately 100 feet below the concrete mat slab foundation.

Additionally, a proposed utility corridor between the Original Building and New Wing would necessitate excavation. The depth of the utility corridor would be approximately 10 to 15 feet below ground surface and the width would be approximately 10 feet.

Project construction would not require mass grading or modification of existing grade on the Project Site and minimal import of soils is anticipated. Approximately 5,862 cubic yards of excess soil generated by excavation would require export from the Project Site.
The depth of excavation for the new mat slab foundation supporting the Sphere would be approximately seven feet below grade, which is approximately three to four feet above the anticipated high groundwater level. However, the basement concrete slabs of the Original Building and 1946 Addition lie approximately 15 feet below existing grade, and therefore five feet below the anticipated high groundwater level. Therefore, excavation for the elevator pits, micropiles, augercast piles, shear walls, and Gas Mitigation and Monitoring System is expected to encounter shallow groundwater and therefore require temporary dewatering. Excavation for the utility corridor between the Original Building and Sphere could also intercept shallow groundwater.

During Project construction, the use of temporary shoring systems may be necessary where excavation takes place adjacent to existing subsurface and at-grade structures (i.e., on the LACMA Campus) and adjacent to public rights-of-way. Temporary shoring system options may include soldier pile and timber lagging, soldier pile and steel sheets, a soldier pile system with tie-backs, or secant walls.

In accordance with Municipal Code requirements, a final geology/geotechnical report with final design recommendations would be prepared by a California-registered geotechnical engineer and submitted to the City Department of Building and Safety for review prior to issuance of a grading permit. Final foundation design recommendations would be developed during final Project design, and other deep foundation systems that may be suitable would also be evaluated at that time and addressed in this final geotechnical report.

d. Project Impacts

(1) Geologic Hazards

Threshold GS-1: The Project would result in a significant geology and soils impact if it causes or accelerates geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury.

Impact Statement GS-1: The Project would not cause or accelerate geologic hazards (i.e., fault rupture, seismic ground shaking, groundwater, liquefaction, expansive and compressible soils, and tar sands) that could result in damage to structures or infrastructure or expose people to substantial risk of injury, with compliance with regulatory requirements applicable to Project construction and operation that address these potential hazards. Therefore, impacts associated with these geologic hazards would be less than significant. While considered unlikely, excavation has the potential to encounter previously known or undiscovered oil wells on the Project Site, resulting in a potentially significant impact.

(a) Fault Rupture

No known active or potentially active faults underlie the Project Site and the Project Site is not located within a designated earthquake fault zone. Thus, the potential for surface ground rupture at the Project Site is considered low. Based on current information, development of the Project would not result in substantial damage to structures or cause or accelerate geologic hazards, which would result in substantial damage to structures or infrastructure, or expose people to substantial risk of injury. Therefore, impacts regarding fault rupture would be less than significant, and no mitigation measures would be necessary.
(b) Seismic Ground Shaking

As previously stated, the Project Site is located within a seismically active region of Southern California, and the most likely sources for ground motion are known faults (e.g., Newport-Inglewood Fault, Hollywood Fault, and Santa Monica Fault) that are located within four miles of the Project Site. Moderate to strong ground motion (acceleration) at the Project Site could be caused by an earthquake at these or any of the local or regional faults.

During the Project design phase, a final geology/geotechnical report would be prepared by a California-registered geotechnical engineer and submitted to the Department of Building and Safety for review and approval. The report would evaluate known and potentially active faults and ground-motion parameters in compliance with Chapter IX, Div. 16 of the Municipal Code (including applicable sections of California Building Code, Chapter 16), and Chapter IX, Div. 88, which applies to the reduction of earthquake hazards through seismic reinforcement of the Original Building. The estimated peak ground acceleration at the Project Site would be based on probabilistic seismic hazard analysis tools available from the U.S. Geological Survey, that estimate ground motions while taking into account uncertainties and randomness in potential earthquake source, size, location, recurrence, and source-to-Project Site attenuation. Ground motions may be amplified or attenuated in the softer alluvial deposits at the Project Site depending on the level of ground shaking of the underlying bedrock, soil type, depth to bedrock, and other factors.

The final geology/geotechnical report would also contain complete evaluations of Project Site foundation conditions and recommendations for foundation type and design criteria, including but not limited to bearing capacity of natural soil or compacted fill materials, provisions to remove or mitigate the effects of expansive soils, differential settlement and varying soils strength, and the effects of adjacent loads. As with any new construction in the City, the foundation and structural design of the Project would conform to the Municipal Code’s current seismic design provisions, including Chapter IX, Div. 16, Section 91.1613. These regulations incorporate seismic safety provisions of the California Building Code (and the American Society of Civil Engineers) by reference, and Municipal Code Div. 88, Section 91.8807, which require that all existing structures, including historical buildings such as the Original Building, be analyzed and constructed to resist minimum total lateral seismic forces. Finally, Project design and construction would comply with Municipal Code Div. 17, Section 91.1707, which requires structural inspections for seismic resistance. Compliance with these regulatory requirements would ensure that final design would incorporate adequate foundation support during seismic events and would ensure that structural design of the Sphere, as well as seismic reinforcement of the Original Building, would be consistent with seismic loading and other structural design standards set forth in the Municipal Code and the California Building Code. Therefore, in the event of an earthquake, the Project is not anticipated to result in substantial damage to structures or cause or accelerate geologic hazards that would expose people to substantial risk of injury. Impacts from seismic ground shaking would be less than significant.

(c) Groundwater

As previously discussed, for purposes of preliminary Project design, groundwater is assumed to be present approximately 10 feet below grade. Excavation in limited areas, for construction of elevator pits, installation of micropiles, construction of shear walls, elevator pits, in the basement of the Original Building, installation of deep augercast piles to support the Sphere, installation of the Gas Mitigation and Monitoring System, and the underground utility corridor between the Original Building and Sphere, is anticipated to be sufficiently deep to intercept groundwater and temporary dewatering is expected to be necessary. Dewatering would
involves the construction of temporary dewatering wells, the lowering of well points to lower groundwater during construction, and installation of sumps and/or trenches in limited areas; dewatering wells are expected to extend at least 20 feet into the tar sands or approximately 40 feet below the concrete basement topping slabs in the Original Building. Because the groundwater encountered would most likely be impacted with hydrocarbons, dissolved methane and hydrogen sulfide gases, and other urban pollutants testing and treatment of contaminated dewatering effluent would be required prior to disposal of groundwater discharge. Permanent dewatering for these temporary excavations is not anticipated.

As stated in Section 4.F, Hydrology and Water Quality, of this Draft EIR, the Applicant is required to prepare a final construction dewatering plan and water treatment system prior to the commencement of Project construction, in accordance with National Pollution Discharge Elimination System regulations. With compliance with this regulatory requirement, the potential for substantial damage to structure or infrastructure related to the presence of shallow groundwater during construction would be less than significant.

As described in Section 4.E, Hazards and Hazardous Materials, a drainage system would be required as part of the Gas Mitigation and Monitoring System proposed for the Project, unless a waiver is granted by the Los Angeles Department of Building and Safety. The drainage system is intended to address the potential for groundwater infiltration. In the event groundwater were to infiltrate into the Gas Mitigation and Monitoring System, only limited quantities are expected, and they would be collected in the sump of the Gas Mitigation and Monitoring System. The water collected may be treated prior to discharge into the sewer system in accordance with Bureau of Sanitation, Industrial Waste Management Division, Industrial Waste Water Discharge Permit requirements. Compliance with regulatory requirements would ensure that impacts due to the treatment and disposal of groundwater during operation would be less than significant.

For further discussion of this issue, please refer to Section 4.F concerning construction dewatering and Section 4.E concerning the potential need for drainage of groundwater during operation of the Gas Mitigation and Monitoring System.

(d) Liquefaction

As previously discussed, the Project Site is not within a State- or City-designated liquefaction zone, and despite the shallow depth of groundwater, is not considered susceptible to liquefaction, given the types and thicknesses of the underlying soils. Therefore, the potential for substantial damage to structures or infrastructure as a result of liquefaction is considered less than significant.

(e) Expansive and Compressible Soils

Potential construction-related impacts on existing structures and infrastructure include damage to existing adjacent buildings (the Original Building itself as well as the Broad Contemporary Art Museum, Resnick Exhibition Pavilion, and Pritzker Garage on the western portion of the LACMA Campus), roadways, service driveways, walkways and underground utilities. Renovation of the Original Building may require temporary cuts including slopes and/or shoring to facilitate construction. Potential impacts of temporary cuts include damage to existing buildings, roadways, service driveways, sidewalks and underground utilities from temporary slope failures or settlement associated with deflection by temporary shoring. However, with isolated exceptions, most excavations are anticipated to extend to less than 10 feet below grade on the Project Site, and the distance to the nearest off-site buildings and subterranean structures is a minimum of
50 feet (see Figure 2 in the Geology and Soil Discipline Report provided in Appendix G of this Draft EIR). Moreover, the safety and protection of existing abutting buildings is also regulated under Chapter IX, Division 18 (Soils and Foundations), Sections 1804 (Allowable Load-Bearing Values) and 1807 (Foundation Walls, Retaining Walls), of the Municipal Code, and as stated therein, required practices to protect abutting structures include including proper slope cut and shoring standards. For these reasons, and through compliance with Municipal Code requirements, the potential for construction activities to substantially damage off-site buildings and infrastructure is considered less than significant.

Some areas of the Project Site contain alluvial or non-engineered fill that may be weak and compressible, particularly when saturated. These materials may also be subject to settlement and would not be suitable for support of foundations, slabs on grade, paving or new compacted fills. The proposed concrete mat slab foundation supporting the Sphere would remove up to seven feet of the existing 10 feet of fill, which constitutes the majority of the existing fill. The underlying dense, stiff nature of the near-surface alluvial deposits is likely not to be compressible. With proposed deep foundations in dense, stiff soils that underlie the existing fill (which would be removed), the potential for building settlement from compressible existing fill materials is unlikely.

Existing moderately expansive soils also present a potential impact to lightly loaded foundation elements and flatwork (e.g., sidewalks, service driveways). Excavation and replacement of moderately expansive soil with soils of low or non-expansive potential, in accordance with Municipal Code requirements, would address this condition. Alternately, the design of flatwork and other lightly loaded structures in accordance with Chapter IX, Division 18 requirements of the Municipal Code would also address this condition.

On-site clay soils within the alluvium and some of the fill are also subject to expansion and shrinkage and could affect the structural integrity of pilings or other foundation structures. The Geology and Soil Discipline Report prepared for the Project indicates that development would be feasible through compliance with applicable regulations and with construction and design performed to address the Project Site’s geologic characteristics and soils. Preliminary design recommendations include spread footings or mat foundations founded in stiff or dense alluvial deposits. With implementation of recommendations in the final geology/geotechnical report to be prepared in accordance with Municipal Code requirements, such as Chapter IX, Division 18, Soils and Foundations (which incorporates California Building Code Chapter 18), Section 91.1802, (standards for foundation and soils investigation), Section 91.1803, (required geotechnical investigation), Section 91.1804 (allowable bearing values of soils), and Section 91.1807 (pier and foundation pilings), subject to City review and approval, the Project would not cause or accelerate geologic hazards relating to expansive and compressible soils. Therefore, the Project would not result in substantial damage to structures or infrastructure or expose people to substantial risk of injury. Impacts with respect to soils would be less than significant.

(f) Tar Sands and Oil Wells

Soil excavated above existing groundwater is primarily fill and alluvium that are not expected to contain natural tar or oil and could be disposed of as clean soil, absent other conditions. However, spoils from excavation that extends below the groundwater level could contain natural tar that would require chemical analysis prior to off-site disposal. Excavation activities associated with the Original Building could penetrate tar sands during installation of micropiles to support new shear walls for seismic upgrades, the construction of elevator pits, and the installation of the Gas Mitigation and Monitoring System. In addition, excavation
could penetrate tar sands during installation of augercast piles to support the Sphere. Excavation for utility trenches and the utility corridor proposed between the Original Building and Sphere could also penetrate tar sands. The new concrete mat foundation for the Sphere would require excavation to a depth of only about seven feet and is therefore not expected to penetrate tar sands, and excavation for the Piazza and other related surface improvements would also be sufficiently shallow to avoid tar sands. As discussed in Section 4.E, Hazards and Hazardous Materials, excavated and stockpiled soils would be tested, treated, and disposed of in accordance with Project Design Feature PDF-HAZ-2, Soil Management Plan, which would ensure compliance with regulatory requirements. Therefore, impacts associated with excavation, removal, and disposal of tar sands would be less than significant.

As previously discussed, the nearest oil wells are located approximately 200 feet and 500 feet from the Project Site and are buried and idle. While it is unlikely that oil wells would be discovered during construction of the Project, excavation activities on the Project Site have the potential to encounter known or previously undiscovered oil wells, since DOGGR’s well locations are approximate and location errors are possible. While it is unlikely that oil wells would be discovered during construction of the Project, it is conservatively concluded that a significant impact associated with encountering known or previously undiscovered oil wells could occur.

(g) Subsidence

Although there is a potential for subsidence due to groundwater withdrawal for temporary construction dewatering, the volume of extracted groundwater would be limited to small excavation areas to produce a localized drawdown around the deep foundations, elevator pits, deep utility trenches, and Gas Mitigation and Monitoring System. Furthermore, the relatively stiff and dense soil below the existing basement is unlikely to settle from temporary dewatering. Therefore, impacts related to subsidence from construction dewatering activities would be less than significant.

The drainage system proposed as part of the Gas Mitigation and Monitoring System is not expected to involve regular dewatering and in the event groundwater is encountered, the volume is expected to be limited such that impacts related to subsidence from operation would be less than significant.

(2) Erosion and Sedimentation

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<tr>
<th>Threshold GS-2: The Project would have a significant geology and soils impact if it constitutes a geologic hazard to other properties by causing or accelerating instability from erosion.</th>
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**Impact Statement GS-2:** The Project would not cause geologic hazards related to instability from erosion, due to compliance with regulatory requirements that address these potential hazards during Project construction and operation and require development and implementation of a Storm Water Pollution Prevention Plan (“SWPPP”) and Standard Urban Stormwater Mitigation Plan (“SUSMP”), and compliance with regulations that require preparation of a final geology/geotechnical report which defines Project Site-specific design criteria related to the nature of foundation materials and geological conditions. Impacts would be less than significant.
(a) Construction

Construction activities may require temporary cuts and shoring of excavations. Potential impacts associated with temporary cuts include structural damage to the Original Building from temporary slope failures or settlement associated with deflection of temporary shoring or other geologic hazards related to instability of the temporary cuts through erosion. No other land features that might be subject to erosion are located between the Project Site and adjoining off-site properties; the LACMA Campus is either paved or landscaped with turf or ornamental plantings, and the Project Site is otherwise bordered by sidewalks and roadways. As stated in Section 4.F, Hydrology and Water Quality, the Applicant is required to prepare a site-specific SWPPP that identifies appropriate Best Management Practices (“BMPs”) for erosion control, wind erosion control, and tracking control. The Applicant is also required to comply with Municipal Code Chapter IX, Div. 70, Section 91.7013 regarding erosion control and drainage and Section 91.7005.2 pertaining to shoring and other retaining structures. Therefore, Project construction activities would have a less than significant impact with respect to instability from erosion. The SWPPP and implementation of associated BMPs is discussed in detail in Section 4.F, Hydrology and Water Quality, of this Draft EIR.

(b) Operation

With respect to Project operation, as stated in Section 4.F, Hydrology and Water Quality, the Applicant is required to prepare and implement a SUSMP that would ensure post-development runoff rates do not increase the potential for downstream erosion. Additionally, the Applicant is required to comply with recommendations of the final approved geology/geotechnical report with respect to building and foundation design, including, but not limited to, bearing capacity of natural or compacted soil, provisions to mitigate the effects of expansive soils, differential settlement and varying soils strength, and the effects of adjacent loads. With regulatory compliance, Project operation would have a less than significant impact with respect to instability from erosion.

Threshold GS-3: The Project would have a significant geology and soils impact if it accelerates natural processes of wind and water erosion and sedimentation, resulting in sediment runoff or deposition which would not be contained or controlled on the Project Site.

Impact Statement GS-3: The Project would have a less than significant impact related to the containment of erosion or sedimentation on-site, due to compliance with applicable State and City regulations that require preparation and implementation of a SWPPP and SUSMP, and the incorporation of BMPs that meet the City’s Low Impact Development (“LID”) standards.

(a) Construction

Construction activities have the potential to result in soil erosion during demolition, clearing of the construction area, excavation, grading, and any soils stockpiling. Exposed soils can be transported off-site as wind-borne dust or as sediment in sheet flow during rain events. The Project Site consists of approximately 2.2 acres, more than half of which would be disturbed by construction, including demolition of the 1946 Addition and construction of the Sphere and hardscape and landscape features. As discussed in detail in Section 4.F, Hydrology and Water Quality, of this Draft EIR, disturbance of more than one acre is covered under the State General Construction Activities Stormwater Permit, which requires filing a Notice of Intent with the SWRCB and development and implementation of a SWPPP that specifies BMPs intended to prevent
construction pollutants from discharging off-site. This is enforced by the Department of Public Works, Bureau of Sanitation, Watershed Protection Division. Additional construction-related fugitive dust control regulatory requirements of the South Coast Air Quality Management District (“SCAQMD”) are discussed in Section 4.B.1, Air Quality. With regulatory compliance, Project construction is not anticipated to accelerate erosion or sedimentation or result in sediment runoff or deposition that cannot be contained or controlled on the Project Site, and impacts would be less than significant.

(b) Operation

As discussed in Section 4.F, Hydrology and Water Quality, of this Draft EIR, the Applicant is required to develop and implement a SUSMP to control the discharge of pollutants, including sediment, within stormwater generated following new construction or redevelopment. The Applicant is also required to comply with the City’s LID Ordinance (Ordinance No. 181,899), which is intended to reduce the quantity and intensity of stormwater flows and minimize the off-site transport of pollutants in stormwater. LID standards promote the use of natural infiltration systems (biofiltration is proposed for the Project Site), evapotranspiration, and the reuse of stormwater. With regulatory compliance, Project operation is not anticipated to accelerate erosion or sedimentation or result in sediment runoff or deposition that cannot be contained or controlled on the Project Site, and impacts would be less than significant.

e. Cumulative Impacts

Geological and geotechnical impacts are defined by site-specific conditions for the Project and related projects, and are therefore typically confined to contiguous properties or a localized area in which concurrent construction projects in close proximity could be subject to the same fault rupture system or other geologic hazard, or exacerbate erosion impacts. The Project Site is not underlain by an active earthquake fault, and regulations in the City as well as other local city building codes already require the consideration of seismic loads in structural design. For these reasons, Project implementation is not expected to result in a cumulatively considerable contribution to cumulatively significant impacts related to substantial damage from fault rupture or seismic ground shaking to structures, infrastructure, or human safety, when considered together with the related projects defined in Chapter 3.0, General Description of Environmental Setting, of this Draft EIR.

As listed in Table 3-1 and shown on Figure 3-1, the nearest related projects that could be under construction concurrently with the Project and have the potential to result to contribute to cumulative soil erosion impacts include the following:

- Related Project No. 1: Wilshire Skyline
- Related Project No. 12: Wilshire and Crescent Heights Mixed Use
- Related Project No. 2: Desmond Tower
- Related Project No. 27: Museum Square
- Related Project No. 16: Wilshire La Brea High Rise Mixed Use
- Related Project No. 28: LACMA Redevelopment Plans
the concurrent development of any of these projects could contribute to cumulative geologic hazards related to soil erosion, shoring, and other soil and foundation issues. As with the Project, Municipal Code standards for shoring, SCAQMD’s requirements for dust control, and Regional Water Quality Control Board regulations pertaining to surface water runoff and water quality (which would require BMPs for construction projects greater and smaller than one acre of disturbance), would prevent significant cumulative impacts related to erosion and other geological impacts. In addition to the projects referenced above, cumulative geologic hazards could also result from the construction of the Metro Westside Subway Extension and station entrance. The Draft EIS/EIR for the Metro Westside Subway Extension concluded that with implementation of recommended mitigation measures, impacts related to geologic hazards and hazardous materials would be less than significant. The Draft EIR for the Museum Square Office Building similarly concluded that impacts related to geologic hazards would be less than significant with mitigation and compliance with regulatory requirements. Therefore, the Project would have a less than considerable contribution to cumulatively significant impacts related to erosion and sedimentation.

4. MITIGATION MEASURES

With implementation of Project Design Features provided in Sections 4.E, Hazards and Hazardous Materials and 4.F Hydrology and Water Quality, the Project would have less than significant impacts with respect to most geology and soils and no mitigation measures are required.

However, to address potential Project impacts related to abandoned oil wells, Mitigation Measure MM-HAZ-1, presented in Section 4.E, Hazards and Hazardous Materials would be required.

5. LEVEL OF SIGNIFICANCE AFTER MITIGATION

With implementation of Mitigation Measure MM-HAZ-1, impacts related to abandoned oil wells would be less than significant.

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19 City of Los Angeles, Department of City Planning, Museum Square Office Building Draft Environmental Impact Report, February 2014.
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