4. ENVIRONMENTAL IMPACT ANALYSIS
5. GEOLOGY/SOILS

4.5.1 INTRODUCTION

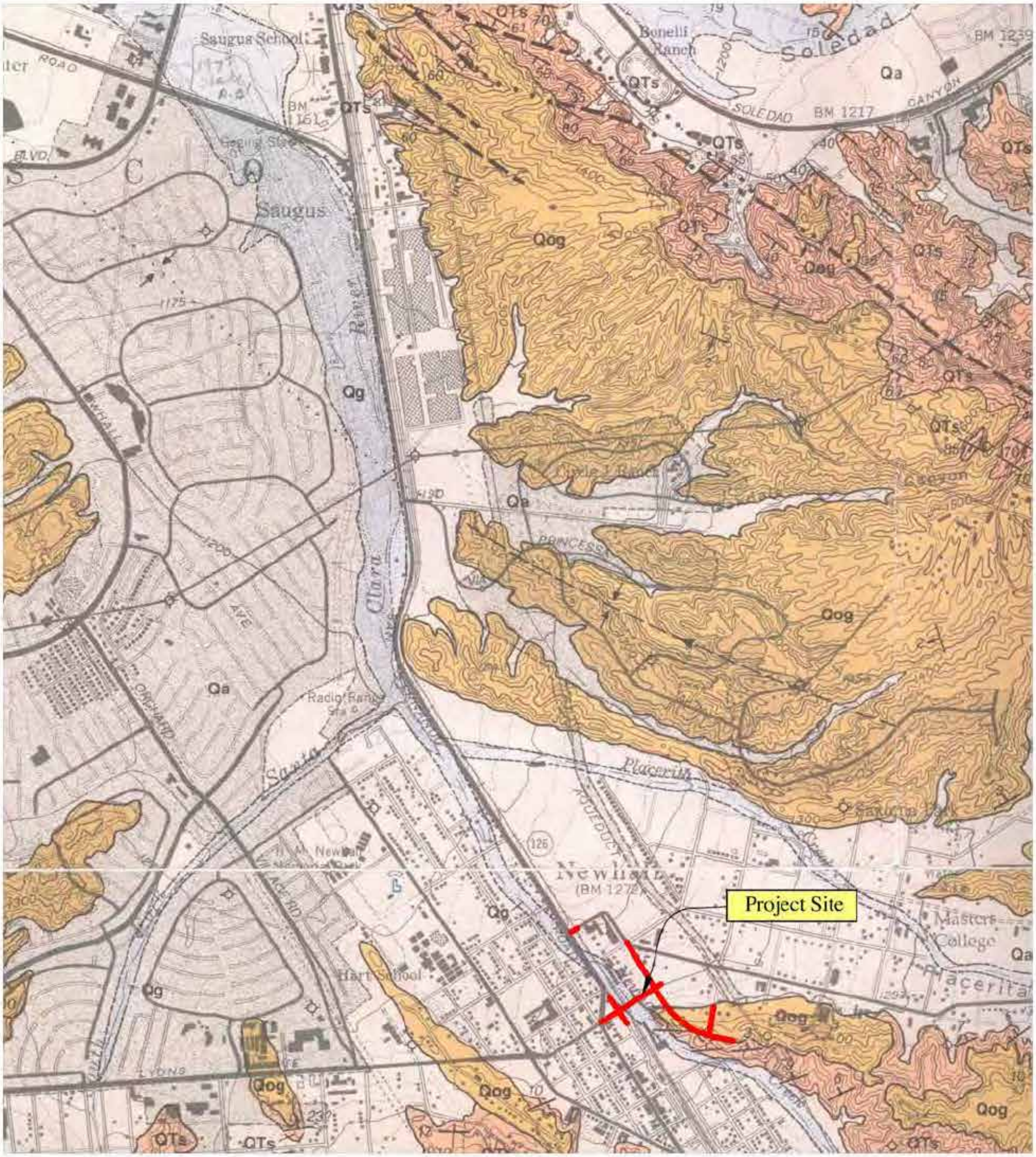
The following section of the Draft EIR evaluates potential impacts related to geology, including seismicity and soils associated with development of the Proposed Project. The majority of the analysis is based on the *Geologic and Geotechnical Report EIR-Level Review Of Road Alignments For Dockweiler Road and Lyons Avenue (The "Geotechnical Report")* prepared by Allan E. Seward Engineering Geology, Inc., dated October 17, 2014. The Geotechnical Report is included as Appendix F of this Draft EIR.

4.5.2 ENVIRONMENTAL SETTING

The Project Site is generally located in the Old Town Newhall area of the City of Santa Clarita. The Project Site is located at the intersection of Lyons Avenue and Railroad Avenue and extends eastward towards the General Plan alignment for Dockweiler Drive towards The Master's University and northwest towards the intersection of 12th Street and Arch Street. The Project Site also includes the closure of an at-grade crossing at the intersection of Railroad Avenue and 13th Street and associated street modification improvements.

With respect to the Geotechnical Report, and the analysis presented below, the Project Site is defined as the area that consists of future road alignments for extension of Lyons Avenue from its current northeastern terminus at Railroad Avenue to a future intersection with proposed Dockweiler Drive approximately 600 ft. to the northeast. This includes a proposed at-grade crossing over the existing Southern Pacific railroad tracks and a crossing over Newhall Creek using a box culvert to connect to the proposed extension of Dockweiler Drive. Dockweiler Drive is proposed to extend from a point of connection at the Master's University property boundary northwesterly for approximately 2,000 feet to the intersection of Arch Street and 13th Street. Aden Avenue is to extend from its current southerly terminus to intersect with the future Dockweiler Drive approximately 250 ft. to the south (See Figure 4.5-1, Geologic Overview Map).

The proposed road alignments are located on the alluvial flood plain and hillside areas adjacent to Newhall Creek. The majority of the proposed road alignment for Lyons Avenue traverses undeveloped land, except for areas where artificial fill and railroad ballast have been placed to elevate and support the existing railroad double tracks. Dumped fill with abundant blocks of asphalt and concrete and other miscellaneous debris has been placed on the southwest bank of Newhall Creek, just northeast of the proposed at-grade railroad crossing. The proposed road alignment of Dockweiler Drive also traverses undeveloped land and a storage yard utilized by Los Angeles County Department of Public Works. The Project Site is covered with light to moderate growth of natural grasses and chaparral. Elevations at the site range from approximately 1255 to 1370 feet above mean sea level.



Source: Dibblee Geological Foundation Map #DF-56, (Dibblee, 1996)

Approximate Scale: 1"=2,000'

Qa - Quaternary Alluvium
Qog - Quaternary Older Gravels
QTs - Saugus Formation

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Source: Allan E. Seward Engineering Geology, Inc., October 2014.

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Figure 4.5-1
Geological Overview Map

Regional Geologic Conditions

The Project Site is located within the central part of the Transverse Ranges geomorphic province of southern California, in the eastern portion of the Ventura Basin. The Ventura Basin has been tectonically down-warped in the geologic past to produce a large-scale synclinal structure in which a thick sequence of Cenozoic sediments has accumulated. In the vicinity of the proposed road alignments, much of the hillside area along the northeastern margin of Newhall Creek consists of bedrock of the Quaternary-age Pacoima Formation (Qp). The relatively flat flood plain southwest of Newhall Creek is underlain by sub-horizontal alluvium deposited (Qal). The Pacoima Formation and alluvial deposits are underlain by bedrock of the Plio-Pleistocene, nonmarine Saugus Formation (TQs). No faults or folds have been identified at the Project Site on the referenced published geologic map of the area. Figure 4.5-1 provides a Geologic Overview Map, which is based on the Geologic Map of the Newhall Quadrangle (Dibblee, 1996).

Geological Structure

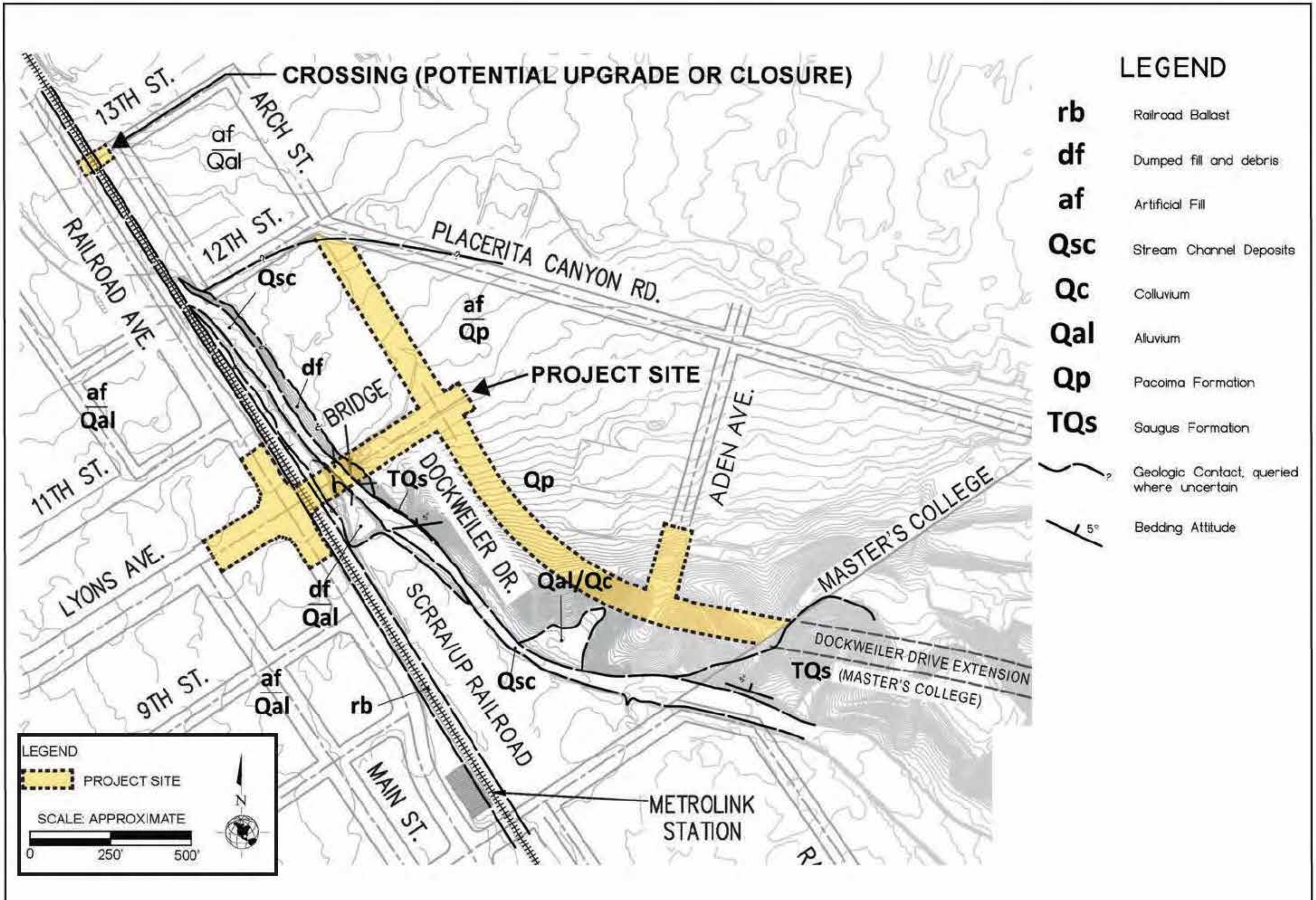
The natural slopes at the Project Site are underlain by sub-horizontally bedded Pacoima Formation in erosional unconformable contact over Plio-Pleistocene non-marine sediments of the Saugus Formation. The Saugus Formation in the vicinity of the Project Site generally strikes roughly east to west and dips gently to the north (Treiman, 1987; and Dibble, 1996). The Saugus Formation bedding measured in northern bank of the Newhall Creek strikes N70W and dips 5° north. The measured bedding is generally consistent with regional geologic maps and the geologic structure as documented during a previous investigation and published report.

Geologic Units

As depicted in Figure 4.5-2, Geologic Map, Plate I, the approximate limits of exposed geologic units based on field observations and the referenced published geologic maps. Artificial fill and railroad ballast have been placed below the railroad tracks. Pavement and aggregate base have been placed beneath existing roadways. General descriptions of geologic units provided below are based the prior geologic observation in the vicinity of the Project Site, and the exposures in the banks of Newhall Creek in the vicinity of the proposed box culvert.

Saugus Formation (TQs)

Bedrock of the Plio-Pleistocene-age Saugus Formation (TQs) is exposed along the lower portion of the northerly eroded bank of Newhall Creek, just east of the proposed road alignment. The Saugus Formation sediments consist dominantly of gray to light brown sandstone and conglomeratic sandstone with scattered greenish-gray siltstone and silty sandstone (Treiman, 1987). Bedding within the Saugus Formation varies from predominately massive and indistinct to cross-bedded to locally well-developed planes on lensing, fine-grained units. Local variance in bedding orientations is common and is due to cross bedding and/or channelized (erosional) contacts.



Source: Allan E. Seward Engineering Geology, Inc., October 2014.

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Figure 4.5-2
Geologic Map, Plate I

Pacoima Formation (Qp)

Bedrock of the Quaternary-age Pacoima Formation (Qp) mantles the majority of the hillside area along the northern margin of Newhall Creek. This formation has been designated as "Older Dissected Surficial

Sediments or Qog" after Dibblee, 1996; however, these terrace deposits have been assigned to the Pacoima Formation (of Oakeshott, 1958) by Treiman (CDMG, 1987). In the Geotechnical Report, the nomenclature by Treiman is used. The bedrock generally consists of lensing, crudely stratified, light yellowish-brown to yellowish-brown to brown, silty to clayey, fine- to coarse-grained sandstone with some gravel, cobbles and rare boulders. Bedding is generally crude to locally well defined. Generally the bedrock is concealed by a mantling of soil and colluvium. However, the eroded banks of the Newhall Creek expose unweathered bedrock.

Quaternary Alluvium (Qal)

Quaternary Alluvium (Qal) underlies the existing surficial artificial fill materials located westerly of Newhall Creek south of 12th Street, and easterly of Newhall Creek north of 12th Street. Based on data obtained by this firm for the adjacent Old Town Newhall Library site, the alluvium is anticipated to consist of interbedded layers of poorly graded sand, silty sand, and gravelly sand. Interbedded layers of sandy silts and clays may also be present. These materials are typically medium dense to dense in the upper 30 to 40 feet with locally loose conditions in the upper 10 feet.

Recent Stream Channel Deposits (Qsc)

Quaternary Stream channel deposits (Qsc) are located within the active Newhall Creek channel. These deposits consist of recent alluvium that has been reworked due to heavy runoff during periodic rains. Stream channel deposits are very similar to the Quaternary alluvium and generally consist of silty sands, sands, and gravels with cobbles.

Quaternary Colluvium (Qc)

Colluvium (Qc) is a non-bedded, heterogeneous accumulation of soil and weathered bedrock deposited by gravity on all but the steepest slopes. These deposits have been mapped based on review of the topography where the estimated thickness is greater than about 3 feet.

Artificial Fill (af)

Artificial fill (af) was apparently placed below the existing railroad tracks to elevate the tracks above the Newhall Creek Flood Plain. The engineering characteristics of this material are currently unknown.

Dumped Fill (df)

Dumped fill (df) is present along the active stream margins of Newhall Creek at the vicinity of the proposed Lyons Avenue road alignment. The dumped fill consists of fill soils with abundant debris (asphalt, concrete, construction trash, metal, vehicle tires). Also present near the proposed alignment is an abandoned vehicle that is partially buried.

Railroad Ballast (rb)

Railroad ballast (rb) consisting of crushed natural rock was placed to support and elevate the two sets of railroad tracks at the site.

Landslides

Review of the referenced published geologic maps indicates that no landslides have been mapped at or adjacent to the site. Review of aerial photographs lack geomorphic features that would indicate prior landslide movement.

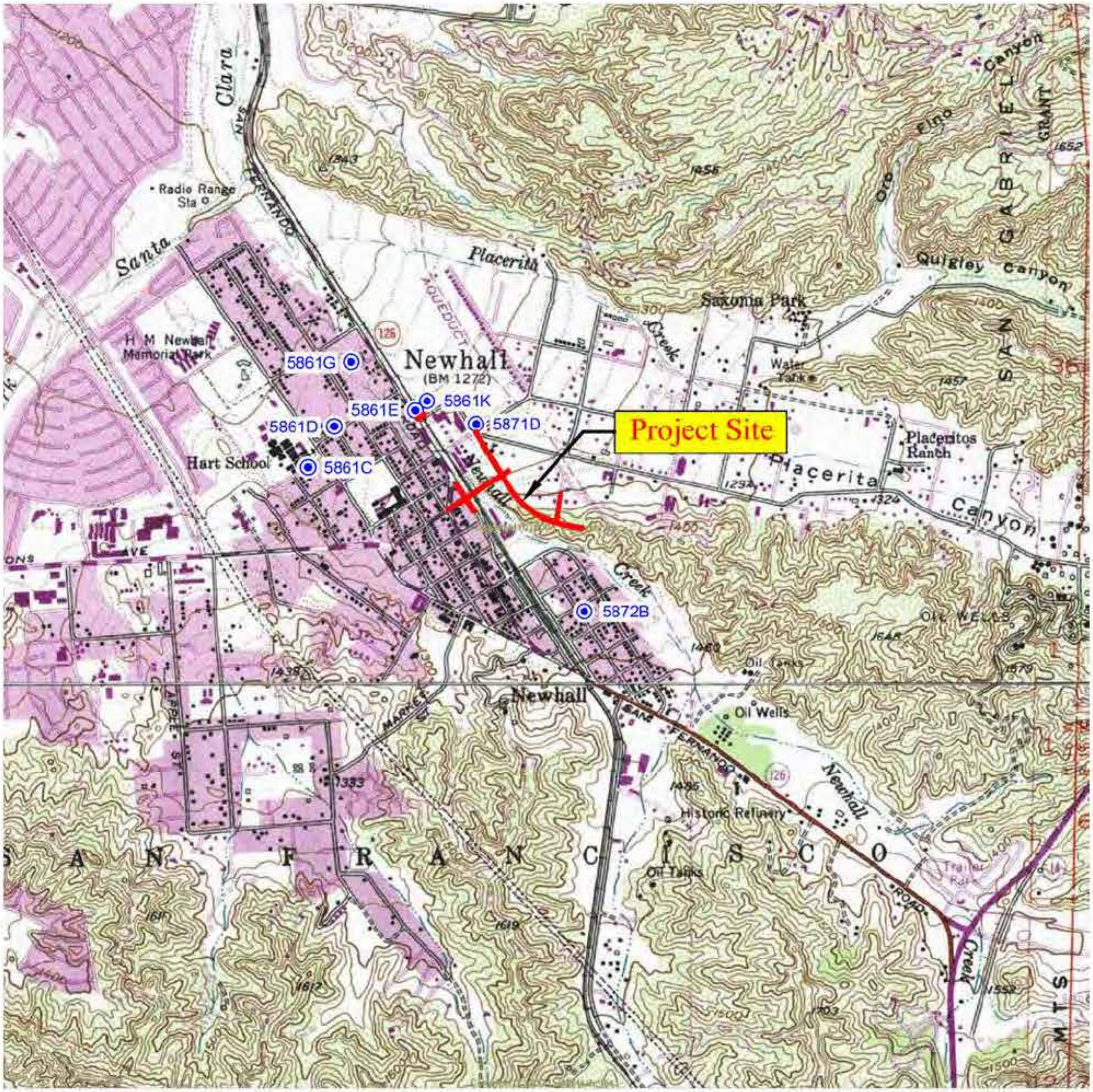
Ground Water

Review of historic ground water data from the Seismic Hazard Map for the Newhall Quadrangle, Water-Resources Investigation using Analog Model Techniques in the Saugus-Newhall Area (Robson, 1972), and Los Angeles Flood Control District (LACFCD) water well records indicates that historic high ground water levels are between 75 and 100 feet below the existing surface at the Project Site. The locations of nearby water wells are shown in Figure 4.5-3, Water Well Location Map. The historic ground water levels for each well obtained from LACFCD records are provided in Table 4.5-1, Summary of LAFCD Water Well Data. In addition, ground water was not encountered in subsurface explorations performed by this firm to a depth of 50 ft in the alluvium for the adjacent Old Town Newhall Library. However, temporary perched ground water conditions may exist below Newhall Creek following periods of significant rainfall and runoff.

Table 4.5-1
Summary of LAFCD Water Well Data

LACFCD Well Number	Surface Elevation	Historic High			Historic Low			Monitoring Period
		Depth	Elevation	Date	Depth	Elevation	Date	
5861C	1231.0	47.5	1183.5	11/24/58	179.3	1051.7	11/7/68	11/7/57 to 4/30/81
5861D	1236.5	103.2	1133.8	12/11/56	202.1	1034.4	10/28/67	12/11/56 to 11/30/88
5861E	1249.0	102.0* 33.0**	1147.0 1216.0	11/29/60 10/15/05	212.0	1037.0	10/15/91	11/19/59 to 10/15/08
5861G	1232.0	71.0	1161.0	4/14/76	81.3	1150.7	5/13/83	4/11/76 to 5/13/83
5861K	1250.0	102.0	1148.0	11/15/06	222.0	1028.0	10/15/91	10/15/91 to 10/15/08
5871D	1270.0	100.2	1169.8	4/6/73	230.8	1039.2	10/30/91	10/22/48 to 11/6/06
5872B	1290.0	66.6	1223.4	5/5/80	78.4	1211.6	11/8/77	4/14/76 to 4/8/86

Note: All depths and elevations in feet
** The historic high depth to ground water recorded between 1959 and 2000 is 102.0 ft*
*** The historic high depth to ground water recorded between 2000 and 2008 is 33.0 ft*
Source: Allan E. Seward Engineering Geology, Inc., October 2014.



Legend

Source: U.S. Geological Survey Newhall, and Oat Mountain Quadrangles, Dated 1952 (Photorevised 1969), Dated 1952 (Photorevised 1969), Respectively

Approximate Scale: 1"=2,000'

NOTE: THIS IS NOT A SURVEY OF THE PROPERTY

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6981E *Location of LACFCD water well*

Source: Allan E. Seward Engineering Geology, Inc., October 2014.

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Figure 4.5-3
Water Well Location Map

A low potential exists for temporary, perched ground water conditions to develop within the bedrock of the Pacoima formation. Perched ground water can contribute to slope instability in natural slopes and cut slopes. To prevent build-up of water, subdrains are typically recommended in canyon areas in which fill will be placed and back drains for slopes that are to be constructed as Stability Fills or Buttress Fills.

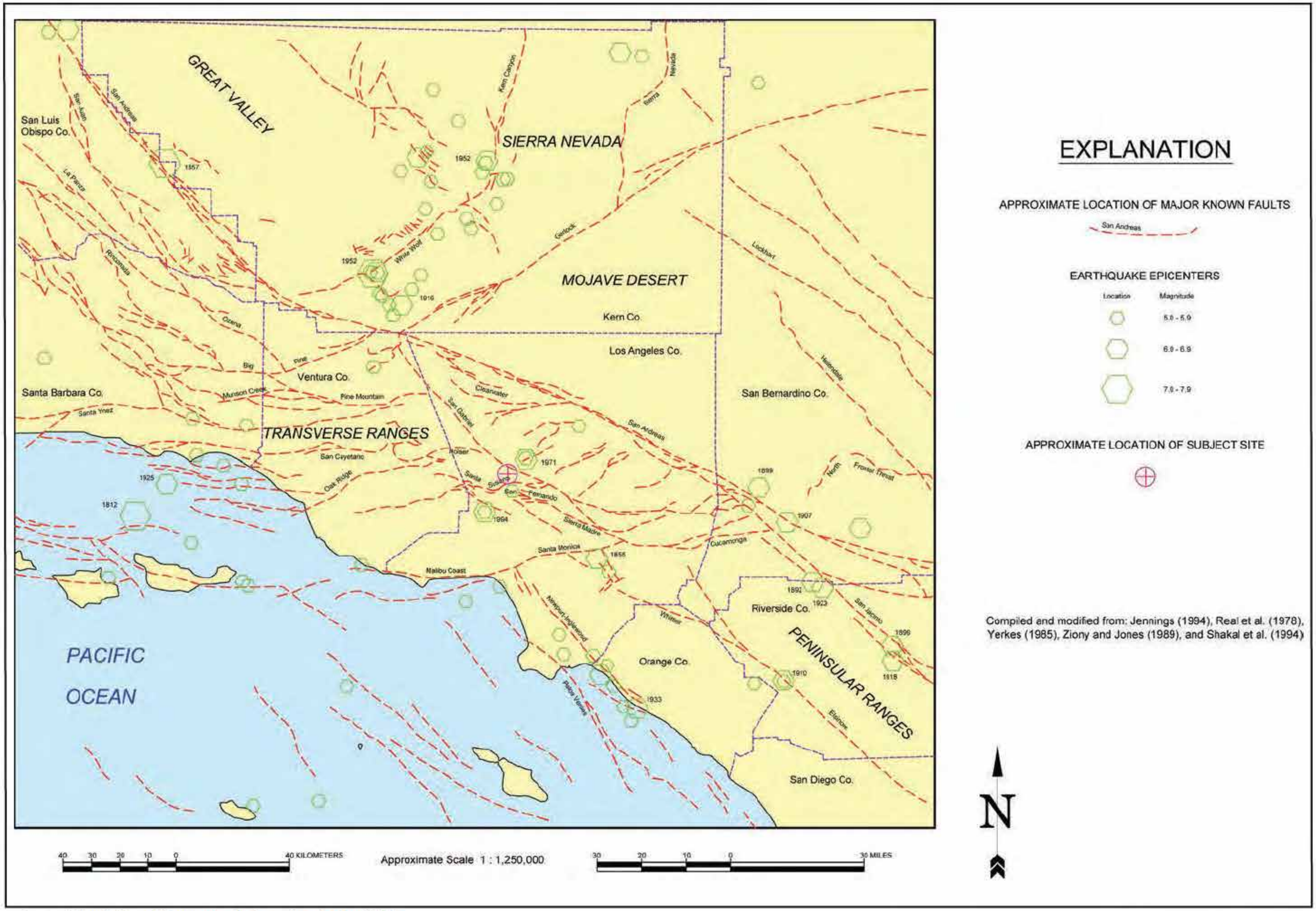
Due to the historic high ground water elevations and the elevated nature of portions of the road alignment, ground water is not expected to significantly affect the project, provided the proposed grading is evaluated from a geotechnical standpoint during the design stage and the geotechnical recommendations are implemented during construction.

Seismic Considerations

The Project Site lies within the seismically active southern California region. Earthquake-related hazards typically include ground rupture, ground shaking, and ground failure. Review of the Alquist-Priolo Earthquake Fault Zone Map for the Newhall Quadrangle, the Seismic Safety Element of the L.A. County General Plan, and the published Geologic Maps indicates that no active or potentially active faults traverse the Project Site. Review of the site topography and the aerial photographs did not reveal any lineaments or other indicators suggestive of faulting at the Project Site. The nearest known active fault is the San Gabriel Fault, which is 3.7 km from the site at its nearest point. Table 4.5-2 provides a list of regional faults near the Project Site, Figure 4.5-4 provides a map of the fault locations, and Figure 4.5-5 provides a Seismic Hazards Map. Based on these distances, the probability of fault-related ground rupture at the site is considered to be very low.

Table 4.5-2
Summary of Nearby Faults

Fault Name	Closest Distance to Site (km)		Maximum Magnitude	Slip Rate (mm/yr)
	Surface Trace	Surface Projection of Rupture Area		
San Gabriel	3.7	3.7	7.0	1.0
Holser	4.3	3.1	6.5	0.4
Northridge (E. Oak Ridge)	5.1	5.1	6.9	1.5
Santa Susana	7.1	0.0	6.6	5.0
Sierra Madre (San Fernando)	9.9	4.7	6.7	2.0
Verdugo	16.7	15.8	6.7	0.5
Oak Ridge (on shore)	17.8	17.8	6.9	4.0
San Cayetano	22.2	22.2	6.8	6.0
Sierra Madre	24.5	21.4	7.0	3.0
Simi-Santa Rosa	26.7	26.7	6.7	1.0
San Andreas	33.1	33.1	7.8	34.0
Source: Allan E. Seward Engineering Geology, Inc., October 2014.				



Source: Allan E. Seward Engineering Geology, Inc., October 2014.

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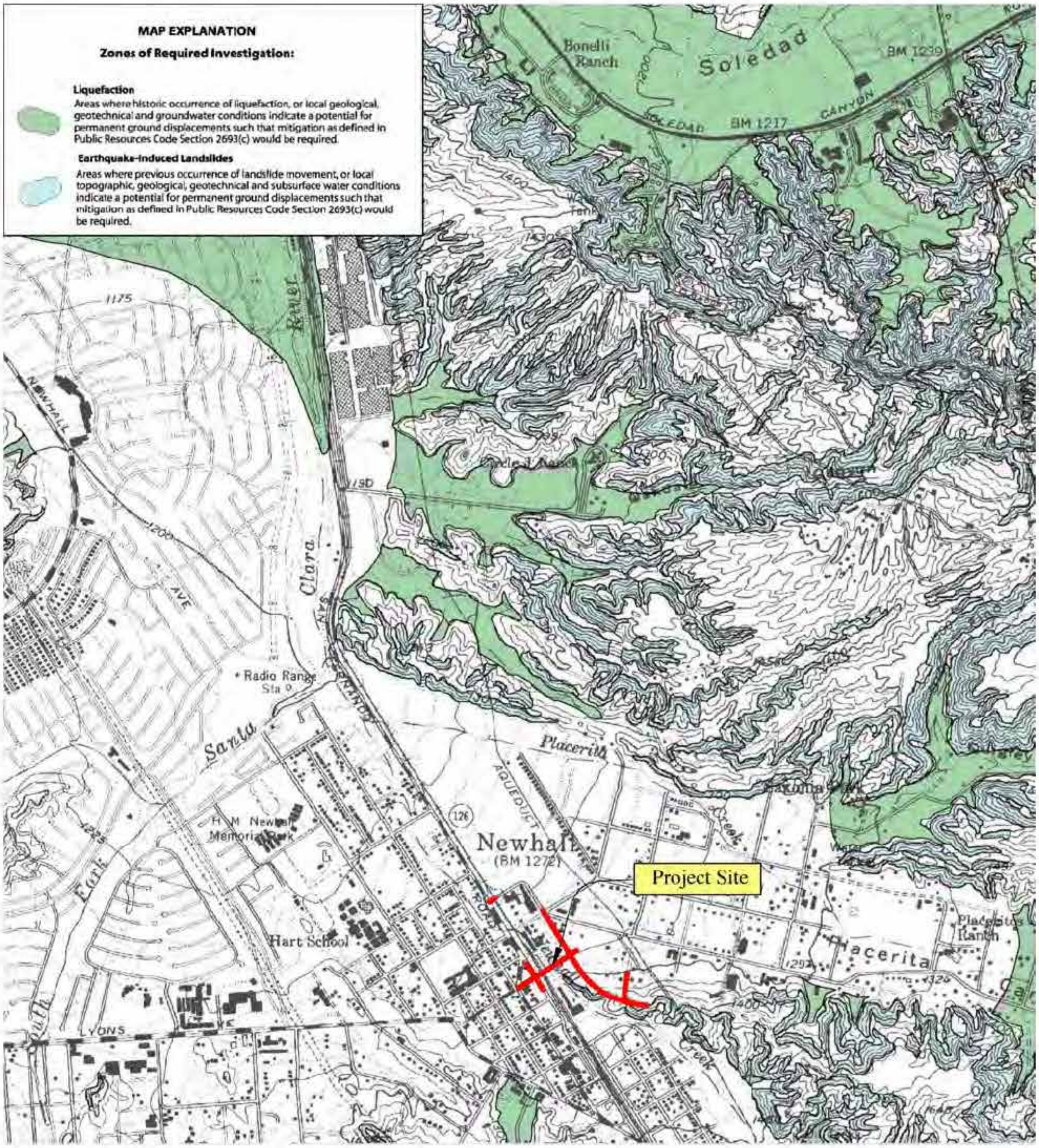
Figure 4.5-4
Fault and Earthquake Epicenter Location Map



Source: Seismic Hazard Zones Maps for the Newhall Quadrangle - Official Map Released 1/1/98

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Approximate Scale: 1"=2,000'

Source: Allan E. Seward Engineering Geology, Inc., October 2014.

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Figure 4.5-5
Seismic Hazard Map

Ground Shaking

Peak ground acceleration (PGA) consistent with maximum considered earthquake (MCE) ground motions were evaluated at the site for bedrock (Site Class B) and alluvial (Site Class C) soil conditions in accordance with the 2013 California Building Code and ASCE 7-10. The mapped MCE geometric mean (MCE_G) peak ground accelerations (PGA_M) adjusted for Site Class effects were first evaluated using the U.S. Seismic Design Maps web tool provided by the United States Geological Survey (USGS). The MCE_G PGA_M was then evaluated for a two percent probability of exceedance within a 50-year period

using the USGS 2008 Interactive Deaggregation web tool. The PGA_M calculated using the probabilistic procedure is based on estimated values of shear wave velocity (V_{s30}) within the range designated for the corresponding Site Class. The estimated PGA_M for bedrock (1.17g) and alluvial (1.03g) soil conditions was taken as the lesser of the mapped geometric mean peak ground accelerations and the probabilistic geometric mean peak ground accelerations indicated in the Table 4.5-3.

Table 4.5-3
MCE Geometric Mean (MCE_G) Peak Ground Accelerations (PGA_M)

Geologic Unit	Site Class	Estimated shear wave velocity, V_{s30} (m/s)	MCE_G PGA_M	
			Mapped	Probabilistic
Bedrock	C	455	1.10g	1.17g
Alluvium	D	270	1.10g	1.03g
Source: Allan E. Seward Engineering Geology, Inc., October 2014.				

Ground Failure

Ground failure is a general term for seismically induced, secondary, permanent ground deformation caused by strong ground motion. This includes liquefaction, lateral spreading, ground lurching, seismic settlement of poorly consolidated materials (dynamic densification), differential materials response, sympathetic movement on weak bedding planes or non-causative faults, slope failures, and shattered ridge effects.

The majority of the Project Site is underlain by bedrock materials that are not susceptible to liquefaction. The alluvial soils present at the site, as depicted in Figure 4.5-2, are not designated on the State of California Seismic Hazard Zone Map for the Newhall Quadrangle as a zone in which investigation of potentially liquefiable materials is required. The depth to historic high ground water at the Project Site is greater than 50 feet. Based on the preceding factors, the potential for liquefaction and associated seismic settlements and lateral spreading is therefore considered very low.

Relatively loose granular alluvial soils located within and adjacent to the active Newhall Creek channel and within minor tributary canyons adjacent to the road alignment may be prone to dynamic densification as a result of future earthquake shaking. Evaluation of the potential for dynamic densification should be performed at the design stage. Typically the potential for dynamic densification of these materials can be mitigated by removal of the materials and then replacing them as compacted fill. Potential for seismic settlement (dynamic densification) is negligible in the bedrock portions of the site.

The hillside areas directly adjacent to the road alignment are designated on the State of California Seismic Hazard Zone Map for the Newhall Quadrangle as a zone in which investigation of potential for earthquake-induced landslides is required (see Figure 4.5-5). The potential for earthquake-induced slope failures and surficial failures on the critical natural and proposed design slopes will need to be evaluated at the design stage. Cut and fill slopes constructed per the California Building Code typically are not subject to earthquake-induced failures. Typical mitigation for slopes prone to earthquake-induced failures include avoidance, removal of surficially unstable materials, laying back the slope to a shallower gradient, buttressing, construction of shear keyways, or debris basins and walls that may be designed to divert and/or collect the calculated volume of material expected to fail. Additionally, no landslides have been mapped at the Project Site. Due to the relatively shallow dip of the bedding of the Pacoima Formation and the Saugus Formation bedrock, and of the flat-lying alluvial deposits that underlie the site, the potential for differential materials response and slippage along weak bedding planes is considered to be negligible.

Slope Stability

It is anticipated that both cut and fill slopes will be necessary at various locations along the proposed alignments and that cut slopes will expose Saugus Formation and Pacoima Formation bedrock. These proposed slopes should be designed and constructed at gradients of 2:1 horizontal to vertical or shallower. All constructed slopes should be evaluated by a geotechnical firm for conformance to applicable requirements/standards for gross and surficial slope stability. If it is determined that proposed slopes do not satisfy required factor of safety requirements for gross slope stability, mitigation measures will have to be designed based on results of slope stability analyses. If surficial stability of the proposed slopes is determined to be insufficient, measures to mitigate surficial stability will be required. This may include but not be limited to the following:

1. Avoidance
2. Stability fills
3. Flattening of slopes to 3:1 (h:v), or flatter
4. Seeding/planting of slopes
5. Guniting of slopes
6. Mechanically Stabilized Earth (MSE) slopes

Natural slopes adjacent to the proposed road alignments exposing adverse geologic bedding conditions or steep gradients should be evaluated. If it is determined that these slopes do not satisfy required factor of safety requirements the natural slopes may be stabilized with Buttress Fills or Shear Keys designed by the Project Geotechnical Engineer.

Laboratory testing fill source materials is required to evaluate both gross and surficial stability of the proposed fill slopes, including remedial Buttress Fills and Stability Fills. Shear strength testing should be performed on soil samples that represent the mixture of materials that will be placed in the proposed fills.

Steep natural slopes adjacent to the proposed road alignment should also be evaluated for potential debris flow hazards. Avoidance of the hazard by selective structural locations, construction of impact or debris walls and/or debris basins, control of run-off or removal of loose surficial materials can be used to mitigate debris flow hazards.

Deep Fills

Based on preliminary review of the proposed road alignments, deep fill areas (i.e. fills deeper than 40 ft below proposed grade) are not anticipated.

Soil Compressibility

Rapidly buried, unsaturated sediments, such as colluvium and alluvium, commonly contain extensive voids and, as a consequence, are subject to hydro-compression (collapse) settlement when inundated. Hydro-compression occurs when water enters sediments and reorients the sediment particles into a more compact arrangement with fewer and smaller voids. Compacted fills and structures constructed over deposits prone to hydro-compression may experience settlement and associated distress and damage.

Based on explorations for the adjacent Old Town Newhall Library site, alluvial soils at the Project Site are anticipated to be typically medium dense to depths of 30 to 40 ft, with local loose zones in the upper 10 feet. The density of the artificial fill placed below the railroad tracks is currently undefined. The potential for settlement within these units should be addressed in more detail during a future geotechnical investigation at the design stage.

If soils subject to hydro-compression or consolidation are identified at the Project Site, settlement and potential adverse impacts to the proposed road improvements can be mitigated by removal and recompaction of loose or soft material.

The phenomenon of hydro-compression does not apply to the bedrock deposits that underlie most of the Project Site. Further exploration should be performed at the site to evaluate if hydro-compression-prone materials, such as colluvium, are present in areas where pavements or compacted fills are proposed.

Erosion Potential and Drainage

Fill, bedrock, and soil materials at the site will be susceptible to erosion if drainage features to control sheet flow over the ground surface are not provided. The drainage features should be designed to prevent water from ponding on graded areas and from flowing over natural or constructed slopes, and should direct surface water to designed debris basins or natural drainage courses, where applicable. Debris material generated by erosion of site materials should be contained inside the site boundaries. The potential for erosion of the banks of Newhall Creek should be evaluated by the project civil engineer.

Dam Inundation and Flooding

No dams currently exist in the Newhall Creek Drainage and the Project Site is not in a dam inundation area per the Flood and Inundation Hazard Map (Plate 6) of the Los Angeles County Safety Element of the

General Plan. The potential for dam inundation is therefore considered nonexistent. The potential for flooding of Newhall Creek is addressed in Section 4.6, Hydrology and Water Quality.

Regulatory Framework

Applicable State Regulations/Policies

Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Act (Public Resources Code § 2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zone Act and renamed in 1994, is intended to reduce the risk of life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along active faults (Earthquake Fault Zone). It also defines criteria for identifying active faults, giving legal weight to terms such as "active," and establishes a process for reviewing building proposals in and adjacent to Earthquake Fault Zones.

Under the Alquist-Priolo Act, fault zones are defined, and construction along or across them is strictly regulated if they are "sufficiently active" and "well-defined." A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for the purposes of the Act as within the last 11,000 years). A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (Public Resources Code §§ 2690-2699.6) is intended to reduce the damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act; the State is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards; and cities and counties are required to regulate development within mapped Seismic Hazard Zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans.

California Building Standards Code

The State of California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (California Code of Regulations Title 24). The CBSC is based on the IBC (International Code Council, 1997), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity will be shown in the building plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including but not limited to: excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, the Project would be required to comply with all provisions of the CBSC.

Applicable Local Regulations/Policies

City of Santa Clarita Unified Development Code

All grading and excavation activities are subject to comply with Chapters 17.20 to 17.30 (Division 3) of the City of Santa Clarita Unified Development Code (UDC). Rules and regulations contained within these chapters provide for the control of excavation, grading, and earthwork construction, including fills or embankment activities. During the grading permit application process, the City Engineer may require engineering geological and soil reports, as well as seismic hazard zone studies be prepared for proposed developments. The engineering geological report would require an adequate description of the geology of the site, along with conclusions and recommendations regarding the effect of geologic condition of any proposed development. Soil reports would be required to characterize the existing soil resources on a site, and provide recommendations for grading and design criteria. Development in seismic hazard zone will require studies that evaluate the potential for seismically induced liquefaction, soil instability, and earthquake induced landslides to occur on a site. The City of Santa Clarita enforces structural requirements of the building code, the Alquist-Priolo Special Studies Zones, and sound engineering and geotechnical practices in evaluating structural stability of proposed new development.

4.5.3 ENVIRONMENTAL IMPACTS

Thresholds of Significance

In accordance with guidance provided in the Environmental Checklist Form contained in Appendix G to the *State CEQA Guidelines*, lead agencies are encouraged to address the questions from the Checklist that are relevant to the Project's environmental effects. With respect to Geology and Soils, the following Checklist Questions are addressed under the Project Impacts/Environmental Consequences subheading below. Would the Project:

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

  i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (Refer to Division of Mines and Geology Special Publication 42);

ii) Strong seismic ground shaking;

iii) Seismic-related ground failure, including liquefaction; or

iv) Landslides;

(b) Result in substantial soil erosion or the loss of topsoil;

(c) 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;

(d) 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

(e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for disposal of waste water?

As discussed in the Initial Study, the Proposed Project would have a potentially significant impact on Geology and Soils Checklist questions (a)-(d) and less than significant impact on Checklist question (e), reproduced above.

Project Impacts

Strong Seismic Ground Shaking

Potential for primary ground rupture on a fault at the Project Site is considered to be low. Peak ground acceleration (PGA) consistent with maximum considered earthquake (MCE) ground motions is expected to be 1.03g in alluvial portions of the site and 1.10g in portions of the site where bedrock outcrops or is present at shallow depth. Therefore, with implementation of Mitigation Measure 4.5-1, impacts with respect to strong seismic ground shaking would be less that significant.

Seismic-Related Ground Failure, Including Liquefaction

The alluvium that underlies portions of the Project Site is not designated as potentially liquefiable on the State of California Seismic Hazard Zone Map for the Newhall Quadrangle. In addition, historic high ground water elevations are greater than 50 ft in depth. Therefore the potential for liquefaction of alluvium is considered very low.

The potential for seismic settlement (dynamic densification) during future seismic events is non-existent in the bedrock portions for the Project Site but should be evaluated in site alluvial soils, colluvium, and existing artificial fills to remain in place.

All slopes should be evaluated by the Project Geotechnical Engineer at the planning and design stages. The hillside area of the Project Site is designated on the State of California Seismic Hazard Zone Map to have earthquake-induced slope instability. However, the potential for earthquake-induced slope failures is considered low provided that future geologic and geotechnical evaluations and recommendations for slope stability is incorporated into design and construction. Therefore, with implementation of Mitigation Measure 4.5-1, impacts with respect to seismic-related ground failure would be less that significant.

Landslides

No landslides have been mapped on the subject Project Site. Stability of cut slopes that are constructed at gradients of 2:1 or shallower are anticipated to expose favorable bedding conditions and be grossly stable. However, cut slopes will require subsurface investigation to determine the specific geologic conditions for evaluation by the Geotechnical Engineer. Remedial measures will be required where ascending or descending cut slopes are not stable as determined by geologic or geotechnical stability analyses.

A study should be conducted at the design stage to confirm the geologic conditions of natural slopes. This study should include subsurface investigation to determine the specific geologic conditions for evaluation by the Geotechnical Engineer. Remedial measures will be required where ascending or descending slopes are not stable as determined by geologic or geotechnical stability analyses. A study should be conducted at the design stage to evaluate potential debris flow hazards on steep natural slopes ascending from the proposed road alignments. Avoidance of the hazard by selective structural locations, construction of impact or debris walls and/or debris basins, control of run-off or removal of loose surficial materials can be used to mitigate debris flow hazards. Therefore, with implementation of Mitigation Measure 4.5-1, impacts with respect to landslides would be less that significant.

Soil Stability

Rapidly buried silty sediments such as thick colluvium and alluvium may be subject to hydro-compression. A study should be conducted to evaluate the hydro-compression potential of colluvial deposits and portions of the alluvium. Materials characterized as susceptible to hydro-compression tests in the laboratory can be mitigated by removal prior to the placement of fill. Specific recommendations should be provided at the design stage.

The bedrock is moderately consolidated, which indicates that grading operations can be performed with conventional equipment.

Cobbles and small boulders are likely present within the alluvium and bedrock. This oversize material may present difficulties during cutting operations with some types of equipment. In addition, oversize material will require special handling during fill construction.

A study should be conducted to evaluate the expansive potential of fine-grained soils during the design stage. If potentially expansive units are encountered in the street grades during construction, they should be evaluated by Expansion Index (EI) tests by the Project Geotechnical Engineer relative to mitigations. The expansive material can be removed to a specified depth determined by the Project Geotechnical Engineer and replaced with soil with very low to non-expansive characteristics. Alternatively, the expansive soil may be treated with additives to lower the expansion potential.

Soils on the Project Site may be corrosive to concrete and ferrous metals. Soil moisture, chemistry, and other physical characteristics all have important effects on corrosivity. Testing during development will indicate what special measures, such as cement type in concrete and corrosion protection for metallic pipes, may be required for construction. Planting and irrigation of cut slopes and fill slopes should be included in future design phases in order to improve surficial stability of slopes and to mitigate potential for erosion. Therefore, with implementation of Mitigation Measure 4.5-1, impacts with respect to soil stability would be less that significant.

Construction Considerations

Rippability

The Project Site is underlain by Saugus Formation, Pacoima Formation, Quaternary alluvium and artificial fill. These materials can be ripped with standard grading equipment.

Oversized Material

The alluvial and bedrock materials underlying the site may contain significant quantities of oversized material. Additionally, the dumped fill located along the southwest bank of Newhall Creek contains common blocks of asphalt and concrete as well as scattered boulders, car parts, and other oversized debris. Any oversized material that may be encountered during construction should not be incorporated into potential compacted fill during grading operations. Specifications and guidelines for handling and disposal should be addressed by the project geotechnical engineer at the design stage.

Expansion Potential of Soils

The site alluvial materials are generally granular and are not typically expansive in nature. However, fine-grained units of the Saugus Formation are known to have significant expansion potential when exposed to water. In addition, Pacoima formation bedrock, artificial fill, colluvium and alluvial deposits present at the site may contain material with significant expansion potential. Expansive materials at the site should be evaluated by the Project Geotechnical Engineer during the grading plan stage of development. Expansion potential of site soils can be mitigated by controlling the water content and density of fill soils, by specifying embedment and reinforcement of structures, and by removing the expansive materials and replacing them with compacted material with low expansion potential.

Soil Corrosivity

Past experience with similar soils on nearby sites suggests that the on-site soils likely have a low concentration of sulfate and chloride, and low acidity. This indicates a low potential for corrosion of concrete and, therefore, it is anticipated that Type I or II Portland cement will be satisfactory for use at the site. The resistivity of similar soils near the site tested by this firm indicates that they are typically moderately corrosive to ferrous metals. The corrosive characteristics of the site soils should be verified with laboratory testing at the design stage. If corrosive soils are encountered, options to mitigate potential corrosive soils include protective wraps and coatings for buried metal pipes and special types of cement that are resistant to corrosion.

Shrinkage and Bulking of Materials

Typically, soil, colluvium, uncompacted artificial fill, alluvial deposits, and terrace deposits (i.e. Pacoima formation bedrock) reduce in volume (“shrink”) by up to about 10 percent when excavated and subsequently recompacted. In contrast, Saugus Formation bedrock typically increases in volume ("bulk") by up to about 5 percent when excavated and recompacted. In order to evaluate the cut-fill balance of the proposed grading, shrinkage/bulking of on-site materials including landslide debris should be estimated at the design stage.

Retaining Walls

The grades at the northeast end of Lyons Avenue and adjacent portions of Railroad Avenue will need to be raised in order to tie into the existing grade at the railroad crossing. It is the geotechnical engineer's understanding that retaining walls may be used to accommodate the changes from the proposed grades to adjacent properties proposed to remain at existing grades. Geotechnical parameters for these walls and for design of the proposed box culvert and associated wing walls for the Newhall Creek crossing should be addressed at the design stage.

Oil Wells and Water Wells

Review of the Munger Map Book and California Division of Oil and Gas records indicates that no oil wells have been drilled on or immediately adjacent to the site. If any undocumented oil wells are encountered during future construction operations at the site, their location(s) should be surveyed and the current well conditions evaluated. Review of LACFCD records indicates that water wells have been drilled in the vicinity of the proposed road alignments. If one of these water well is within the proposed road alignment, or if a water well is encountered during future construction operations at the site, the location should be surveyed and the potential impacts to well conditions should be evaluated.

Therefore, with implementation of Mitigation Measure 4.5-1, impacts relating to geology and soils would be less that significant.

4.5.4 CUMULATIVE IMPACTS

Geotechnical impacts related to future development in the City of Santa Clarita would involve hazards related to site-specific soil conditions, erosion, and ground-shaking during earthquakes. Such conditions are site-specific and would not be common to (nor shared with, in an additive sense) the impacts on other sites that are not physically connected. Cumulative development in the area would increase the overall population for exposure to seismic hazards by increasing the number of people potentially exposed. However, with adherence to applicable State and Federal regulations, buildings codes and sound engineering practices, geologic hazards could be reduced to less-than-significant levels. Furthermore, development of each of the related projects and the Proposed Project would be subject to uniform site development and construction review standards that are designed to protect public safety. Therefore, cumulative geotechnical impacts would be less than significant.

4.5.5 MITIGATION MEASURES

4.5-1 The Proposed Project shall be designed and constructed in accordance with the City and State Building Codes and shall adhere to all modern earthquake standards, including the recommendations provided in the Project's Geotechnical Report, which shall be reviewed by the

City's Building and Safety Division.

4.5-2 Prior to the issuance of a grading permit, the Applicant shall provide grading plans to the City's Building and Safety Division for review and approval. Grading plans shall comply with the City's requirements for slope stability. Grading plans shall also comply with City requirements for stability under static and pseudo static loading conditions to mitigate risks associated with earthquake induced landslides.

4.5.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

With the implementation of mitigation measure listed above, impacts related to geology and soils would be less than significant.