4.4 GEOLOGY AND SOILS

4.4.1 Introduction

This section describes the existing Project Site conditions related to geology and soils. The Proposed Project's potential impacts in these areas are discussed and mitigation measures are provided for impacts determined to be potentially significant. Except as noted in the text, information contained within this section has been directly extracted or restated from the *Draft Geotechnical Engineering Investigation Proposed Home Depot Store SS-00936.2007, Other Retail Development and Off-Site Improvements NWC of Arden Avenue and East of 20th Street San Bernardino, California*, prepared by Moore Twining Associates Incorporated, September 23, 2011. The geotechnical report is included as Appendix D in this Draft EIR.

To supplement preparation of this document, various aerial photographs of the Project Site dating back to 1994 were reviewed. The purpose of the aerial photograph review is to provide site-scale reconnaissance of Project Site geology and potential hazards, including geologic units and site history, as well as the presence or absence of large, deep-seated landslides and surficial failures that potentially affect stability on the Project Site.

4.4.2 Environmental Setting

The Project Site consists of approximately 17.37 acres in the City of San Bernardino. The site is located at the northwest corner of Arden Avenue and East 20th Street. Highland Avenue lies north of the project site, and the Interstate 210 (I-210) overpass transects the northeast corner of the site.

The surface of the Project Site is relatively level with elevations ranging between 1,205 feet above mean sea level (amsl) in the southwest corner and 1,247 feet amsl in the northeast corner. The surface soils at the Project Site consist of silty sands with varying amounts of gravel and debris. One-hundred nineteen test borings were drilled at the site by Moore Twining Associates, Inc. to explore subsurface soil conditions. Fill soils were encountered beneath the surface soils in the majority of the borings; native silty sands underlie the fill soils and extend to depths of about 15 to 20 feet. The native silty sands were underlain by poorly graded sands that generally extended to the bottom of the borings. Test borings encountered no groundwater in the upper 50 feet below the site.

<u>Regional Geologic Setting and Site Geology</u>

The Project Site is located within the Bunker Hill - San Timoteo Basin portion of the San Bernardino Valley, at the northern edge of the Peninsular Ranges Geomorphic Province. The Bunker Hill - San Timoteo Basin is a subsiding series of horsts and grabens bounded on the northeast by the San Andreas fault and on the southwest by the San Jacinto fault. Coalesced alluvial fans emanating from the San Bernardino Mountains to the north and, to a lesser extent, from the San Timoteo Badlands to the south fill the basin as it subsides, and have formed an alluvial plain on the San Bernardino Valley floor. Because of the irregular surface of the basin floor, the depth of the in-filling sediments is exceedingly variable.

Local Groundwater

Groundwater was not encountered in the test borings to a maximum depth of 50 feet below ground surface (BGS). Utility services and underground improvements associated with the residential development previously located at the Project Site remain present throughout the site. Based on the absence of groundwater, the potential for liquefaction to occur at the site is considered low.

Geologic Structure and Seismic Setting

The tectonics of the Southern California area are dominated by the interaction of the North American plate and the Pacific plate, which are apparently sliding past each other in a translational manner. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone is thought to represent the major surface expression of the tectonic boundary and to be accommodating most of the translational motion between the Pacific plate and the North American plate. However, some of the plate motion is apparently also partitioned out to the other northwest-trending strike-slip faults that are thought to be related to the San Andreas system, such as the San Jacinto fault and the Elsinore fault. Local compressional or extensional strain resulting from the translational motion along this boundary is accommodated by left-lateral, reverse, and normal faults such as the Cucamonga fault, the Crafton Hills fault zone, and the blind thrust faults of the Los Angeles Basin (Matti and others, 1992; Morton and Matti, 1993).

The closest active fault to the Project Site is the San Andreas Fault. The San Andreas Fault zone is located along the southwest margin of the San Bernardino Mountains approximately 1.3 miles northeast of the Project Site. The toe of the mountain front in the San Bernardino area roughly demarcates the presently active trace of the San Andreas fault, which is characterized by youthful fault scarps, vegetational lineaments, springs and offset drainages.

The Reservoir Canyon fault of the Crafton Hills fault zone is located approximately 5 1/2 miles southeast of the site. The Crafton Hills fault zone is a system of normal faults bounding the Crafton Hills horst that are thought to be the result of regional extension associated with right-lateral slip on the faults of the San Andreas system (Matti and others, 1992). Several faults of the Crafton Hills fault zone are demonstratively Holocene active and are presently included in Alquist-Priolo Earthquake Fault Zones. The Reservoir Canyon fault is considered potentially active in that offset of Quaternary-age material can be observed but not necessarily Holocene-age material.

The main trace of the San Jacinto fault is located approximately 6 1/4 miles southwest of the site (Dutcher and Garrett, 1963; Morton, 1978; Morton and Matti, 1991). The San Jacinto fault zone is a system of northwest-trending, right-lateral, strike-slip faults. More large historic earthquakes have occurred on the San Jacinto fault than any other fault in Southern California (Working Group on California Earthquake Probabilities, 1988). Based on the data of Matti and others (1992), the San Bern-ardino Valley segment of the San Jacinto fault may be accommodating much of the motion between the Pacific Plate and the North American Plate in this area. Matti and others (1992) suggest this motion is transferred to the San Andreas fault in the Cajon Pass

region by "stepping over" to parallel fault strands which include the Glen Helen fault. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 37 percent (±17 percent) probability of a major earthquake on the San Bernardino Valley segment of the San Jacinto fault for the 30-year interval from 1994 to 2024.

The Cleghorn fault is a relatively short, westerly-trending feature identified in the Cajon Pass area. This fault is located approximately 15 miles northwest of the site and is classified as questionably Holocene in age (Jennings, 1994).

The southern margin of the San Gabriel Mountains is coincident with a series of east-west trending, predominantly reverse and thrust faults known as the Transverse Ranges frontal fault system. The San Fernando fault of this system ruptured during the 1971 preferred magnitude (M) 6.7 San Fernando earthquake. The Cucamonga fault of this system is located at the base of the San Gabriel Mountains, approximately 15 miles northwest of the site. Evidence of recent activity on this fault includes fresh scarps, sag ponds and disrupted Holocene alluvium (Dutcher and Garrett, 1963; Yerkes, 1985; Morton and Yerkes, 1987).

Earthquake History

No large earthquakes have occurred on the San Bernardino Mountains segment of the San Andreas fault within the regional historical time frame. Using dendrochronological evidence, Jacoby and others (1987) inferred that a great earthquake on December 8, 1812 ruptured the northern reaches of this segment. Recent trenching studies have revealed evidence of rupture on the San Andreas fault at Wrightwood occurred within this time frame (Fumal and others, 1993). Comparison of rupture events at the Wrightwood site and Pallett Creek and analysis of reported intensities at the coastal missions led Fumal and others (1993) to conclude that the December 8, 1812 event ruptured the San Bernardino Mountains segment of the San Andreas fault largely to the southeast of Wrightwood, possibly extending into the San Bernardino Valley. The average recurrence interval for large earthquakes along the southern San Andreas fault at six paleoseismic sites is 182 years (Stone and others, 2002).

4.4.3 Applicable Policies, Plans and Regulations

State

Seismic Hazards Mapping Act

The California Geological Survey (CGS) provides guidance with regard to seismic hazards under the Seismic Hazards Mapping Act. Seismic hazard zones are identified and mapped by the CGS to assist local governments in land use planning. The intent of the Act is to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes. In addition, CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California, provides guidance for the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations.

Uniform Building Code (Title 24)

Title 24 of the California Code of Regulations (CCR) governs the design and construction of buildings, associated facilities, and equipment. These regulations are also known as buildings standards. CCR Title 24 is published by the California Building Standards Commission and it applies to all building occupancies, related features, and equipment throughout the State of California. The California Building Standards Code contains structural, mechanical, electrical, and plumbing system requirements and requires measures for energy conservation, green design, construction and maintenance, fire and life safety, and accessibility. Title 24 was last updated and adopted for an effective date of January 1, 2011.

Cities and Counties are required by state law to enforce CCR Title 24. Due to varying local climatic, geological, and topographic conditions, City and County agencies have the prerogative of adopting requirements more restrictive than those provided for by CCR Title 24. An adoption of building standards differing from those established in CCR Title 24 must be filed with the California Building Standards Commission along with a finding of need statement. Additionally, cities and counties may adopt ordinances that require fire suppression sprinkler systems and other fire protections that are more restrictive than those found in CCR Title 24. Such ordinances must be filed with the Department of Housing and Community Development.

The City of San Bernardino Building Code is found in Title 15 of the San Bernardino City Municipal Code. The purpose of the building code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality or materials, use and occupancy, location and maintenance of all buildings and structures within the City's jurisdiction (Ord. MC-699, 7-17-89). Title 24 is adopted by reference within the City's Building Code.

City of San Bernardino General Plan

Goal 10.7 Protect life, essential lifelines, and property from damage resulting from seismic activity.

Policies:

10.7.3 Enforce the requirements of the California Seismic Hazards Mapping and Alquist-Priolo Earthquake Faulting Zones Acts when siting, evaluating, and constructing new projects within the City. (LU-1)

10.7.4 Determine the liquefaction potential at a site prior to development, and require that specific measures be taken, as necessary, to prevent or reduce damage in an earthquake.

Goal 10.9 Minimize exposure to and risk from geologic activities.

Policies:

10.9.2 Require geologic and geotechnical investigations in areas of potential geologic hazards as part of environmental and/or development review process for all new structures. (LU-1)

4.4.4 Project Impact Analysis and Mitigation Measures

4.4.4.1 Thresholds of Significance

The Initial Study Checklist for the Proposed Project was completed and circulated with a Notice of Preparation to identify potential environmental impacts that could occur as a result of the Proposed Project. The Checklist identifies the primary thresholds of significance relating to CEQA issues. The Proposed Project would have a significant effect on Geology and Soils if it would:

- Involve earth movement (cut and or/fill) based on information included in the Project Description form.
- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death.
- Be located within an Alquist-Priolo Earthquake Fault Zone.
- Result in substantial soil erosion or the loss of topsoil.
- Be located within an area subject to landslides, mudslides, subsidence, or other similar hazards as identified in the City's General Plan.
- Be located within an area subject to liquefaction as identified in the City's General Plan.
- Modify any unique physical feature based on a site survey/evaluation.
- Result in erosion, dust, or unstable soil conditions from excavation, grading, fill, or other construction activities.

4.4.4.2 Geology and Soils Issues Identified to Have No Impacts

The Initial Study Checklist for the Proposed Project that was circulated with a Notice of Preparation (NOP) identified the following threshold areas where no impacts would occur as a result of the Proposed Project. No additional information was received during the NOP review period to change the conclusions of the Initial Study.

Modify any unique physical feature based on a site survey/evaluation.

The Proposed Project would not modify any unique physical features. No unique geologic features were identified during a site/survey evaluation; therefore no impact would occur.

4.4.4.3 Geology and Soils Issues Determined to Have a Less Than Significant Impact

The Initial Study Checklist for the Proposed Project that was circulated with a Notice of Preparation (NOP) identified the following threshold areas where less than significant impacts would occur as a result of the Proposed Project. No additional information was received during the NOP review period to change the conclusions of the Initial Study.

Be located within an Alquist-Priolo Earthquake Fault Zone.

The Project Site is located outside of an Alquist-Priolo Special Studies Zone as depicted on Figure S-3 of the City's General Plan. Reviews of official maps delineating State of California earthquake fault zones (7.5 Minute Series, State of California Special Studies Zones, San Bernardino North Quadrangle, Official Map) indicated the site is not located within a zone for mandatory study for active faulting. The nearest known active or potentially active fault is the San Andreas fault, located about 1.3 miles northeast of the site. No evidence of faulting was visible on the aerial photographs reviewed nor are any faults mapped as being located on the Project Site on the published geologic maps reviewed as part of the site's geotechnical investigation. Therefore, potential impacts to the Proposed Project associated with earthquakes are determined to be less than significant.

Be located within an area subject to landslides, mudslides, subsidence, or other similar hazards as identified in the City's General Plan.

Be located within an area subject to liquefaction as identified in the City's General Plan.

The Project Site is relatively flat and is not located in an area prone to land or mudslides. The Project Site is not located within an area susceptible to liquefaction and/or ground subsidence, as shown in Figures S-5 and S-6 of the City's General Plan. The geotechnical report prepared for the Proposed Project found that no special procedures to address expansive soils are required. As determined in the geotechnical report, soils at the Project Site exhibit moderate to high compressibility characteristics, low collapse potential, low shear strength, and very low expansion potential. Evaluations of dry seismic settlement resulted in estimated seismic settlements within the Proposed Project's Home Improvements store building pad area to be as much as approximately 20 inches total and 10 inches differential in 50 feet of the very loose to loose silty sands and poorly graded sands extending to depths of 20 to 30 feet BGS. Seismic settlements within the Major 1 and Shops building pad areas were estimated to be as much as about 12 inches total and 6 inches differential in 50 feet. Seismic settlements with the areas of Pads 1 through 4 were estimated to be as much as about 19 inches total and 9 ½ inches differential in 50 feet. Potential impacts from landslide, mudslide, or subsidence are determined to be less than significant.

One-hundred and nineteen borings were drilled at the Project Site as part of the geotechnical investigation. The borings identified no groundwater within 50 feet below ground surface; as a result the potential for liquefaction to occur was determined to be low and therefore less than significant.

4.4.4.4 Geology and Soils Issues Determined to Have Potentially Significant Impacts

The Initial Study Checklist for the Proposed Project that was circulated with a Notice of Preparation (NOP) identified the following thresholds areas where impacts associated with the Proposed Project could potentially be significant thereby warranting additional analysis in the Draft EIR. Each issue identified in the Initial Study relates to the grading activities required at the Project Site and the potential for erosion and slope instability; these issues have therefore been grouped into one impact statement.

Impact GS-1:

The Proposed Project results in the development of a vacant site that would involve substantial earth movement (cut and/or fill) with the potential to result in substantial soil erosion or the loss of topsoil, or unstable soil conditions. The earth movement and grading activities could expose nearby people or structures to potential substantial adverse effects, including the risk of loss, injury, or death.

On-site activities related to the movement of earth would involve grading. According to the A.L.T.A. survey by Tait, the site ranges in elevation from about 1,205 feet amsl in the southwest corner of the site to about 1,247 feet amsl in the northeast corner of the site. Based on the Home Improvement Store finished floor elevation of 1,218 feet amsl listed on the site plan and the current elevation within the building pad area (about 1,207 to 1,224 feet amsl) cuts up to about five feet and fills of up to about ten feet are anticipated to achieve the proposed building pad subgrade elevation. Based on a finished surface elevation of 1,220 feet amsl for Major 1 listed on the site plan provided and the current elevations within the Major 1 building pad area (about 1,220 to 1,230 feet amsl), cuts of up to about ten feet are anticipated to achieve the proposed Major 1 building pad subgrade elevation.

Site grading can leave soils vulnerable to wind and water erosion during construction. The lack of soil moisture and the minimal amount of clay material for binding could subject loose surface soils to high winds or substantial rainfall. Blowing soil not only depletes soils on-site, it reduces visibility, decreases air quality, abrades surfaces, and can affect the operation of machinery off-site as well. Water eroded soil can make travel on roads dangerous; it can affect water levels by blocking culverts and increasing the chance of flooding. Eroded sediment could carry petroleum or other pollutants into the water system, and the sediment from eroding soils could affect light penetration into water bodies reducing the photosynthetic ability of water plants.

Soils left bare during construction activities can erode due to high wind speeds or the presence of swiftly moving water. To avoid off-site erosion impacts, a storm water management plan which incorporates drainage design features to mitigate for storm related impacts has been prepared. The NPDES permit process requires developers or contractors to reduce, to the extent practical,

the discharge of pollutants into water bodies by using Best Management Practices (BMP's). Compliance with NPDES permitting process requires storm water quality management to be considered during a project's planning phase and be implemented during construction. A SWPPP would be prepared to identify structural and nonstructural controls using BMP's to avoid storm water effluence. BMPS will include at a minimum that disturbed soils shall be watered at least twice daily to ensure the control of fugitive dust escaping off-site and soils left bare or inactive for longer than thirty days shall be planted with ground cover or covered by approved means to assure no loss of topsoil. After construction of the buildings, erosion potential would be minimal due to much of the disturbed area being covered by structures, hardscape (asphalt and sidewalks), and landscaping. The SWPPP would be approved by the City prior to issuance of permits.

According to the geotechnical engineering report, the Project Site is not located in an Alquist-Priolo Earthquake Fault Zone. The potential for fault rupture at the site is considered low, the nearest known active or potentially active fault is the San Andreas fault, located about 1.3 miles northeast of the site. Horizontal seismic ground acceleration at the site is considered high in the event of an earthquake. However, the construction of the proposed commercial structures would comply with the California Building Code (CBC) and impacts due to ground shaking would be reduced to less than significant level. The City of San Bernardino Building and Safety Department will approve all plans prior to the issuance of permits.

Mitigation Measures:

Mitigation Measure GS-1:

Prior to issuance of grading permits, the developer shall submit grading plans that incorporate the general earthwork and grading specifications for rough grading as set forth in the geotechnical reports for the project (see Draft EIR Appendix D). These include such measures as clearing and grubbing to remove all vegetation and any preexisting above ground and underground structures; over excavating and recompacting soil; placement or disposal of oversized material; construction of cut or fill slopes; preliminary foundation recommendation; and grading requirements for seismic considerations. Final recommendations shall be noted on all grading plans to be carried out by grading contractors, and monitored by the City of San Bernardino Building and Safety staff.

Mitigation Measure GS-2:

Prior to issuance of building permits, including permits for utilities, the developer shall submit development plans that incorporate the recommendations of the geotechnical report prepared by Moore Twining Associates, Inc., dated March 25, 2011 (Appendix D) for preliminary foundation work, utility trenching, and concrete slabs. These include specifications for concrete slabs and footings, temporary excavation for utilities, preliminary pavement design, and protection of foundations from surface drainage.

Level of Significance After Mitigation

Implementation of the above mitigation measures GS-1 and GS-2 would ensure that impacts associated with geological and geotechnical hazards would be less than significant pursuant to the significance criteria set forth by CEQA.