4.9 GEOLOGY

INTRODUCTION

The Geology section of the EIR describes the geologic and soils characteristics of the project site and evaluates the extent to which implementation of the proposed project could be affected by seismic hazards such as groundshaking and liquefaction soil characteristics. The analysis also addresses potential effects of the proposed project on erosion. Information sources for this evaluation include the *Program EIR for the City of Davis General Plan Update and Project EIR for Establishment of a New Junior High School* (General Plan Update EIR)[1], the *Geotechnical Investigation for the Crossroads Place Project*[2], and the U.S. Soil Conservation Service (SCS) *Soil Survey for Yolo County*[3].

ENVIRONMENTAL SETTING

The project site is situated within the Sacramento Valley, just outside the Davis city limits in Yolo County, California. The project site encompasses approximately 422 acres, and surface elevations vary gradually from about 45 feet at the northwest corner to 36 feet on the northeast corner and 42 feet in the southeast portion.

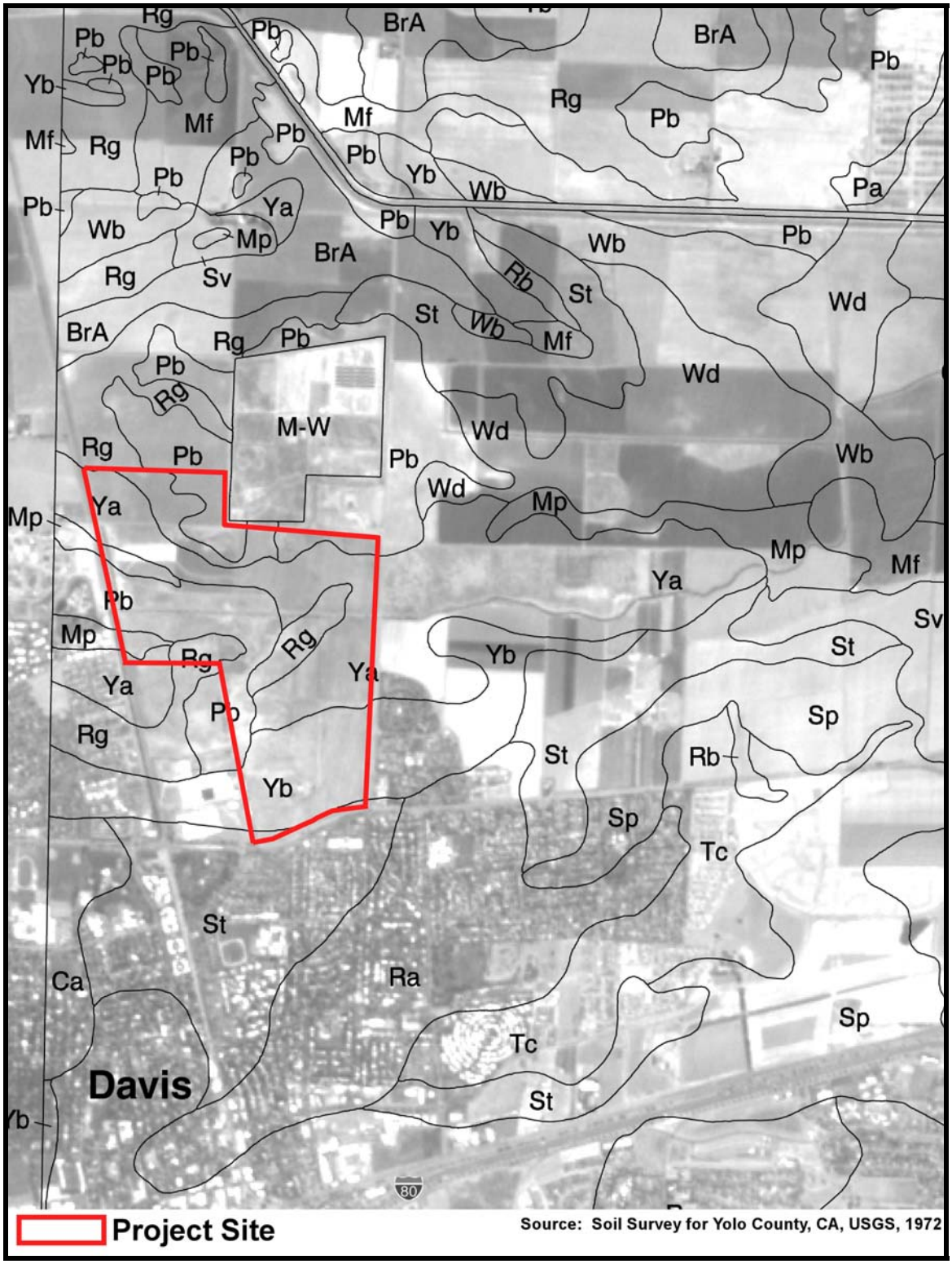
Regional Geology

The Davis planning area is surrounded by several faults in the San Andreas fault system to the west and the Eastern Sierra fault system to the east. A series of faults also run along the eastern base of the foothills west of the City. Faults do not run directly through the planning area, although numerous earthquakes have been felt in the City (General Plan Update EIR, p. 5I-2). Major earthquakes occurred in 1833, 1868, 1892, 1906, and 1989, but the City did not experience damage. The Uniform Building Code identifies the planning area as being in Seismic Risk Zone III, which indicates that the maximum intensity of an earthquake that would be experienced in the planning area would be VII to VIII on the modified Mercalli intensity scale. An earthquake of such magnitude would result in "slight damage in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures" (General Plan Update EIR, p. 5I-2).

Soil Conditions

According to the USDA *Soil Survey of Yolo County, California*, the project site contains the following soils (see Figure 4.9-1, Project Site Soils). (For a more detailed description of these soils, see Chapter 4.2, Agricultural Resources, of this Draft EIR.)

Figure 4.9-1
Project Site Soils



- Yolo silt loam (Ya)
- Yolo silty clay loam (Yb)
- Rincon silty clay loam (Rg)
- Pescadero silty clay, saline alkali (Pb)
- Sycamore silty clay loam (St)
- Merritt Complex, saline alkali (Mp)

The test borings conducted for the project site by Raney Geotechnical revealed two general surface soil types on the property. Throughout most of the property the surface soils to depth of three to four feet were found to consist of low to moderate plasticity, firm to stiff, gray-brown silty clays and clay-silt mixtures. The test borings as well as Raney Geotechnical's reconnaissance of the project site in 1989 indicated that the surface materials within a band extending east-west across the northern half of the site do not conform to the above description and consist of moderate to high plasticity, firm to stiff, gray-brown to black clays. This band of high plasticity clays appears to be centered along the east-west drainage ditch, beginning about 1,200 feet west of Pole Line Road and tapering from a few hundred to several hundred feet wide at the west property line.

Beneath the surface soils to the 15-foot maximum depth of exploration, relatively uniform soil conditions were observed throughout the project site. These subsurface soils were found to mostly consist of interlayered, firm to stiff, light brown to gray brown, fine sandy to clayey silts and silty clays. Occasionally, two to four foot thick layers of loose, light brown silty fine sands are interspersed with the silts and clays. In rare instances, thin lenses of loose, clean fine to medium sands with gravel were also observed.

The native, undisturbed soils have strength and compressibility properties, which are indicated to be favorable for support of the proposed residential construction (Geotechnical Investigation, p. 4). The Geotechnical Investigation indicates that portions of a swale on the project site have been backfilled. Although the backfill materials were not encountered by Raney Geotechnical's test borings, experience in similar circumstances has shown that such backfill materials are often placed by agricultural equipment with little compactive effort and would be unsuitable for support of houses or other construction (Geotechnical Investigation, p. 4).

Erosion

The *Soil Survey* provides the following information regarding the erosivity of the project site soils:

- Yolo silt loam (Ya) and Yolo silty clay loam (Yb) – Permeability is moderate (Ya) to moderately slow (Yb). Surface runoff is very slow, and the erosion hazard is none to slight.
- Rincon silty clay loam (Rg) – This soil is slowly permeable. Surface runoff is very slow, and the erosion hazard is none to slight.

- Pescadero silty clay, saline alkali (Pb) – This soil is slowly permeable. Surface runoff is very slow, and the erosion hazard is none to slight.
- Sycamore silty clay loam (St) – Permeability is moderately slow. Surface runoff is very slow, and the erosion hazard is none to slight.
- Merritt Complex, saline alkali (Mp) – Permeability of the Merritt complex soils is moderate. (Surface runoff and erosion hazard not given.)

Groundwater

Groundwater was not observed in the test borings completed by Raney Geotechnical in 1989.

REGULATORY CONTEXT

The following section is a brief summary of the regulatory context under which soils and geologic hazards are managed at the federal, State, and local levels.

National Pollutant Discharge Elimination System (NPDES)

As required under the federal Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources, such as construction sites, that discharge pollutants into waters of the United States. In California, NPDES permit issues are overseen by the nine individual Regional Water Quality Control Boards. For further discussion of NPDES, please refer to Section 4.11 (Hydrology, Water Quality, and Drainage) of this Draft EIR.

California Building Standards Code / Uniform Building Code

The State of California provides minimum standards for building design through the California Building Standards Code (California Code of Regulations (CCR), Title 24). The California Building Code (CBC) is based on the Uniform Building Code (UBC) used widely throughout the U.S. and has been modified for California conditions with numerous more detailed and/or more stringent requirements.

City of Davis General Plan

The City of Davis General Plan contains the following goals and policies that are relevant to geotechnical aspects of the proposed project:

Soils and Erosion

Goal AG 3.	Conserve soil resources within the planning area.
Policy AG 3.1	Develop programs to help conserve soil resources.

Standard AG 3.1(a)	Drainage facilities shall be designed to control runoff and minimize erosion.
Goal WATER 2.	Ensure sufficient supply of high quality water for the Davis Planning Area.
Policy WATER 2.3	Maintain surface water quality.
Action WATER 2.3(a)	Continue to implement best management practices and policies incorporated in the Urban Water Management Plan and other adopted plans.
Action WATER 2.3(b)	Continue to monitor and enforce, at the local level, provisions to control non-point source water pollution contained in the United States Environmental Protection Agency NPDES program.
Action WATER 2.3(c)	Continue to enforce provisions to control erosion and sediment from construction sites.

Geotechnical Safety

Goal HAZ 2.	Minimize risks associated with soils, geology, and seismicity in Davis.
Policy HAZ 2.1	Take necessary precautions to minimize risks associated with soils, geology, and seismicity.

IMPACTS AND MITIGATION MEASURES

Standards of Significance

For the purposes of this EIR, impacts are considered potentially significant if the Proposed Project would result in:

- Exposure of people or structures to substantial, adverse effects as a result of strong groundshaking, seismic-related ground failure, liquefaction, lateral spreading, landslides, or lurch cracking;
- Development that would be inconsistent with the City's General Plan;
- Development that would be inconsistent with other City plans, policies, or ordinances;
- Substantial erosion or unstable slope or soil conditions through alteration of topographic features, dewatering, or changes in drainage patterns; or

- Exposure of people, structures, or infrastructure components to increased risk of injury or damage due to the presence of expansive soils, soil settlement/compaction, or other geotechnical constraints.

Methods of Analysis

The environmental setting section and the impact discussions below are based primarily on the Geotechnical Report for the Crossroads Place project site (formerly proposed on the project site) prepared by Raney Geotechnical. Other documents, including but not limited to, the General Plan Update EIR and the Soil Survey for Yolo County were reviewed.

Project Impacts and Mitigation Measures

4.9-1 Impact of seismic activity on proposed development.

Proposed Project

Major earthquakes along the San Andreas and Eastern Sierra faults may cause ground shaking in the Davis Planning Area. The severity of the ground shaking in the area would depend on the characteristics of the earthquake (strength and duration of shaking) and the distance to the epicenter of the earthquake. Faults are not known to exist in the Davis Planning Area and even such a major seismic event as the 1906 San Francisco earthquake did not cause damage in the City of Davis (General Plan Update EIR, p. 5I-10). Ground shaking is not considered a major geologic hazard in Davis.

Implementation of the Proposed Project would result in the construction of 1,515 residential units, a commercial Village Center, recreation facilities, and other amenities. All project development would be required by the City to comply with the requirements of the Uniform Building Code (UBC), which is intended to protect structures from collapse during a seismic event. Minor damage may occur, including the cracking of walls, chimneys, and masonry veneers; and the severing of water, natural gas, and wastewater pipes. In addition, personal property may be displaced or damaged. However, because ground shaking is not considered a major geologic hazard, this impact is considered ***less-than-significant*** on project structures.

High Density Alternative

As compared to the Proposed Project, the High Density Alternative would result in the construction of a greater amount of structures and associated infrastructure on the project site, and correspondingly, a greater population on the site. Despite the increased intensity of development, potential impacts from seismic activity would not be expected to increase under the High Density Alternative, because as noted above, all project development would be required by the City to comply with the requirements of the Uniform Building Code (UBC), which is intended to

protect structures from collapse during a seismic event. Therefore, the impact would be considered ***less-than-significant***.

Mitigation Measure(s)
None Required.

4.9-2 Increased soil erosion.

Proposed Project
Construction activities would expose disturbed and loosened soils to erosion from rainfall, water, and wind erosion. Soil erosion is the process by which soil particles are removed from the land surface by wind, water, or gravity. Most natural erosion occurs at slow rates; however, the rate increases when the land is cleared or altered and left disturbed. Construction activities remove the protective cover of vegetation and natural soil resistance to rainfall impact erosion. Sheet erosion, the carrying away of organic matter, soil nutrients, and seed stocks, occurs when slope length and runoff velocity increase on disturbed areas. As runoff accumulates, the runoff concentrates into rivulets that cut grooves (rills) into the soil surface. These rills may develop into gullies if the flow is sufficient. Excessive stream and channel erosion may occur if runoff volumes and rates increase as a result of construction activities.

Sedimentation is the settling out of soil particles transported by water. Sedimentation occurs when the velocity of water in which soil particles are suspended is slowed sufficiently to allow particles to settle out. Larger particles such as gravel and sand settle out more rapidly than fine particles such as silt and clay. Sediments may block, clog, or significantly reduce the conveyance capacity of the storm water infrastructure.

Excessive sediment can cause increased turbidity and reduced light penetration in natural waterways, which could result in adverse impacts to plant and animal life. Although these effects are usually short-term and greatly diminish after re-vegetation, sediment and sediment-borne pollutants may be remobilized under suitable hydraulic conditions. Therefore, soil erosion associated with project construction activities would have ***significant*** impacts to receiving waters.

High Density Alternative
As with the Proposed Project, the High Density Alternative would require substantial grading on the project site, which would expose disturbed and loosened soils to erosion from rainfall, water, and wind erosion. Although this alternative would result in smaller lot sizes and require dedication of approximately six (6) additional acres of parkland, the effects of site grading would remain essentially similar to those of the Proposed Project. Therefore, the impacts of the High Density Alternative relating to project-associated soil erosion would be considered ***significant***.

Mitigation Measure(s)
Implementation of the following mitigation measure would reduce the above impact to a *less-than-significant* level. It should be noted that the project would also be required to comply with the City's grading regulations and the City's Urban Water Management Plan, which would further reduce impacts associated with erosion.

The following measure is identified for the Proposed Project and the High Density Alternative.

4.9-2 *Prior to the City approving subdivision improvement plans and/or issuing building permits, the developer shall prepare individual storm water pollution prevention plans (SWPPP) applicable to the individual project being considered, consistent with the California DWR NPDES requirements.*

4.9-3 Damage to foundations, pavements, and other structures from expansive soils.

Proposed Project
Expansive soils are those that greatly increase in volume when they absorb water and shrink when they dry out. These soils are typically characterized by large amounts of finer grained materials such as silts and clays within the soil matrix. Expansion is measured by shrink-swell potential, which is the relative volume change in a soil with a gain in moisture.

According to the Geotechnical Investigation performed for the project site in 1989 by Raney Geotechnical, the surface clays and clay/silt mixtures present over most of the site are only of low plasticity and have low to medium expansion potential with variations in moisture content. However, the high plasticity clays found near Channel A are highly expansive. Both material types can cause distress to floor slabs and foundations unless special measures are undertaken to reduce expansion effects (Geotechnical Investigation, p. 5). These special measures could include use of imported, nonexpansive soils in construction of building pads; chemically treating surface soils with lime to reduce expansive tendencies; or presaturation of building pad soils prior to slabs and foundations. Use of nonexpansive fill or lime treatment of the clays are effective means of reducing expansion but the added cost of these measures is usually considered to be unwarranted for residential construction. Presaturation and reinforcement, though less effective, has been found to provide an acceptable reduction in expansion effects on similar construction in the area. Recommendations for presaturation of floor slab subgrades and reinforcement of floor slabs and foundations are presented in the Geotechnical Investigation prepared by Raney Geotechnical in May 1989.

Therefore, due to the presence of expansive soils over most of the project site, expansive soils could have ***significant*** impacts to project structures.

High Density Alternative

The effects of the project site's expansive soils on grading and construction would not be expected to change under the High Density Alternative, because the scope of the construction activities would remain essentially similar to that of the Proposed Project. Although the applicant would ensure that special measures are undertaken to reduce potential damage from soil expansion, the impact would remain ***significant***.

Mitigation Measure(s)

Implementation of the following mitigation measure would reduce the above impact to a *less-than-significant* level.

The following measure is identified for the Proposed Project and the High Density Alternative.

4.9-3 *Prior to the iapproval of final maps, a final design-level geotechnical report will be prepared and submitted to the City for review and approval. The geotechnical consultant will consider the recommendations made in the Geotechnical Investigation prepared by Raney Geotechnical (May 1989) and their appropriateness for the Covell Village site plan. The recommendations of the final geotechnical report will be incorporated into the project design prior to issuance of building permits for review and approval of the City Engineer and Chief Building Official.*

Cumulative Impacts and Mitigation Measures

The continuing buildout of developments in the City of Davis and surrounding areas would be expected to increase the need for surface grading and excavation, thereby increasing the potential for impacts related to soil erosion, unforeseen hazards, and exposure of people and property to earthquakes.

4.9-4 Long-term geologic and seismic impacts from the proposed project in combination with existing and future developments in the Davis area.

Proposed Project

The Proposed Project would result in the construction of 1,515 residential units, a commercial Village Center, and other facilities on the project site, increasing the number of people and structures that could be exposed to potential effects related to seismic hazards. Development of the proposed project would also increase the number of structures that could be subject to the effects of expansive soils. Site preparation would also result in temporary and permanent topographic changes that could affect erosion rates or patterns. However, potentially adverse environmental effects associated with seismic hazards, as well as those associated with geologic or soils constraints, topographic alteration, and erosion, are usually

site-specific and generally would not combine with similar effects that could occur with other projects in Davis. Furthermore, all projects would be required to comply with the UBC and other applicable safety regulations. Consequently, the proposed project would generally not be affected by, nor would it affect, other development approved by the City of Davis. Therefore, the impact would be considered ***less-than-significant***.

High Density Alternative

Although development intensity would be increased by the High Density Alternative, the long-term effects of seismic hazards and other geologic or soils constraints would be considered site-specific and unlikely to create a cumulative effect in combination with other projects in the Davis area. As with the Proposed Project, all projects would be required to comply with the UBC and other applicable safety regulations. For these reasons, the cumulative impact of this alternative, relating to geologic hazards, would be considered ***less-than-significant***.

Mitigation Measure(s)

None Required.

Endnotes

[1] City of Davis, *Program EIR for the City of Davis General Plan Update and Project EIR for Establishment of a New Junior High School*, January 2000.
[2] *Geotechnical Investigation, Crossroads Place, Pole Line Road and Covell Boulevard, Davis, California*, Raney Geotechnical, May 1989.
[3] *Soil Survey of Yolo County, California*, US Department of Agriculture, Soil Conservation Service, 1972.