Section 5.8
GEOLOGY, SOILS, AND SEISMICITY

5.8 GEOLOGY, SOILS, AND SEISMICITY

This section describes the geologic, soil, and seismic setting of the project area; identifies potential impacts of the proposed project; and recommends mitigation measures to reduce the significance of such impacts. Information in this section is based on the *Geology, Soils and Seismicity Technical Report* prepared by Geologist D. Scott Magorien (February 2005). The scope of work conducted by Mr. Magorien included compilation and review of published geologic and seismic hazards maps; geotechnical reports prepared by Leighton & Associates (1986, 1987, 1989, 1990) for the existing Skilled Nursing Facility and Diagnostic and Treatment Center and adjacent parking lots; and combined geotechnical and geologic hazards and seismic reports prepared by URS Corporation (URS) (2002, 2003) for the proposed addition to the northwest corner of the Henry Mayo Newhall Memorial Hospital (HMNMH) and helipad. The *Geology, Soils and Seismicity Technical Report* is included in its entirety in Appendix H, Geology and Soils Analysis.

5.8.1 ENVIRONMENTAL SETTING

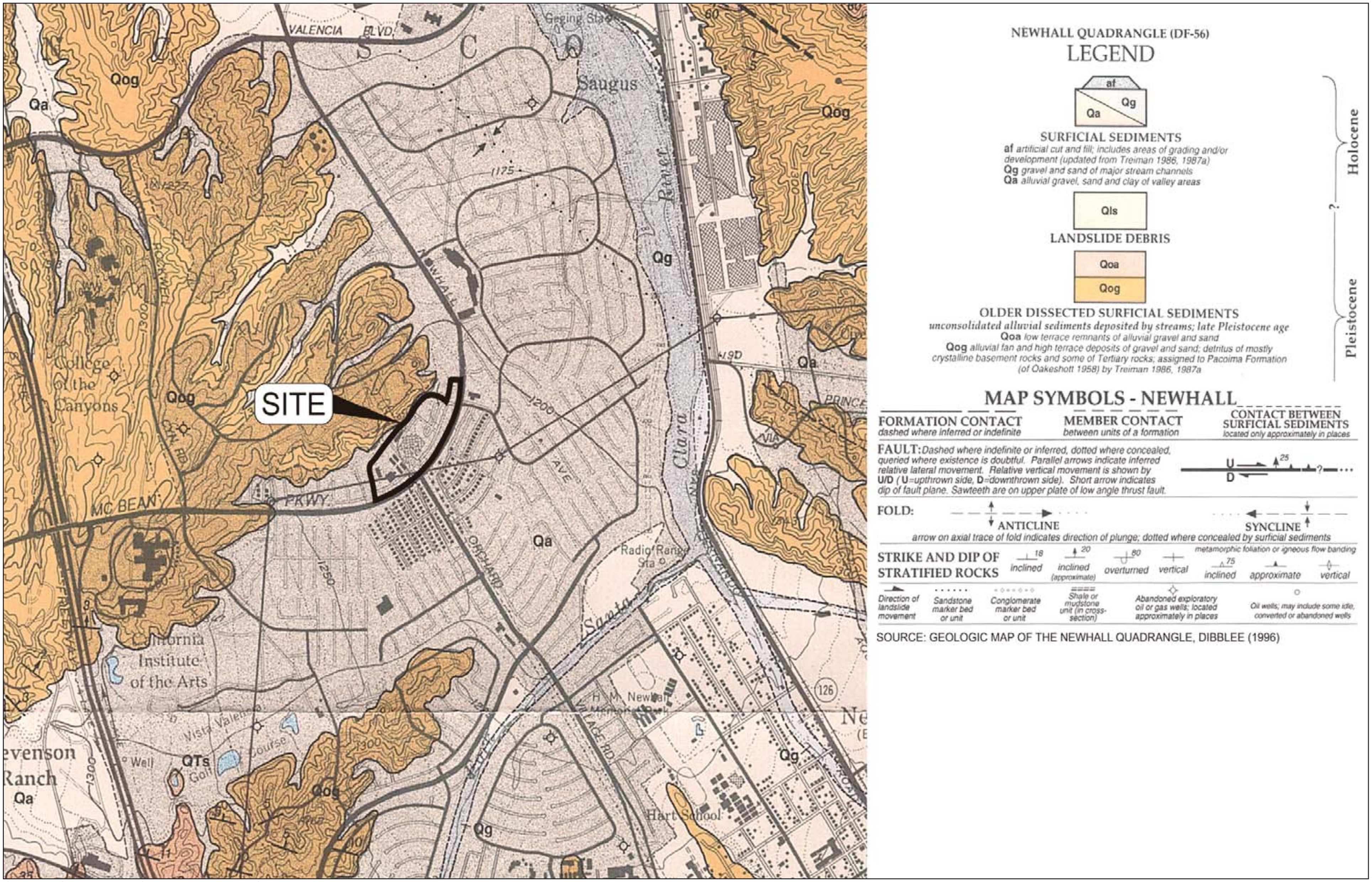
GEOLOGIC SETTING

The HMNMH project area is situated in the southeasternmost portion of the East Ventura Basin, a former structural basin that is part of the western Transverse Ranges Province of southern California. This structural basin is filled with more than 10,000 feet of both marine and non-marine sediments that were deposited in Tertiary (beginning about 65 million years ago) through Quaternary time (1.6 million years ago to the present), with periods of erosion and non-deposition. The East Ventura Basin is bounded on the north and northeast by the San Gabriel fault and on the south and east by the Oat Mountain/Santa Susana and Weldon Canyon thrust faults, each of which is considered seismically active. Tectonic activity during the last 5 million years (+/-) has produced a series of large-amplitude, east-west trending anticlines and synclines within the bedrock, portions of which have been exploited for oil and gas. The project area lies outside known oilfields.

The HMNMH project area is situated on the margin of an alluvial floodplain near the mouth of Pico Canyon and its confluence with the South Fork of the Santa Clara River. This area is represented by a relatively broad flat valley that is filled with young (Holocene age) alluvium, as shown on *Exhibit 5.8-1*, *Geologic Map*. Older (Pleistocene age) alluvium underlies the younger alluvium at depths ranging from 20 to 75 feet below ground surface. These same Pleistocene alluvial deposits are exposed in the topographically elevated terrace along the north side of the project area, and are underlain by non-marine sedimentary fluviatile deposits (i.e., sandstone and conglomerate with minor siltstone) of the Saugus formation. The depth to the Saugus formation is not well known, but is estimated to be approximately 200 to 400 feet below ground surface.

Site Conditions

The approximately 30.4-acre HMNMH project site has little to no topographic relief and lies at an elevation of about 1,225 feet (+/- several feet) above mean sea level.



Source: D. Scott Magorien, Consulting Engineering Geologist. February 10, 2005.

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REVISED ENVIRONMENTAL IMPACT REPORT
HENRY MAYO NEWHALL MEMORIAL HOSPITAL MASTER PLAN

Geologic Map

Exhibit 5.8-1

Since the original development of the medical campus, the uppermost 2 to 10 feet of the native alluvial soils has been excavated and replaced with compacted fill for support of the parking areas and medical buildings. Based on a review of recent aerial photographs, it appears that most, if not all, of the native near-surface soils have been removed within the limits of the project area. The only exposed remaining natural soils in the vicinity of the project area are on the slopes along the southern flanks of the elevated terrace containing older alluvial deposits that border the northern margin of the site.

GEOLOGIC MATERIALS

The subsurface geologic materials that would likely have an influence on the proposed expansion of the HMNMH are the artificial fill soils that have been placed beneath the existing buildings and parking areas (younger Holocene age and possibly older Pleistocene age alluvial sediments).

Artificial Fill

Artificial fill soils within the project area vary from approximately 2 to 10 feet thick. There are essentially two types of artificial fill soils within the project site: engineered fill soils, which support the existing buildings and the parking areas; and approximately 2 to 5 feet of artificial fill soils beneath other portions of the site, which are likely to be loose, porous, and to contain varying amounts of organic debris and trash. Where these "non-engineered" types of soils are encountered, they are expected to be compressible and therefore subject to long-term consolidation. If not removed and/or replaced with compacted fill beneath proposed buildings, the building's foundations and/or structural elements could experience moderate to significant distress.

Younger Alluvium (Geologic Map Symbol: Q_a)

Younger alluvial sediments are those that have been deposited by the intermittent stream flows and periods of severe flooding during the Holocene age (last 11,000 years). Exploratory borings drilled within the northeastern portion of the project site encountered alluvial sediments to approximately 40 feet below ground surface that consisted of layers and lenses of gravelly silty sand that are moist and medium dense, and overlain by up to 10 feet of artificial fill.

Most of the subsurface explorations within the alluvial sediments occurred in the central and north-central portions of the project site, in the vicinity of the Main Hospital and Nursing Pavilion, and in the parking areas to the north and south. The subsurface explorations identified what appears to be a southward- to eastward-thickening, 10- to 25-foot-thick (+/-) upper layer of alluvium consisting of layers and lenses of poorly to well-graded sand, silty sand, and sand with gravel that is moist and medium dense to dense. Below this upper sandy/gravelly layer is a 10- to 20-foot-thick, southward- to eastward-thinning layer of lean clay and sandy lean clay that is moist and very stiff to hard. Below this clay layer, the alluvium consists of very dense sand, sand with silt, and silty sand to depths of 51.5 feet. Saugus formation bedrock was not encountered in the deeper borings.

Based on the geotechnical information reviewed, the physical character of the alluvial soils indicates that they are not subject to collapse or settlement upon wetting and/or placement of structural loads (e.g., embankment and fill soils for buildings).

Older (Pleistocene) Alluvium (Geologic Map Symbol: Q_{og})

Older Pleistocene age alluvial deposits are exposed only on the south facing natural slope adjacent to the northern perimeter of the project area (refer to *Exhibit 5.8-1*). These sediments are an ancient alluvial fan deposit consisting of gravel and sand. No "weak" clay layers are known to occur within these coarse-grained deposits. It is unknown whether any of the exploration borings conducted in 1986, 2002, or 2003 encountered these older deposits. The sedimentary layering within these deposits strikes northwest-southeast and, in all likelihood, dips to the northeast at very shallow angles (less than 7 degrees).

GROUNDWATER

The project site lies just beyond the southern margin of the Eastern Groundwater Basin within the Upper Santa Clara River Valley Hydrologic Area. The alluvium and Saugus formation bedrock forms the Eastern Groundwater basin aquifer. Groundwater levels in the alluvium can fluctuate rapidly in response to changes in recharge or groundwater extraction and pumping because of the high permeability of these deposits. According to the California Geological Survey (formerly known as the California Division of Mines and Geology), the depth to historic high groundwater in the vicinity of the project area is approximately 70 feet below ground surface.

There is no evidence of past or present groundwater use in the project area. No evidence of springs or seeps has been observed along the base of the alluvial terrace deposits north of the site.

MINERAL RESOURCES

There are no economic metallic or nonmetallic ore deposits within or directly adjacent to the project area. Although the project area is essentially surrounded by either existing or abandoned oil producing areas, there are no known producing oil wells within several miles of the project area.

POTENTIAL GEOLOGIC HAZARDS AND CONSTRAINTS

The project is situated within an area underlain, for the most part, by dense alluvial soils that are not considered subject to static or seismically induced settlement and are regarded as relatively safe from damage by ground shaking resulting from seismic activity. The risk from damage resulting from earthquake-induced liquefaction, lateral spread, landslides, seiches, or tsunami is considered remote.

The primary geologic hazards and constraints identified during this study are those associated with collapsible fill soils, possibly seismically induced settlement within isolated pockets of loose Holocene alluvium, and strong seismically induced ground shaking.

FAULTING AND SEISMICITY

The hazards associated with earthquakes are primary hazards (such as ground shaking and surface rupture) and secondary hazards (such as liquefaction, seismically induced settlement, landsliding, tsunamis, and seiches).

The project area is situated within a highly seismically active area of southern California referred to as the Ventura Basin/ Western Transverse Ranges fold-and-thrust belt. According to the California Geological Survey, a fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. An inactive fault is a fault that has not experienced earthquake activity within the last three million years; an active fault is one that has experienced earthquake activity in the past 11,000 years. A fault that has moved within the last two to three million years, but has not been proven by direct evidence to have moved within the last 11,000 years, is considered potentially active.

SURFACE RUPTURE

The Alquist-Priolo Act of 1972 (now the Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code 2621-2624, Division 2, Chapter 7.5) regulates development near active faults in order to mitigate the hazard of surface fault rupture. Under the Act, the State Geologist is required to delineate "special study zones" along known active faults in California. The Act also requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within the lead agency's organization or retained by the lead agency for the project, must prepare this geologic report.

A 50-foot building setback from any known trace of an active fault is required. No active or potentially active faults are located within or extend towards the project area. Thus, the project area is not currently known to be located within an Alquist-Priolo Earthquake Fault Zone, according to the California Geological Survey. The closest Earthquake Fault Zone to the site is a segment of the San Gabriel fault zone that is approximately 1.5 miles northeast of the project site.

GROUND SHAKING

Ground shaking accompanying earthquakes on nearby faults can be expected to be felt within the site. However, the intensity of ground shaking would depend upon the magnitude of the earthquake, the distance to its epicenter, and the geology of the area between the epicenter and the property.

The magnitude of most earthquakes is measured on the Richter scale. The Richter magnitude is calculated from the amplitude of the largest seismic wave recorded for the earthquake, no matter what type of wave was the strongest. The Richter magnitudes are based on a logarithmic scale (base 10). What this means is that for each whole number you go up on the Richter scale, the amplitude of the ground motion recorded by a seismograph goes up ten times. Using this scale, a magnitude 5 earthquake would result in ten times the level of ground shaking as a magnitude 4 earthquake (and 32 times as much energy would be released).

Another method to measure the strength of an earthquake is to use the Modified Mercalli Intensity (MMI) scale, developed in 1931, which measures the intensity of an earthquake's effects in a given locality. This scale is based on actual observations of earthquake effects at specific places. On the MMI scale, values range from I to XII. The most commonly used adaptation covers the range of intensity from the conditions of: "I – not felt except by very few, favorably situated," to "XII – damage total, lines of sight disturbed, objects thrown into the air." While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter. In the case of the 1994 Northridge earthquake, the Santa Clarita-Newhall area experienced MMIs between VII and VIII.

Ground motions, on the other hand, are often measured in percentage of gravity (percent g), where g = 32 feet per second per second (980 ft/sec^2) on the earth. Maximum ground motions (referred to as the peak ground acceleration [PGA]) at the project site were determined by utilizing the 1998 California Building Code (CBC) procedures. This "deterministic" approach used the closest distance to known faults and their fault types (i.e., strike-slip, thrust, or combination of the two). Although the CBC method provides generalized results for seismic design, the requirements of California Geological Survey [Note 48] state that a Probabilistic Seismic Hazard Analysis (PSHA) must be performed for certain types of buildings, such as hospitals. A PSHA for the addition to the northwest corner of the HMNMH was prepared in 2002. This analysis produced PGA values of 0.86g that corresponds to a 475-year return period (e.g., design basis earthquake), and 1.03g corresponding to a 949-year return period (e.g., upper bound earthquake). For comparative purposes, ground motion from the Northridge earthquake, in which the epicenter was about 12 miles south of the project site, produced a PGA (i.e., a horizontal component) of 1.03g at the Los Angeles County fire station in Newhall, approximately 1.25 miles east of the site.

A listing of active faults considered capable of producing strong ground motion at the site, their closest distances to the property, and the maximum expected earthquake along each fault is presented in *Table 5.8-1*, *Summary of Faults and Generalized Earthquake Information*. Also presented are generalized evaluations of maximum ground shaking at the project site for the maximum earthquakes, and generalized predictions of the likelihood of such events occurring.

Table 5.8-1
Summary of Faults and Generalized Earthquake Information

Fault	Miles from Project Site	Maximum Magnitude on Richter Scale (M)	Expected Level of Ground Shaking	Likelihood of Occurrence
Northridge(E Oak Ridge)	3.5*	6.9	High	High
Santa Susana	6	6.6	High	High
Holser	1.5	6.5	High	Moderate
San Gabriel	1.5	7.0	High	Moderate
Sierra Madre	17.5	6.7	Moderate	High
Simi-Santa Rosa	8.5	6.7	Moderate	Moderate
Northridge Hills	9.3	6.6	Moderate	Moderate
San Andreas (Mojave)	19	7.1	Moderate	High
Oak Ridge (onshore)	9.3	6.9	Moderate	High
San Cayetano	11.5	6.8	Moderate	Moderate
Newport-Inglewood	27.5	6.9	Low	High

* This fault is a blind thrust fault that has no surface projection. The closest distance to a projection of the rupture area along the subsurface trace of the fault is estimated to be about 9 miles.

Liquefaction

Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquefaction is caused by a sudden temporary increase in pore water pressure due to seismic densification or other displacement of submerged granular soils. Liquefaction more often occurs in earthquake-prone areas underlain by young (i.e., Holocene age) alluvium where the groundwater table is higher than 50 feet below ground surface.

The California Geological Survey has designated certain areas within California as potential liquefaction hazard zones. The project site is not designated as being within a zone having the potential for earthquake-induced liquefaction.

Lateral Spreading

Lateral spreading is the lateral displacement of surficial blocks of sediment as a result of liquefaction in a subsurface layer. Because the liquefaction potential within the project area is unlikely, the likelihood of lateral spread is considered to be remote.

Ground Lurching

Lurching is a phenomenon in which loose to poorly consolidated deposits move laterally as a response to strong ground shaking during an earthquake. Lurching is typically associated with soil deposits on or adjacent to steep slopes. Lurching that occurred in the Santa Monica and Santa Susana mountains during the 1994 Northridge earthquake usually was attributable to the outer two to eight feet of loose fill soils, which spilled over the edges of graded pads cut into bedrock. Graded and compacted housing pads did not experience lurching during this very damaging earthquake.

Certain soils have been observed to move in a wave-like manner in response to intense seismic ground shaking, forming ridges or cracks on the ground surface. Areas underlain by thick accumulations of alluvium appear to be more susceptible to ground lurching than bedrock. Under strong seismic ground motion, lurching can be expected within loose, cohesionless soils, or in clay-rich soils with high moisture content. Generally, only lightly loaded structures such as pavement, fences, pipelines, and walkways are damaged by ground lurching; more heavily loaded structures appear to resist such deformation. Ground lurching may occur where deposits of loose alluvium exist on the project site. If alluvial soils prove to be loose (i.e., poorly consolidated), ground lurching may affect lightly loaded structures built on these materials. Lurching can also affect graded pads that are underlain by steep contacts of dissimilar bearing materials at depth, such as compacted fill caps that have been placed over a transition from very dense older alluvium, or bedrock, to Holocene age alluvium.

Seismically Induced Ground Settlement

Strong ground shaking can cause settlement by allowing sediment particles to become more tightly packed, thereby reducing pore space. Unconsolidated, loosely packed alluvial deposits are especially susceptible to this phenomenon. Poorly compacted artificial fills may also experience seismically induced settlement.

Seismically Induced Landsliding

Because the project area is situated on a relatively flat alluvial plain and lacks any significant slopes, the hazard from slope instability, from both landslides and debris flows, is considered negligible. However, slopes to the north of the site have the potential for landslide movement during a seismic event, which could impact the project site.

Inundation From Dam Failure

The project site does not lie within either a 100-year or 500-year flood area, or within a dam inundation area, according to the City of Santa Clarita.[1] Moreover, the Flood Insurance Rate Map for the City of Santa Clarita delineates the site as being in "Zone C," which is defined as an area of minimal flooding. Therefore, the likelihood of seismically induced flood inundation at the site is considered minimal.

Section 5.10, Hydrology and Water Quality, further analyzes flooding potential on the project site.

Tsunamis

A tsunami is a seismic sea-wave caused by sea-bottom deformations that are associated with earthquakes beneath the ocean floor. Given the elevation of the project site and the great distance from the project site to the Pacific Ocean (approximately 26 miles at the closest point), the site would not be subject to hazards associated with tsunamis.

Seiching

Seiching is the oscillation of an enclosed body of water due to groundshaking, usually following an earthquake. Lakes, reservoirs, and water towers are typical bodies of water affected by seiching. There are no large open bodies of water, reservoirs, or water towers upgradient of the project area. The closest large open bodies of water to the project site are Bouquet Reservoir, located approximately 16 miles northeast of the site, and Castaic Lake, located approximately 8 miles north-northwest of the site. Therefore, the site would not be subject to hazards associated with seiching.

Other Geologic and Geotechnical Hazards

Subsidence

The extraction of groundwater or oil from sedimentary source rocks can cause the permanent collapse of pore space that was previously occupied by the removed fluid. The compaction of subsurface sediments resulting from fluid withdrawal could cause the ground surface overlying the fluid reservoir to subside. If sufficiently great, the subsidence can significantly damage nearby engineered structures.

1 City of Santa Clarita. *City of Santa Clarita Flood Zones*. World Wide Web: http://www.santa-clarita.com/cityhall/admin/technology/gis/maps_av_pics/floodzone.pdf. Accessed June 22, 2005.

Expansive Soils

Expansive soils are clay-rich soils that can undergo a significant increase in volume with increased water content and a significant decrease in volume with a decrease in water content. Significant changes in moisture content within moderately to highly expansive soil can produce cracking, differential heave, and other adverse impacts on structures constructed on such soils. The alluvial soils underlying the area at two likely foundation elevations consist primarily of granular soils and the deeper clays that have high moisture content (i.e., 20 to 30 percent) and a high degree of saturation. These soils exhibit a low expansion potential.

Corrosive Soils

Corrosive soils contain chemical constituents that can react with construction materials, such as concrete and ferrous metals, that may damage foundations and buried pipelines. One such constituent is water-soluble sulfate, which, if in high enough concentration, can react with and damage concrete. Electrical resistivity, chloride content, and pH level are indicators of the soil's tendency to corrode ferrous metals. Preliminary geotechnical investigation testing in 2002 for the proposed addition to the northwest corner of the HMNMH indicated the upper sandy soils could have mild to little corrosion potential. However, the deeper clayey soils (based primarily on the resistivity tests) are moderately to severely corrosive to metallic pipes.

Soil Erosion

Soil erosion is most prevalent in unconsolidated alluvium and surficial soils, which are prone to downcutting, sheetflow, and slumping and bank failure during and after heavy rainstorms. Given that the developed portion of project site is essentially flat and is not conducive to erosion, the potential for soil erosion is nil.

5.8.2 SIGNIFICANCE THRESHOLD CRITERIA

The City of Santa Clarita Local CEQA Guidelines (Resolution 05-38) adopted on April 26, 2005, as well as the City's General Plan and Municipal Code serve as the basis for identifying thresholds determining the significance of the environmental effects of a projects. Where thresholds are not specifically identified, the Initial Study checklist contained in Appendix A of this EIR relating to geology, soils, and seismicity have been utilized to formulate additional significance criteria in this section. Accordingly, a project may create a significant environmental impact if one or more of the following occurs:

- Earth movement (cut and/or fill) of 100,000 cubic yards or more.
- Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards.
- Unstable earth conditions or in changes in geologic substructures.
- Change in soil deposition, erosion or siltation, either on or off the site.

The proposed HMNMH Master Plan has been evaluated based on these standards. Mitigation measures are recommended for potentially significant impacts. If a potentially significant impact cannot be reduced to a less than significant level through the application of mitigation, it is categorized as a significant unavoidable impact.

5.8.3 IMPACTS AND MITIGATION MEASURES

The level of geotechnical and landform information contained in the proposed project's geotechnical investigation is adequate to analyze the potential project effects on earth resources and landforms, and to determine appropriate mitigation measures for the proposed development. A number of short- and long-term impacts related to the current physical and geological setting can be generally expected from grading and development activities associated with the proposed development.

SITE GRADING AND EXCAVATION DURING CONSTRUCTION

Level of Significance Prior to Mitigation: Potentially Significant Impact.

Impact Analysis: The project proposes the construction of an Inpatient Building, three parking structures (PS1, PS2, and PS3), and one subterranean parking structure (PS4). Soil excavation and export is required for all five of these structures. Not all soil to be moved on the site would be transported to an off-site location; instead, it would be used in the construction of the project. The following indicates the amount of soil export required for each of the five buildings:

- Inpatient Building – 13,100 cubic yards;
- PS1 – 17,700 cubic yards;
- PS2 – 11,493 cubic yards;
- PS3 – 9,000 cubic yards; and
- PS4 – 42,000 cubic yards.

The total amount of soil export for the five structures is approximately 93,293 cubic yards, which is below the significance threshold of 100,000 cubic yards. However, soil excavation is necessary to prepare the site which includes overexcavation soil shrinkage. The collective earth movement for excavation and overexcavation would be above the 100,000 cubic-yard significance threshold.

All soil exported from the project site would be hauled off-site using bottom dump trucks to Chiquita Canyon Landfill, which is located at 29201 Henry Mayo Drive, Santa Clarita, and is approximately 7.5 miles northwest of the project, off of State Route 126. Dirt hauling would only occur during the day, Monday through Saturday from 9:00 AM through 3:30 PM, to minimize disruption to adjacent residents and businesses. An analysis of soil hauling impacts is presented in Section 5.6, Air Quality.

As noted previously in the Environmental Setting, the project site has little to no topographic relief. Also, the project site has previously been excavated and developed with hospital and medical office buildings. The majority of the project site is currently paved, is devoid of natural topographical features, and does not contain any ridgelines or other regionally notable topographic features.

Therefore, even though the proposed project would alter the site's topography with the excavation and export of 93,293 cubic yards, the proposed topographic changes and earth movement are considered less than significant impacts.

Grading activities associated with the development and construction of the new buildings and associated parking structures would change the current topography very little. The greatest changes to existing topography would occur from construction of the taller building(s), and the excavation required for the Inpatient Building and the subterranean floors of Parking Structures 1, 2, 3, and 4. The proposed project would have a potentially significant impact with earth movement of 100,000 cubic yards or more; however, this impact would be reduced to less than significant levels with the implementation of air quality and hydrology and water quality mitigation measures that reduce impacts associated with grading to less than significant levels.

Mitigation Measures: Refer to Mitigation Measures AQ1 and HWQ3 that specify requirements during construction to minimize impacts associated with grading. No additional mitigation measures are required since compliance with state and local regulations regarding the grading and export of dirt will ensure no significant impacts result from project implementation.

Level of Significance After Mitigation: Less Than Significant Impact.

SURFACE FAULT RUPTURE

Level of Significance Prior to Mitigation: No Impact.

Impact Analysis: No known active or potentially active faults exist within, or extends onto, the proposed project site. The closest earthquake fault zone is a segment of the San Gabriel fault located approximately 1.5 miles northeast of the project site. As such, there would be no potential for surface fault rupture of an active or potentially active fault. No impact would occur in this regard. The proposed project would have no impact in this regard, as no people or property would be exposed to an active or potentially active fault.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: No Impact.

SEISMIC GROUNDSHAKING

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: Groundshaking accompanying earthquakes on nearby faults is anticipated to be felt within the HMNMH site. The greatest amount of groundshaking at the project site would be expected to accompany large earthquakes on the Northridge/East Oak Ridge, Santa Susana, Holser, and San Gabriel faults. Earthquake magnitudes in the range of M6.5 to M7.0 could produce Modified Mercalli intensities in the range of VIII to XI within the HMNMH site, and maximum horizontal ground acceleration on the order of 1.0g.

Despite the fact that the project site would experience groundshaking as a result of an earthquake along any of the active or potentially active faults in the region, as is the case in all of southern California, proposed structures would be required to be designed, engineered, and constructed to meet all applicable local and state seismic safety requirements.

The proposed project would potentially expose people or property to geologic hazards such as groundshaking resulting from earthquakes. However, compliance with applicable seismic safety requirements and Mitigation Measure GEO1 would reduce impacts on the proposed development from seismic groundshaking to a less than significant level.

Mitigation Measures:

GEO1 The project applicant shall have a geologist registered by the State of California prepare a Probabilistic Seismic Hazard Analysis (PSHA) prior to issuance of grading permits for the Inpatient Building. Any recommendations in the study are applicable to the Inpatient Building, if required by OSHPD, and shall be implemented during site grading and construction.

Level of Significance After Mitigation: Less Than Significant Impact.

GROUND FAILURE

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis:

Settlement and Subsidence-Prone Soils

Based on subsurface data obtained from the exploratory borings drilled in 1986, 2002, and 2003, the Holocene age alluvial soils are, for the most part, dense to very dense and therefore not prone to seismically induced settlement. However, because relatively loose alluvial soils were encountered in one of the 19 exploratory borings drilled beneath the addition to the northwest corner of the HMNMH in 2002, the possibility of other isolated pockets of alluvium that may be subject to seismic settlement cannot be ruled out completely. In addition, portions of the site that are mantled with non-engineered (i.e., loose) fill soils may likely be subject to seismically-induced settlement and/or development of ground cracking. The impact to structures having footings or other structural elements founded in these soils is considered a potentially significant impact. Typical mitigation concepts on non-engineered fill soils or isolated pockets of alluvium would include complete removal and replacement of these soils with engineered fill, performing *in situ* densification, or supporting all future structures that are underlain by these unsuitable soils with piles and grade beams. To further evaluate the nature and extent of these types of soils, the proposed project is required to perform geotechnical engineering studies by a qualified geotechnical firm for each new on-site building to evaluate the nature and extent of loose alluvial soils. Per the project conditions of approval, the geotechnical firm is required to provide construction recommendations to minimize impacts related to seismically-induced settlement (i.e., removal and replacement of loose alluvial soils with engineered fill, performing *in situ* densification, or supporting all future structures that are underlain by unsuitable soils on piles and grade beams). Any recommendations in the study are required to be implemented during site preparation, grading, and construction.

It is also noted that, because significant quantities of water or oil are not being extracted beneath or in close proximity to the project site, subsidence is not anticipated to pose a significant hazard to the project.

Thus, impacts are concluded to be less than significant in this regard.

Ground Lurching

Given the local geologic conditions and latest proposed layout for the buildout of the HMNMH, no structures would overlie a transition between Holocene age alluvium and older alluvium or Saugus formation bedrock. Therefore, the likelihood of lurching affecting the project area is considered low. Thus, impacts are concluded to be less than significant in this regard.

Liquefaction

The California Geological Survey does not consider the site as being subject to a high risk from liquefaction. Although Holocene age alluvium is present beneath the project site, groundwater levels are deeper than 50 feet and, therefore, are not susceptible to liquefaction. The liquefaction potential is considered nil. Thus, impacts are concluded to be less than significant in this regard.

Lateral Spreading

Because the liquefaction potential within the project site is unlikely with removal of liquefiable soil materials from development areas, the likelihood of lateral spreading is remote. Thus, impacts related to lateral spreading are concluded to be less than significant.

In conclusion, the proposed project would potentially expose people or property to geologic hazards such as ground failure or other geologic hazards resulting from earthquakes. However, compliance with applicable seismic safety requirements and the preparation of individual geotechnical engineering studies for each building and implementation of its recommendations during site preparation, grading, and construction would reduce impacts on the proposed development from seismic groundshaking to a less than significant level.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: Less Than Significant Impact.

LANDSLIDES AND SLOPE STABILITY

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: The majority of the project site is situated on a relatively flat alluvial plain and lacks significant slopes, the hazard from slope instability, from both landslides and debris flows, is considered negligible. The California Geological Survey (formerly the California Division of Mines and Geology) has designated the slopes along the north side of the project site as having the potential for landslide movement during a seismic event. However, because the slope was engineered as part of the housing development above the site and the toe of the slope lies more than 50 feet from any of the proposed buildings, it is considered unlikely that future landslide activity on these slopes, if any, would impact the proposed project.

The proposed project would not result in exposure of people or property to geologic hazards such as landslides resulting from earthquakes. Thus, impacts are concluded to be less than significant in this regard.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: Less Than Significant Impact.

EXPANSIVE SOILS

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: As stated in the Environmental Setting section, the alluvial soils underlying the project area at two likely foundation elevations consist primarily of granular soils and the deeper clays that have high moisture content (i.e., 20 to 30 percent) and a high degree of saturation. These soils are reported to exhibit "low" expansion potential and, therefore, the potential for expansive soils to impact new buildings is considered low. However, clay soils exposed at the deeper subgrade level should not be allowed to dry out.

The proposed project would potentially result in unstable earth conditions, such as expansive soils. However, implementation of the Mitigation Measure GEO2 would reduce impacts from expansive soils to a less than significant level.

Mitigation Measures:

GEO2 If potentially expansive units (i.e., clay soils) are encountered during construction, they shall be evaluated by the Project Geotechnical Engineer. Special foundation designs and reinforcement shall be utilized to mitigate expansive material as specified by the Project Geotechnical Engineer and to the satisfaction of the City. Specifically, if clay soils are exposed at the deeper subgrade level, the Construction Contractor shall employ dewatering techniques, as the clay soils shall not be allowed to dry out.

Level of Significance After Mitigation: Less Than Significant Impact.

CORROSIVE SOILS

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: As stated in the Environmental Setting section, preliminary geotechnical investigations conducted in 2002 for the proposed addition to the northwest corner of the HMNMH indicate the upper sandy soils could be considered as having "mild" to "little" corrosion potential. However, the deeper clayey soils, based primarily on the resistivity tests, would be classified as being moderately to severely corrosive to metallic pipes. Because the amount of sulfates in both the sandy and clayey soils was below the detection limit, the exposure to sulfate attack is considered mild. As such, no particular recommendations for cement type or water ratio were necessary to provide sulfate resistance.

Future geotechnical engineering studies to be performed for the proposed buildings would further evaluate the nature and extent of the clayey, alluvial soils that exist at deeper foundation levels on the site, which are severely corrosive to metallic pipes. Specifically, as part of the project conditions of approval, a registered State Geologist shall prepare a geotechnical engineering study prior to issuance of grading permits. In addition, corrosive soils are required to be addressed for the proposed project and in accordance with the latest *UBC* requirements, measures shall be provided for buried metal piping protection to be implemented during site grading and construction. At a minimum, buried metal piping shall be protected with suitable coatings, wrappings, or seals; a corrosion engineer shall be consulted during future, site-specific geotechnical studies to determine the necessary project design features to minimize the effects of corrosive soils. Implementation of the above design measures would ensure that project grading and construction does not result in unstable earth conditions.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: Less Than Significant Impact.

SOIL EROSION

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: Soil erosion is most prevalent in unconsolidated alluvium and surficial soils, which are prone to downcutting, sheetflow, and slumping and bank failure during and after heavy rainstorms. Given that the project site is essentially flat and does not possess site conditions conducive to erosion, the potential for soil erosion is nil.

The proposed project would potentially result in unstable earth conditions. However, implementation of best management practices (BMPs) and adherence to the City's Grading Code would reduce soil erosion impacts to a less than significant level.

Also, refer to Section 5.10, Hydrology and Water Quality, for additional discussion regarding soil erosion impacts during construction, along with storm water runoff and water quality impacts.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: Less Than Significant Impact.

5.8.4 CUMULATIVE IMPACTS AND MITIGATION MEASURES

Level of Significance Prior to Mitigation: Less Than Significant Impact.

Impact Analysis: The proposed project would not result in significant unavoidable impacts related to geology, soils, and seismicity, with implementation of applicable mitigation measures. Furthermore, geology, soils, and seismicity impacts are site-specific and each development site is subject to, at minimum, uniform site development and construction standards relative to seismic and other geologic conditions that are prevalent within the locality and/or region. Because the development of each cumulative project site would have to be consistent with City of Santa Clarita requirements for projects in the City, the requirements of the Los Angeles County Department of Public Works for project sites in unincorporated Los Angeles County, as each pertains to protection against known geologic hazards, and given the known geologic conditions, impacts of cumulative development would be less than significant.

Mitigation Measures: No mitigation measures are required.

Level of Significance After Mitigation: Less Than Significant Impact.

5.8.5 SIGNIFICANT UNAVOIDABLE IMPACTS

With imposition of the recommended mitigation measures, implementation of the proposed project would result in less than significant impacts for seismic groundshaking, expansive and corrosive soils, soil erosion, and ground failure, which includes settlement and subsidence prone soils, ground lurching, liquefaction, and lateral spreading. All other identified impacts were concluded to have no impact or be at less than significant levels, and did not require mitigation. As such, no significant unavoidable impacts would result from implementation of the Henry Mayo Newhall Memorial Hospital Master Plan.