

5.4 - GEOLOGY AND SOILS

5.4.1 - Introduction

Information in this section is based on the following documents:

- Geotechnical Review Report, Leighton Consulting, Inc., June 2004. The complete report is contained in Appendix C of the Technical Appendices of the DEIR.
- Interim Report of Preliminary Geologic/Geotechnical Investigation, Neblett and Associates, Inc., September 2003. The complete report is contained in Appendix C of the Technical Appendices of the DEIR.
- NMC Final EIR, City of Ontario, October 1997. This document is incorporated by reference.
- NMC General Plan, City of Ontario, January 1998. This document is incorporated by reference.

The NMC Final EIR identified potential impacts to proposed development from geologic and seismic hazards. These potential impacts included: expansive soils; weak and compressible soils; chemical reactivity in soils; fault rupture; seismicity; liquefaction; subsidence; and near-surface (perched) groundwater.

The NMC Final EIR was prepared at a broad programmatic level and is not sufficient for full and complete evaluation of geologic and soils conditions at an individual project site. Rather, information contained in the NMC Final EIR is intended to supplement detailed studies prepared for the development of individual subareas.

The NMC Final EIR concluded that adequate geotechnical and geological reports will be required prior to the development of individual subareas and that mitigation measures would be developed as a result of these studies. Preparation of this section of the DEIR conforms to the recommendations contained in the NMC Final EIR and evaluates additional information specific to the project site that may not have been included in the broad, program-level evaluation of the Final EIR prepared for the NMC.

5.4.2 - Existing Conditions

The existing conditions will be described in terms of the project site's setting in a regional context and the actual conditions on the project site.

Regional Conditions

The project site is located in the central portion of the Chino Basin. This basin is an area of large-scale crustal disturbances that exhibit structural faulting and the resultant seismicity. Surficial geology in the Chino Basin generally consists of medium-grained Holocene alluvium, fine-grained Holocene alluvium, and eolian (wind-blown) sands. Alluvium depth in the region varies from 400 to 1,500 feet below ground surface (BGS). Bedrock is considered comprised of Tertiary sedimentary and igneous rock.

Soils generally consist of the following soil associations: Foster-Grangeville, Tujunga-Delhi, Hanford-Greenfield, and Merrill-Chino. Extensive dairy operations in the region have resulted in the commingling of cow manure and soils, which has affected soil conditions. Manure, which has a very high organic content, mixed with native soil results in materials that are unsuitable for support of structures or for use as compacted fill.

Groundwater depths in the vicinity of the project site have been dropping from 100 feet BGS in 1960 to approximately 550 feet BGS in 1991. Groundwater subsidence ranges from 0.8 to 2.5 feet due to historic groundwater extraction. The Chino Basin Watermaster is implementing a program to monitor subsidence and to control groundwater withdrawals in the region.

Faulting and seismicity in the region could occur from various fault systems. The California Geological Survey (formerly known as the Division of Mines and Geology) of the Department of Conservation requires the identification of faults within 62 miles of a project site that have the potential to affect a proposed project. Table 5.4-1 presents information on faults located in the region that could potentially affect the project site.

Table 5.4-1: Regional Fault Systems

Fault	Distance From Project Site	Direction From Project Site	Maximum Magnitude Potential
Chino Fault	8.0 miles	South	6.7
San Jose Fault	10.1 miles	West	6.5
Cucamonga Fault	10.7 miles	North	7.0
Whittier Fault	11.7 miles	West	6.8
Elsinore Fault	12.1 miles	Southeast	6.8
Sierra Madre Fault	12.7 miles	North-northwest	7.0
San Jacinto Fault	13.0 miles	East	6.2
San Andreas Fault Zone	18.5 miles	East-northeast	7.1
Source: Geotechnical Review Report, Leighton Consulting, Inc., June 2004.			

Project Site Conditions

The project site is generally level with a very slight slope (1 - 2 percent) trending toward the south, and has been primarily disturbed from dairy and agricultural activities that have resulted in modification of surface and below-grade conditions. Secondary site disturbances have resulted from the construction and maintenance of the Southern California Edison high-voltage transmission line corridor and the development of a nursery. There are no significant geologic features or rock outcroppings that occur on the project site (Michael Brandman Associates 2004).

Faulting

The California Geological Survey, in conformance with the State-mandated Alquist-Priolo Act of 1972, has delineated Earthquake Fault Study Zones along active or potentially active faults. Development projects proposed within these zones would require detailed investigations to determine the potential for fault movement. An active fault, as defined by state law, is one that has proven movement (offset) within the last 11,000 years. Conversely, inactive faults do not show movement within this same period. Faults are considered potentially active if they lack sufficient proof to conclude either activity or inactivity.

Seismicity

Because the project site is located in the Chino Basin, seismic-related ground shaking on the project site could result from its proximity to the earthquake faults previously identified. The intensity of ground shaking on the project site depends on factors such as: distance to an identified fault; type of fault; thickness and composition of alluvium; depth to bedrock; and soil characteristics. According to the Geotechnical Review Report, the Central Avenue segment of the Chino Fault would likely produce the most intense ground shaking on the project site. As identified in Table 5.4-1, this fault is located 8 miles from the project site and has the capability of producing a magnitude 6.7 seismic event.

Surficial Geology

Figure G-1 of the NMC Final EIR identifies the entire project site as eolian sand. Eolian sand is wind-deposited, has fine to medium sized grains, and has a high potential for erosion. Engineering characteristics are fairly consistent, but due require some precautions. Building materials could become uncemented and subject to consolidation under structural loads.

Soils

Figure 6-2 of the NMC General Plan identifies the entire project site as Delhi Fine Sand, a unit of the Tujunga-Delhi soil association. This soil is considered a Class III soil, as identified on Figure AG-1 of the NMC Final EIR, and is characterized as reaching depths of 60 inches BGS, has moderate

permeability, lacks a clear development profile, and exhibits slow run-off. This soil has a slight potential for hydrocollapse.

Alluvium

Consistent with the regional conditions, the project site is underlain by alluvium consisting of clayey sands with minor amounts of gravelly sands and silts. This alluvium is considered to exhibit slight to moderate potential for hydrocollapse.

Manure

Manure contains a very high organic content, generally greater than 10 percent by weight and includes pure manure or soil mixed with substantial amounts of manure. Manure stockpiling resulting from on-going dairy operations occurs on various locations of the project site. According to the Geotechnical Review Report, concentrations of manure from 1 to 3 inches deep are located near the feedlot and cattle pens. According to the Preliminary Geologic/Geotechnical Investigation, concentrations of manure up to 6 feet in depth occur at the dairy pond.

Artificial Fill

Uncontrolled fill is characterized as loose, dry silty sands, and may contain variable amounts of organic material. These materials are highly susceptible to hydrocollapse. The Preliminary Geologic/Geotechnical Investigation concluded that significant amounts of uncontrolled artificial fill are located on the portion of the project site occupied by the dairy. However, this investigation indicated that no debris or animal carcasses are buried on the project site.

Groundwater

In calendar year 2000, the groundwater table in the vicinity of the project site was approximately 180 feet BGS. Previous records identified groundwater at 150 feet BGS in 1960, 120 feet BGS in 1933, and approximately 85 feet BGS in 1904. This latter elevation is considered to be the historically shallowest groundwater level at the project site. Both the Geotechnical Review Report and Preliminary Geologic/Geotechnical Investigation reported that no groundwater was encountered at 50 feet BGS, which was the maximum depth of the exploratory boring.

5.4.3 - Thresholds of Significance

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

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving:

- Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning map issued by the State Geologist for the area or based on other substantial evidence of a known fault (Refer to Division of Mines and Geology Special Publication 42),
 - Strong seismic ground shaking,
 - Seismic-related ground failure, including liquefaction, or
 - Landslides;
- Result in substantial soil erosion or loss of topsoil;
 - Be located on a geologic unit or soil that is unstable or 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 soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property; or
 - Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

5.4.4 - Project Impacts

The proposed project would develop the project site with urban uses that would expose persons living and working on the project site to potential seismic events and development of structures on potentially unstable ground. Fault rupture would directly expose structures to damage as a result of movement (offset) along an identified fault. Seismicity that occurs as a result of fault movement would expose structures to damage from ground shaking and expose persons to falling objects that become dislodged during a seismic event. Development located on unstable ground would expose buildings to potential structural damage.

Following is a discussion of the project impacts that correspond to the thresholds of significance previously identified in Section 5.3.3.

Impacts Related to Seismic Events

Earthquake Fault Rupture

The potential for fault rupture on the project site is very low due to the distance from the identified faults identified in Table 5-1. The absence of an active or potentially active fault on or adjacent to the project site, according to the Geotechnical Review Report, precludes impacts to structures directly related to fault rupture. Therefore, implementation of the proposed project would result in less than significant impacts related to fault rupture.

Seismic Ground Shaking

Due to the proximity to the Central Avenue segment of the Chino Fault, the potential for seismic ground shaking as a result of movement on this fault is considered to be high. Generally, the effects to structures from ground shaking cannot be entirely eliminated when in proximity to faults. Because of this, exposure to seismic ground shaking is a potentially significant.

Strong ground shaking can result in settlement of the soils by allowing sediment particles to become more tightly packed thereby reducing pore space. Because the dairy portion of the project site contains unconsolidated soils and poorly compacted artificial fills, structures built on these materials could be damaged as a result of a seismic event.

Seismically Induced Ground Failure

The project site is not subject to ground failure resulting from fault rupture and is not subject to ground failure from landslides. Therefore, implementation of the proposed project would result in less than significant impacts related to seismically induced ground failure.

Refer to the following sub-section entitled Impacts Related to Unstable Geologic Units for a discussion on seismically related liquefaction.

Seismically Induced Landslides

No natural or artificial slopes are located on or adjacent to the project site. In addition, no design features are included as part of the proposed project that would result in slopes that could be affected by a seismic event. Therefore, implementation of the proposed project would result in less than significant impacts related to seismically induced landslides.

Impacts Related to Soil Erosion or Loss of Topsoil

As previously identified in Section 5.4.2, the project site is generally level and not subject to high erosion potential that would result in down cutting, sheet wash, slumping, or bank failures from heavy rain events. In addition, the project design does not propose significant changes in site elevation or excessive stormwater discharges that would result in a high potential for erosion. Therefore, implementation of the proposed project would result in less than significant impacts related to soil erosion.

The proposed project would result in a loss of topsoil due to the conversion of a majority of the project site to urban uses as a result of site grading. Because the project would ultimately be converted to urban uses and no longer used for agricultural production, which would require topsoil, less than significant impacts due to the loss of topsoil would result from project implementation. Refer to Section 5.1 (Agriculture) of this document for a discussion on the potential impacts related to

agriculture, which includes loss of topsoil. In addition, refer to Section 5.2 (Hydrology and Water Quality) of this document for a discussion related to project site drainage, which would include erosion control measures, and Section 5.8 (Air Quality) of this document for a discussion on potential impacts related to air quality, which would include a discussion on ground-disturbing activities.

Impacts Related to Unstable Geologic Units

Refer to the previous sub-section entitled Impacts Related to Seismic Events for a discussion on landslides.

Lateral Spreading

The Geotechnical Review Report concluded that the project site does not contain the conditions necessary for lateral spreading to occur. Therefore, implementation of the proposed project would result in less than significant impacts related to lateral spreading.

Subsidence

The Geotechnical Review Report concluded that subsidence has not been observed in the immediate vicinity of the project site. Therefore, implementation of the proposed project would result in less than significant impacts related to subsidence.

Liquefaction

The Geotechnical Review Report did not identify the project site within an area mapped as potentially liquefiable and does not contain the shallow groundwater conditions necessary for liquefaction to occur. Therefore, implementation of the proposed project would result in less than significant impacts related to liquefaction.

Hydrocollapse

Because the dairy portion of the project site contains concentrations of manure, unconsolidated materials, and artificial fill, structures located on these materials could become damaged due to settlement if these materials become too wetted from irrigation or other sources of water. This is considered to be a potentially significant impact.

Corrosive Soils

The Geotechnical Review Report states that corrosive soils are known to exist in the vicinity of the project site. Corrosive soils contain physical characteristics that react with concrete or some metals that cause corrosion and damage to these materials over time. This is considered to be a potentially significant impact.

Impacts Related to Expansive Soils

The Geotechnical Review Report concluded that the on-site soils exhibit a low-to-very-low potential for expansion. Generally, soils at or near the finished grade that exhibit a very low potential for expansion do not require any special construction requirements. When soils at or near the finished grade exhibit a low (or higher) potential for expansion, special building construction measures are required. Because the potential for expansive soils does occur on the project site, this is considered a potentially significant impact.

Impacts Related to Wastewater Disposal Systems

The project does not propose the use of septic tanks or any alternative wastewater disposal systems. Wastewater disposal services would be provided through connections to a regional system. Refer to Section 5.10 of this document for a discussion on wastewater service provision. Therefore, implementation of the proposed project would not result in any impacts related to on-site or alternative wastewater disposal systems.

5.4.5 - Cumulative Impacts

Future development within the NMC would result in the conversion of predominantly agricultural uses to urban uses, consistent with the vision of the NMC General Plan. This would contribute to a cumulative increase in the number of people and amount of structures exposed to similar geologic hazards previously described. While these impacts are expected to be potentially significant, development of these subareas will require geotechnical studies, similar to those completed for the proposed project that would include mitigation measures to reduce potentially significant impacts to less than significant levels, as recommended by the NMC Final EIR.

Therefore, implementation of the Edenglen Project, in combination with other related projects, would not result in cumulatively considerable impacts.

5.4.6 - Mitigation Measures

The Geology Section of the NMC Final EIR identified a single mitigation measure (G-1) that required the development of a Grading and Geotechnical Investigation Standards manual that would be available to developers and consultants. The manual would include topics related to the following: soils; engineering and foundations; slope stability; erosion; liquefaction and dynamic settlement; groundwater elevation; and location to active faults. Application of the recommendations contained in such a study would mitigate potential hazards on a given project site.

Implementation of the NMC Final EIR mitigation measures and the following mitigation measures would reduce potentially significant impacts to a less than significant level.

- GS-1** Structural design shall conform to the seismic related recommendations of the geotechnical consultant. These recommendations shall be reviewed and be approved by the City of Ontario.
- GS-2** Seismic related structural design shall conform to applicable recommendations from the Structural Engineers Association of California.
- GS-3** Seismic related structural design shall conform to applicable sections of the California Building Code.
- GS-4** Seismic related structural design shall conform to applicable sections of the Uniform Building Code.
- GS-5** As part of the site grading and prior to the commencement of building construction, unconsolidated fill materials, organic rich soils having an organic content greater than 3%, and manure shall be excavated and removed off-site and shall be replaced with engineered fill.
- GS-6** Soils shall be tested do determine their corrosive potential. If corrosive soils are proven to be located on-site, all concrete that comes into contact with corrosive soil shall be designed based on Table 19-A-4 of the Uniform Building Code. All metals that come into contact with corrosive soils shall be protected according to the recommendations of a corrosion engineer.
- GS-7** At the conclusion of site grading and prior to the commencement of building construction, soils at the finished grade elevation shall be tested to determine their expansion index.
- GS-8** At the conclusion of site grading, if the tested soils at the finished grade elevation exhibit a low, or higher, potential for expansion, the following construction measures shall be implemented: stiffened foundation design in accordance with the Uniform Building Code; deepened footings; and pre-saturation of the building pad to a specified moisture content.

5.4.7 - Level of Significance After Mitigation

All of the mitigation measures require implementation prior to implementation of site preparation activities or building construction. This eliminates the potential for construction-related activities to commence without the benefit of the recommended mitigation measures.

Mitigation Measures GS-5 through GS-8 would prevent buildings on the project site from being constructed on soil that is improperly compacted, corrosive, or subject to expansion. This would

eliminate the potential for buildings to become damaged during the long-term operational phase of the project.

Mitigation Measures GS-1 through GS-4 would prevent structures from becoming damaged during seismically induced ground shaking.

With the implementation of the recommended mitigation measures, the proposed project would result in less than significant impacts related to geology and soils.