

The purpose of this section is to disclose and analyze the potential impacts associated with the geology of the project region and general vicinity, and to analyze issues such as the potential exposure of people and property to geologic hazards, landform alteration, and erosion. This section is based in part on the following technical studies:

- *Preliminary Geotechnical Assessment – Davis Innovation Center* (ENGEO, 2014);
- *Web Soil Survey* (United States Department of Agriculture Natural Resources Conservation Service, 2016); and
- *Soil Survey of Yolo County, California* (USDA, 1972).

No comments were received during the public review period or scoping meeting for the Notice of Preparation regarding this topic.

3.6.1 ENVIRONMENTAL SETTING

REGIONAL GEOLOGY

The project site is located at the southwestern end of the Sacramento Valley, approximately 30 miles north of the confluence of the San Joaquin and Sacramento Rivers. The Sacramento Valley is bordered by the Coast Ranges and Delta on the west and the foothills of the Sierra Nevada to the east.

The Sacramento Valley has been filled over time with up to a six-mile thick sequence of interbedded clay, silt, sand, and gravel deposits. The sediments range in age from more than 144 million years old (Jurassic Period) to less than 10,000 years (Holocene). The most recent sediments consist of coarse-grained (sand and gravel) deposits along river courses and fine-grained (clay and silt) deposits located in low-lying areas or flood basins and are referred to as alluvial deposits. These deposits are loose and not well consolidated soils.

Older alluvial deposits underlie the edges of the Valley. The older alluvial deposits are exposed in the foothill regions in the eastern portion of the county. The alluvial deposits, which slope gradually toward the center of the Valley, contain most of the groundwater supplies in region. The foothills of the coast ranges to the west of the project site are underlain by alluvial deposits and older marine sediments deposited during the Tertiary Period when an inland sea occupied the Great Valley.

Great Valley Geomorphic Province

The Great Valley is an alluvial plain, about 50 miles wide and 400 miles long, between the Coast Ranges and Sierra Nevada. The Great Valley is drained by the Sacramento and San Joaquin rivers, which join and enter San Francisco Bay. The eastern border is the west-sloping Sierran bedrock surface, which continues westward beneath alluvium and older sediments. The western border is underlain by east-dipping Cretaceous and Cenozoic strata that form a deeply buried synclinal trough, lying beneath the Great Valley along its western side.

City of Davis

The City of Davis is located in the eastern portion of the Putah Creek Plain, one of the major features of the southwestern Sacramento River valley. The land slopes at generally less than one percent, and elevations range from 60 feet above sea level in the west parts of the city to 25 feet in the east parts of the city. The foothills of the Coast Range are approximately fourteen miles to the west, and the Sacramento River is approximately eleven miles to the east.

SITE GEOLOGY

Soil Survey

A *Preliminary Geotechnical Assessment* (ENGEO, 2014) was prepared for the Davis Innovation Center, a project that was previously proposed for development at the project site. According to the Assessment, the project site is underlain by Quaternary (Holocene) Basin Deposits, Upper Modesto Formation alluvial deposits, and Lower Modesto Formation alluvial deposits.

A Custom Soil Survey was completed for the project site using the Natural Resources Conservation Service (NRCS) Web Soil Survey program. The NRCS Soils Map is provided in Figure 3.2-2 in Section 3.2, Agricultural Resources. Table 3.6-1 identifies the type and range of soils found in the project site.

TABLE 3.6-1: PROJECT SITE SOILS

UNIT SYMBOL	NAME	ACRES IN AOI		PERCENT OF AOI
		ON-SITE	OFF-SITE	
BrA	Brentwood silty clay loam	36.20	1.61	43.37
Mf	Marvin silty clay loam	26.75	2.88	33.99
Pb	Pescadero silty clay, saline-alkali	0.56	2.00	2.94
Wc	Willows clay, alkali	11.44	5.74	19.71

NOTE: THE AOI (AREA OF INTEREST) INCLUDES THE ON- AND OFF-SITE IMPROVEMENTS (74.49 ACRES ON-SITE, AND 11.53 ACRES OFF-SITE).

SOURCE: NRCS CUSTOM SOIL SURVEY 2017.

Brentwood silty clay loam. Brentwood soils are on nearly level to gently sloping fans and formed in valley fill from sedimentary rocks. These soils are well to moderately well drained. They have very slow to medium runoff and moderately slow permeability. Most areas are irrigated and are used for tree fruit, nut crops, vegetables, and field crops. Vegetation is annual grasses, forbs, and scattered oaks.

Marvin silty clay loam. Marvin soils are on nearly level flood plains at elevations of 10 to 100 feet under annual grasses and forbs. They formed in fine textured alluvium from mixed sources. These soils are moderately well to somewhat poorly drained. They have slow runoff and slow permeability. Common uses include: irrigated and dry cropland and pasture; and grain, field crops, sugar beets, alfalfa and rice crops.

Pescadero silty clay, saline-alkali. Pescadero soils are in basins and formed in alluvium from sedimentary rock. These soils are poorly drained or ponded on concave slopes. They have very slow runoff and very slow permeability. These soils are used mainly for livestock grazing. Some reclaimed areas are used for irrigated field, row crops and irrigated pasture. Commonly cultivated crops are sugarbeets, barley, alfalfa, corn and tomatoes.

Willows clay, alkali. Willow soils are in basins and formed in alluvium from mixed rock sources. These soils are poorly drained. They have slow runoff and very slow permeability. These soils are used for growing rice, sugar beets and safflower.

Groundwater

According to the *Preliminary Geotechnical Assessment* prepared by Engeo, groundwater elevation at the project site is likely 10 to 40 feet deep. It should be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors. Depth to groundwater can also vary significantly due to localized pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that groundwater may be higher or lower than the level observed during Engeo's investigation.

FAULTS AND SEISMICITY

Faults

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. A fault trace is the line on the earth's surface defining the fault. Displacement of the earth's crust along faults releases energy in the form of earthquakes and in some cases in fault creep. Most faults are the result of repeated displacements over a long period of time.

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Surface ruptures have been known to extend up to 50 miles with displacements of an inch to 20 feet. Fault rupture almost always follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden displacements are more damaging to structures because they are accompanied by shaking.

The State of California designates faults as active, potentially active, and inactive depending on how recent the movement that can be substantiated for a fault. Table 3.6-2 presents the California fault activity rating system.

TABLE 3.6-2: FAULT ACTIVITY RATING

FAULT ACTIVITY RATING	GEOLOGIC PERIOD OF LAST RUPTURE	TIME INTERVAL
Active (A)	Holocene	Within last 11,000 Years
Potentially Active (PA)	Quaternary	11,000-1.6 Million Years
Inactive (I)	Pre-Quaternary	Greater than 1.6 Million Years

No known faults traverse through the Davis Planning Area. However, the site does lie within a seismically active region, as California has numerous faults that are considered active. Generally, a fault is considered active if it has ruptured within the Holocene epoch (11,700 years before present). Mapped, active regional faults within the vicinity of the project site range from 12 to 50 miles away.

Fault Systems

Seismicity is directly related to the distribution of fault systems within a region. Depending on activity patterns, faults and fault-related geologic features may be classified as active, potentially active, or inactive.

The Quaternary Faults and Alquist-Priolo Earthquake Fault Zones are illustrated on Figure 3.6-2. The San Andreas fault system located to the west and the Eastern Sierra fault system located to the east are the closest significant fault systems. Numerous quakes along these fault systems have been felt in Davis. Major quakes occurred in 1833, 1868, 1892, 1902, 1906, and most recently in 2014, but Davis suffered no significant damage.

Seismicity

The amount of energy available to a fault is determined by considering the slip-rate of the fault, its area (fault length multiplied by down-dip width), maximum magnitude, and the rigidity of the displaced rocks. These factors are combined to calculate the moment (energy) release on a fault. The total seismic energy release for a fault source is sometimes partitioned between two different recurrence models, the characteristic and truncated Gutenberg-Richter (G-R) magnitude-frequency distributions. These models incorporate our knowledge of the range of magnitudes and relative frequency of different magnitudes for a particular fault. The partition of moment and the weights for multiple models are given in the following summary.

Earthquakes are generally expressed in terms of intensity and magnitude. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. By comparison, magnitude is based on the amplitude of the earthquake waves recorded on instruments, which have a common calibration. The Richter scale, a logarithmic scale ranging from 0.1 to 9.0, with 9.0 being the strongest, measures the magnitude of an earthquake relative to ground shaking. Table 3.6-3 provides a description and a comparison of intensity and magnitude.

The Office of Planning and Research has placed the Davis area in Seismic Activity Intensity Zone II, which indicates that the maximum intensity of an earthquake would be VII or 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.” The Uniform Building Code places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

TABLE 3.6-3: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

<i>RICHTER MAGNITUDE</i>	<i>MODIFIED MERCALLI SCALE</i>	<i>EFFECTS OF INTENSITY</i>
0.1 – 0.9	I	Earthquake shaking not felt
1.0 – 2.9	II	Shaking felt by those at rest.
3.0 – 3.9	III	Felt by most people indoors, some can estimate duration of shaking.
4.0 – 4.5	IV	Felt by most people indoors. Hanging objects rattle, wooden walls and frames creak.
4.6 – 4.9	V	Felt by everyone indoors, the duration of shaking can be estimated by most people. Standing autos rock. Crockery clashes, dishes rattle and glasses clink. Doors open, close and swing.
5.0 – 5.5	VI	Felt by all who estimate duration of shaking. Sleepers awoken, liquids spill, objects are displaced, and weak materials crack.
5.6 – 6.4	VII	People frightened and walls unsteady. Pictures and books thrown, dishes and glass are broken. Weak chimneys break. Plaster, loose bricks and parapets fall.
6.5 – 6.9	VIII	Difficult to stand. Waves on ponds, cohesionless soils slump. Stucco and masonry walls fall. Chimneys, stacks, towers, and elevated tanks twist and fall.
7.0 – 7.4	IX	General fright as people are thrown down, hard to drive. Trees broken, damage to foundations and frames. Reservoirs damaged, underground pipes broken.
7.5 – 7.9	X	General panic. Ground cracks, masonry and frame buildings destroyed. Bridges destroyed, railroads bent slightly. Dams, dikes and embankments damaged.
8.0 – 8.4	XI	Large landslides, water thrown, general destruction of buildings. Pipelines destroyed, railroads bent.
8.5 +	XII	Total nearby damage, rock masses displaced. Lines of sight/level distorted. Objects thrown into air.

Alquist-Priolo Special Study Zone

The California legislature passed the Alquist-Priolo Special Studies Zone Act in 1972 to address seismic hazards associated with faults and to establish criteria for developments for areas with identified seismic hazard zones. The California Geologic Survey (CGS) evaluates faults with available geologic and seismologic data and determines if a fault should be zoned as active, potentially active, or inactive. If CGS determines a fault to be active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquake Hazard Act. Alquist-Priolo Special Study Zones are usually one-quarter mile or less in width and require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a project site. The project site is not within an Alquist-Priolo Special Study Zone.

SEISMIC HAZARDS

Seismic Ground Shaking

The potential for seismic ground shaking is expected in California. As a result of the foreseeable seismicity in California, the State requires special design considerations for all structural improvements in accordance with the seismic design provisions in the California Building Code. These seismic design provisions require enhanced structural integrity based on several risk

parameters. Seismic ground shaking on the project site is expected during the life of the project. All structures will be built in accordance with the seismic design standards in California.

Fault Rupture

A fault rupture occurs when the surface of the earth breaks as a result of an earthquake, although this does not happen with all earthquakes. These ruptures generally occur in a weak area of an existing fault. Ruptures can be sudden (i.e. earthquake) or slow (i.e. fault creep). The Alquist-Priolo Fault Zoning Act requires active earthquake fault zones to be mapped and it provides special development considerations within these zones. The project site does not have surface expression of active faults and fault rupture is not anticipated.

Liquefaction

Liquefaction typically requires a significant sudden decrease of shearing resistance in cohesionless soils and a sudden increase in water pressure, which is typically associated with an earthquake of high magnitude. The potential for liquefaction is highest when groundwater levels are high, and loose, fine, sandy soils occur at depths of less than 50 feet.

The site is not located in a currently established State of California Seismic Hazard Zone for liquefaction. Additionally, the *Preliminary Geotechnical Assessment* (ENGEO, 2014) notes that, based on the fine-grained silt and clay anticipated in the Quaternary Basin deposits and the relatively dense nature of the Upper and Lower Modesto formations, the risk of liquefaction is considered low.

Lateral Spreading

Lateral spreading typically results when ground shaking moves soil toward an area where the soil integrity is weak or unsupported, and it typically occurs on the surface of a slope, although it does not occur strictly on steep slopes. Oftentimes, lateral spreading is directly associated with areas of liquefaction. Areas in the region that are susceptible to this hazard are located along creeks or open water bodies, or within the foothills to the west. There are no creeks or open bodies of water within an appropriate distance from the project site for lateral spreading to occur on the project site. For this reason, the probability of lateral spreading occurring on the project site is low.

Landslides

Landslides include rockfalls, deep slope failure, and shallow slope failure. Factors such as the geological conditions, drainage, slope, vegetation, and others directly affect the potential for landslides. One of the most common causes of landslides is construction activity that is associated with road building (i.e. cut and fill). The potential for landslides is considered remote in the valley floors due to the lack of significant slopes. For this reason, the probability of landslides occurring on the project site is low.

NON-SEISMIC HAZARDS

Expansive Soils

According to the *Preliminary Geotechnical Assessment* (ENGEO, 2014), based on a geologic review and review of limited subsurface data, expansive soil may be encountered in the project site. Expansive soils can undergo significant volume change with changes in moisture content. They shrink and harden when dried and expand and soften when wet. If structures are underlain by expansive soils, it is important that foundation systems be capable of tolerating or resisting any potentially damaging soil movements. In addition, it is important to limit moisture changes in the surficial soils by using positive drainage away from buildings as well as limiting landscaping watering.

Erosion

Erosion naturally occurs on the surface of the earth as surface materials (i.e. rock, soil, debris, etc.) is loosened, dissolved, or worn away, and transported from one place to another by gravity. Two common types of soil erosion include wind erosion and water erosion. The steepness of a slope is an important factor that affects soil erosion. Erosion potential in soils is influenced primarily by loose soil texture and steep slopes. Loose soils can be eroded by water or wind forces, whereas soils with high clay content are generally susceptible only to water erosion. The potential for erosion generally increases as a result of human activity, primarily through the development of facilities and impervious surfaces and the removal of vegetative cover.

According to the *Soil Survey of Yolo County, California* (USDA 1972), the erosivity of the soils on the project site are "slight". The surface runoff potential is considered "very slow to medium".

Subsidence

Land subsidence is the gradual settling or sinking of an area with little or no horizontal motion due to changes taking place underground. It is a natural process, although it can also occur (and is greatly accelerated) as a result of human activities. Common causes of land subsidence from human activity include: pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils. Monitoring of subsidence in Yolo has been occurring since 1999 on a regional level. The monitoring efforts show that the greatest subsidence occurs in the corridor that runs north from Davis, through Woodland, north to Zamora and through to the northeast corner of the county. The subsidence does not appear to be strictly uniform, a characteristic of subsidence, but rather a result of several factors. Subsidence is likely a result of the groundwater pumping, water usage, and other related issues, but additional regional studies are needed over an extended period of time to better understand the subsidence in the region.

3.6.2 REGULATORY SETTING

FEDERAL

Uniform Building Code (UBC)

The purpose of the Uniform Building Code (UBC) is to provide minimum standards to preserve the public peace, health, and safety by regulating the design, construction, quality of materials, certain equipment, location, grading, use, occupancy, and maintenance of all buildings and structures. UBC standards address foundation design, shear wall strength, and other structurally related conditions.

Hazardous Materials Transportation Act

The Hazardous Materials Transportation Act, as amended, is the basic statute regulating hazardous materials transportation in the United States. The purpose of the law is to provide adequate protection against the risks to life and property inherent in transporting hazardous materials in interstate commerce. This law gives the U.S. Department of Transportation (USDOT) and other agencies the authority to issue and enforce rules and regulations governing the safe transportation of hazardous materials (DOE 2002).

Resource Conservation and Recovery Act

The 1976 Federal Resource Conservation and Recovery Act (RCRA) and the 1984 RCRA Amendments regulate the treatment, storage, and disposal of hazardous and non-hazardous wastes. The legislation mandated that hazardous wastes be tracked from the point of generation to their ultimate fate in the environment. This includes detailed tracking of hazardous materials during transport and permitting of hazardous material handling facilities.

The 1984 RCRA amendments provided the framework for a regulatory program designed to prevent releases from USTs. The program establishes tank and leak detection standards, including spill and overflow protection devices for new tanks. The tanks must also meet performance standards to ensure that the stored material will not corrode the tanks. Owners and operators of USTs had until December 1998 to meet the new tank standards. As of 2001, an estimated 85 percent of USTs were in compliance with the required standards.

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (the Act) introduced active federal involvement to emergency response, site remediation, and spill prevention, most notably the Superfund program. The Act was intended to be comprehensive in encompassing both the prevention of, and response to, uncontrolled hazardous substances releases. The Act deals with environmental response, providing mechanisms for reacting to emergencies and to chronic hazardous material releases. In addition to establishing procedures to prevent and remedy problems, it establishes a system for compensating appropriate individuals and assigning appropriate liability. It is designed to plan for and respond to failure in other

regulatory programs and to remedy problems resulting from action taken before the era of comprehensive regulatory protection.

Natural Gas Pipeline Safety Act

The Natural Gas Pipeline Safety Act authorizes the U.S. Department of Transportation Office of Pipeline Safety to regulate pipeline transportation of natural (flammable, toxic, or corrosive) gas and other gases as well as the transportation and storage of liquefied natural gas. The Office of Pipeline Safety regulates the design, construction, inspection, testing, operation, and maintenance of pipeline facilities. While the federal government is primarily responsible for developing, issuing, and enforcing pipeline safety regulations, the pipeline safety statutes provide for State assumption of the intrastate regulatory, inspection, and enforcement responsibilities under an annual certification. To qualify for certification, a state must adopt the minimum federal regulations and may adopt additional or more stringent regulations as long as they are not incompatible.

STATE

The State of California has established a variety of regulations and requirements related to seismic safety and structural integrity, including the California Building Code, the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act.

California Building Code

The California Building Code (CBC) is included in Title 24 of the California Code of Regulations (CCR) and is a portion of the California Building Standards Code. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The CBC incorporates the Uniform Building Code, a widely adopted model building code in the United States. Through the CBC, the state provides a minimum standard for building design and construction. The CBC contains specific requirements for seismic safety, excavation, foundations, retaining walls and site demolition. It also regulates grading activities, including drainage and erosion control.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 sets forth the policies and Criteria of the State Mining and Geology Board, which governs the exercise of governments' responsibilities to prohibit the location of developments and structures for human occupancy across the trace of active faults. The policies and criteria are limited to potential hazards resulting from surface faulting or fault creep within Earthquake Fault Zones, as delineated on maps officially issued by the State Geologist. Working definitions include:

- Fault – a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side;
- Fault Zone – a zone of related faults, which commonly are braided and sub parallel, but may be branching and divergent. A fault zone has a significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles;

- Sufficiently Active Fault – a fault that has evidence of Holocene surface displacement along one or more of its segments or branches (last 11,000 years); and
- Well-Defined Fault – a fault whose trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The geologist should be able to locate the fault in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

“Sufficiently Active” and “Well Defined” are the two criteria used by the State to determine if a fault should be zoned under the Alquist-Priolo Act.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. Under the Act, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Zoning Act (which addresses only surface fault-rupture hazards) and are outlined below:

The State Geologist is required to delineate the various “seismic hazard zones.”

- Cities and Counties, or other local permitting authority, must regulate certain development “projects” within the zones. They must withhold the development permits for a site within a zone until the geologic and soil conditions of the site are investigated and appropriate mitigation measures, if any, are incorporated into development plans.
- The State Mining and Geology Board provides additional regulations, policies, and criteria, to guide cities and counties in their implementation of the law. The Board also provides guidelines for preparation of the Seismic Hazard Zone Maps and for evaluating and mitigating seismic hazards.
- Sellers (and their agents) of real property within a mapped hazard zone must disclose that the property lies within such a zone at the time of sale.

National Pollutant Discharge Elimination System (NPDES)

National Pollutant Discharge Elimination System (NPDES) permits are required for discharges of pollutants to navigable waters of the United States, which includes any discharge to surface waters, including lakes, rivers, streams, bays, the ocean, dry stream beds, wetlands, and storm sewers that are tributary to any surface water body. NPDES permits are issued under the Federal Clean Water Act, Title IV, Permits and Licenses, Section 402 (33 USC 466 et seq.)

The Regional Water Quality Control Board (RWQCB) issues these permits in lieu of direct issuance by the Environmental Protection Agency, subject to review and approval by the Environmental Protection Agency Regional Administrator. The terms of these NPDES permits implement pertinent provisions of the Federal Clean Water Act and the Act’s implementing regulations, including pre-

treatment, sludge management, effluent limitations for specific industries, and anti- degradation. In general, the discharge of pollutants is to be eliminated or reduced as much as practicable so as to achieve the Clean Water Act's goal of "fishable and swimmable" navigable (surface) waters. Technically, all NPDES permits issued by the RWQCB are also Waste Discharge Requirements issued under the authority of the California Water Code.

These NPDES permits regulate discharges from publicly owned treatment works, industrial discharges, stormwater runoff, dewatering operations, and groundwater cleanup discharges. NPDES permits are issued for five years or less, and are therefore to be updated regularly. The rapid and dramatic population and urban growth in the Central Valley Region has caused a significant increase in NPDES permit applications for new waste discharges. To expedite the permit issuance process, the RWQCB has adopted several general NPDES permits, each of which regulates numerous discharges of similar types of wastes. The SWRCB issues general permits for stormwater runoff from construction sites statewide. Stormwater discharges from industrial and construction activities in the Central Valley Region can be covered under these general permits, which are administered jointly by the SWRCB and RWQCB.

Water Quality Control Plan for the Central Valley Region

The Water Quality Control Plan for the Central Valley Region (Basin Plan) includes a summary of beneficial water uses, water quality objectives needed to protect the identified beneficial uses, and implementation measures. The Basin Plan establishes water quality standards for all the ground and surface waters of the region. The term "water quality standards," as used in the Federal Clean Water Act, includes both the beneficial uses of specific water bodies and the levels of quality that must be met and maintained to protect those uses. The Basin Plan includes an implementation plan describing the actions by the RWQCB and others that are necessary to achieve and maintain the water quality standards.

The RWQCB regulates waste discharges to minimize and control their effects on the quality of the region's ground and surface water. Permits are issued under a number of programs and authorities. The terms and conditions of these discharge permits are enforced through a variety of technical, administrative, and legal means. Water quality problems in the region are listed in the Basin Plan, along with the causes, where they are known. For water bodies with quality below the levels necessary to allow all the beneficial uses of the water to be met, plans for improving water quality are included. The Basin Plan reflects, incorporates, and implements applicable portions of a number of national and statewide water quality plans and policies, including the California Water Code and the Clean Water Act.

LOCAL

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

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.

City of Davis Municipal Code

The City of Davis regulates site grading design in Chapter 40, Zoning, of the Municipal Code. The following guidelines are outlined in the ordinance:

40.42.110 Grading design plan

- (a) For the efficient use of water, grading of a project site shall be designed to minimize soil erosion, runoff, and water waste. A grading plan shall be submitted as part of the landscape documentation package. A comprehensive grading plan prepared by a civil engineer for other local agency permits satisfies this requirement.
 - 1) The project applicant shall submit a landscape grading plan that indicates finished configurations and elevations of the landscape area including:
 - A. Height of graded slopes;
 - B. Drainage patterns;
 - C. Pad elevations;
 - D. Finish grade; and
 - E. Stormwater retention improvements, if applicable.
 - 2) To prevent excessive erosion and runoff, it is highly recommended that project applicants:

- A. Grade so that all irrigation and normal rainfall remains within property lines and does not drain on to non-permeable hardscapes;
 - B. Avoid disruption of natural drainage patterns and undisturbed soil; and
 - C. Avoid soil compaction in landscape areas; and
 - D. Decompact and break up compacted soil in landscape areas.
- 3) The grading design plan shall contain the following statement: "I have complied with the criteria of the ordinance and applied them accordingly for the efficient use of water in the grading design plan" and shall bear the signature of a licensed professional as authorized by law. (Ord. 2369 § 2, 2010).

3.6.3 IMPACTS AND MITIGATION MEASURES

THRESHOLDS OF SIGNIFICANCE

Consistent with Appendix G of the CEQA Guidelines, the proposed project will have a significant impact on geology, soils, and minerals if it will:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
 - Strong seismic ground shaking; or
 - Seismic-related ground failure, including liquefaction;
- Result in substantial soil erosion or the loss of topsoil;
- 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;
- 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;
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water;
- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state;
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan; or,
- Conflict, or create an inconsistency, with any applicable plan, policy, or regulation adopted for the purpose of avoiding or mitigating environmental effects related to geology, soils, and mineral resources.

According to the Davis General Plan, the most important mineral resources in the region are sand and gravel, which are mined on Cache Creek and other channels in Yolo County. A survey of aggregate resources by the State Division of Mines and Geology did not show significant aggregate resources in the planning area. As a result, mineral resources were found not to be a significant

issue for the City and further environmental analysis was not required in the Davis General Plan EIR.

Known mineral resources are not located on the project site or in the immediate vicinity and land designated or zoned for mineral resources is not within the City limits. As mineral resources are not located in the vicinity of the proposed project or the City, implementation of the proposed project would not result in the loss of availability of a known mineral resource or of a locally-important mineral resource recovery site. Therefore, the proposed project would have **no impact** related to mineral resources. Issues related to known or locally-important mineral resources are not further discussed.

In addition, the proposed project would connect to the existing City wastewater collection infrastructure and be served by the City's wastewater treatment facility. Therefore, the proposed project would not utilize a septic tank system and **no impact** would occur. Issues related to septic tanks or alternative wastewater disposal systems are not further discussed.

IMPACTS AND MITIGATION MEASURES

Impact 3.6-1: The proposed project may expose people or structures to potential substantial adverse effects involving strong seismic ground shaking or seismic related ground failure (Less than Significant)

The California Geologic Survey (CGS) evaluates faults and determines if a fault should be zoned as active, potentially active, or inactive. All active faults are incorporated into a Special Studies Zone, also referred to as an Alquist-Priolo Special Study Zone. The project site is not within an Alquist-Priolo Special Study Zone. In fact, there are no known faults (active, potentially active, or inactive) that traverse through the City of Davis.

The San Andreas fault system located to the west and the Eastern Sierra fault system located to the east are the closest significant fault systems. Numerous quakes along these fault systems have been felt in Davis. Major quakes occurred in 1833, 1868, 1892, 1902, 1906, and most recently in 2014, but Davis suffered no significant damage.

The Office of Planning and Research has placed the Davis area in Seismic Activity Intensity Zone II, which indicates that the maximum intensity of an earthquake would be VII or 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." The Uniform Building Code places all of California in the zone of greatest earthquake severity because recent studies indicate high potential for severe ground shaking.

There will always be a potential for groundshaking caused by seismic activity anywhere in California, including the project site. In order to minimize potential damage to the buildings and site improvements, all construction in California is required to be designed in accordance with the

latest seismic design standards of the California Building Code. Design in accordance with these standards would reduce any potential impact to a ***less than significant*** level.

Impact 3.6-2: Implementation and construction of the proposed project may result in substantial soil erosion or the loss of topsoil (Less than Significant with Mitigation)

According to the *Soil Survey of Yolo County, California (USDA 1972)*, the erosivity of the soils on the project site are "slight". According to the NRCS Web Soil Survey (USDA NRCS, 2016), the surface runoff potential is considered "very slow to medium". However, there is always the potential for human caused erosion associated with construction activities or through the operational phase of a project.

Grading, excavation, removal of vegetation cover, and loading activities associated with construction activities could temporarily increase runoff, erosion, and sedimentation. Construction activities also could result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at construction sites and staging areas. Mitigation Measure 3.6-1 requires an approved storm water pollution prevention plan (SWPPP) that includes best management practices for grading, and preservation of topsoil. The SWPPP will be designed to control storm water quality degradation to the extent practicable using best management practices during and after construction. The project applicant will submit the SWPPP with a Notice of Intent to the RWQCB to obtain a General Permit. The RWQCB is an agency responsible for reviewing the SWPPP with the Notice of Intent, prior to issuance of a General Permit for the discharge of storm water during construction activities.

Additionally, there is the potential for erosion associated with stormwater runoff throughout the operational phase of the project. The potential for erosion is associated with the design of the improvements, structures, and landscaping. Mitigation Measure 3.6-2 requires the project to incorporate design measures that treat stormwater runoff in accordance with the standards of the California Stormwater Best Management Practice New Development and Redevelopment Handbook and Section E.12 of the Phase II Small MS4 General Permit. This includes the drainage design from all paved surfaces, including streets, parking lots, driveways, and roofs, as well as landscaping.

With the implementation of the following mitigation measures the proposed project would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.6-1: Prior to any site disturbance, the project proponent shall submit a Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) to the RWQCB in accordance with the NPDES General Construction Permit requirements. The SWPPP shall be designed to control pollutant discharges utilizing Best Management Practices (BMPs) and technology to reduce erosion and sediments. BMPs may consist of a wide variety of measures taken to reduce pollutants in stormwater runoff from the project site. Measures shall include

temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) that will be employed to control erosion from disturbed areas. Final selection of BMPs will be subject to approval by the City of Davis and the RWQCB. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB.

Mitigation Measure 3.6-2: *Prior to any site disturbance, the project proponent shall document to the satisfaction of the City of Davis that stormwater runoff from the project site is treated per the standards in the California Stormwater Best Management Practice New Development and Redevelopment Handbook and Section E.12 of the Phase II Small MS4 General Permit. Drainage from all paved surfaces, including streets, parking lots, driveways, and roofs shall be routed either through swales, buffer strips, or sand filters or treated with a filtering system prior to discharge to the storm drain system. Landscaping shall be designed to provide water quality treatment, along with the use of a Stormwater Management filter to permanently sequester hydrocarbons, if necessary. Roofs shall be designed with down spouting into landscaped areas, bubbleups, or trenches. Driveways should be curbed into landscaping so runoff drains first into the landscaping. The aforementioned requirements shall be noted on the Preliminary and Final Planned Developments for the project.*

SIGNIFICANCE AFTER MITIGATION

Implementation of Mitigation Measures 3.6-1 and 3.6-2 would require the implementation of best management practices to reduce erosion from stormwater runoff and the introduction of pollutants into the local storm drainage system. These mitigation measures would reduce potential impacts related to erosion and the loss of topsoil to a ***less than significant*** level.

Impact 3.6-3: The proposed project would be located on a geologic unit or soil that is unstable, or that would become unstable as a result of project implementation, and potentially result in landslide, lateral spreading, subsidence, liquefaction or collapse (Less than Significant with Mitigation)

LIQUEFACTION

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands. The site is not located in a currently established State of California Seismic Hazard Zone for liquefaction. Additionally, the *Preliminary Geotechnical Assessment* (ENGEO, 2014) notes that, based on the fine-grained silt and clay anticipated in the Quaternary Basin deposits and the relatively dense nature of the Upper and Lower Modesto formations, the risk of liquefaction is considered low.

LATERAL SPREADING

Lateral spreading typically results when ground shaking moves soil toward an area where the soil integrity is weak or unsupported, and it typically occurs on the surface of a slope, although it does not occur strictly on steep slopes. Oftentimes, lateral spreading is directly associated with areas of liquefaction. Areas in the region that are susceptible to this hazard are located along creeks or open water bodies, or within the foothills to the west. There are no creeks or open bodies of water within an appropriate distance from the project site for lateral spreading to occur on the project site. For this reason, the probability of lateral spreading occurring on the project site is low.

LANDSLIDES

Landslides include rockfalls, deep slope failure, and shallow slope failure. Factors such as the geological conditions, drainage, slope, vegetation, and others directly affect the potential for landslides. One of the most common causes of landslides is construction activity that is associated with road building (i.e. cut and fill). The potential for landslides is considered remote in the valley floors due to the lack of significant slopes. For this reason, the probability of landslides occurring on the project site is low.

DIFFERENTIAL COMPACTION

If near-surface soils vary in composition both vertically and laterally, strong earthquake shaking can cause non-uniform compaction of the soil strata, resulting in movement of the near-surface soils. According to the *Preliminary Geotechnical Assessment* (ENGEO, 2014), Holocene Basin Deposits are mapped underlying the majority of the project. These deposits could be potentially weak and compressible under new loads. Hazards associated with compaction of soils can be successfully mitigated using proper engineering and construction techniques.

SUBSIDENCE

Monitoring of subsidence in Yolo has been occurring since 1999 on a regional level. The monitoring efforts show that the greatest subsidence occurs in the corridor that runs north from Davis, through Woodland, north to Zamora and through to the northeast corner of the county. The subsidence does not appear to be strictly uniform, a characteristic of subsidence, but rather a result of several factors. Subsidence is likely a result of the groundwater pumping, water usage, and other related issues, but additional regional studies are needed over an extended period of time to better understand the subsidence. Subsidence is present throughout the City of Davis including the project site, albeit at a low level.

CONCLUSION

During the geotechnical evaluation of the project site, Enggeo (2014) concluded that the project site has a low potential for liquefaction, lateral spreading, and landslides. However, given that fill was encountered at the site, and the lack of information on the compaction and placement history of the fill, Mitigation Measure 3.6-3 below would be required. Overall, it was determined that the project site was suitable for development, and with implementation of the following mitigation measure, the proposed project would have a ***less than significant*** impact relative to this topic.

MITIGATION MEASURE(S)

Mitigation Measure 3.6-3: *Prior to final design approval and issuance of building permits for each phase of the project, the project applicant shall submit to the City of Davis Building Inspection Division, for review and approval, a design-level geotechnical engineering report produced by a California Registered Civil Engineer or Geotechnical Engineer. The report shall include the recommendations in the report entitled Preliminary Geotechnical Assessment, Davis Innovation Center, dated October 20, 2014 unless it is determined in the design-level report that one or more recommendations need to be revised. The design-level report shall address, at a minimum, the following:*

- *Compaction specifications and subgrade preparation for onsite soils;*
- *Structural foundations;*
- *Grading practices; and*
- *Expansive/unstable soils, including fill.*

The design-level geotechnical engineering report shall include a summary of the site, soil, and groundwater conditions, seismicity, laboratory test data, exploration data and a site plan showing exploratory locations and improvement limits. The report shall be signed by a licensed California Geotechnical Engineer. Design-level recommendations shall be included in the foundation and improvement plans and approved by the Davis Public Works Department prior to issuance of any building permits.

SIGNIFICANCE AFTER MITIGATION

Implementation of Mitigation Measures 3.6-3 would ensure that onsite fill soils are properly compacted and comply with the applicable safety requirements established by the CBC to reduce risks associated with unstable soils. Implementation of this mitigation measure would reduce this potential impact to a ***less than significant*** level.

Impact 3.6-4: The proposed project would be located on expansive soil creating substantial risks to life or property (Less than Significant)

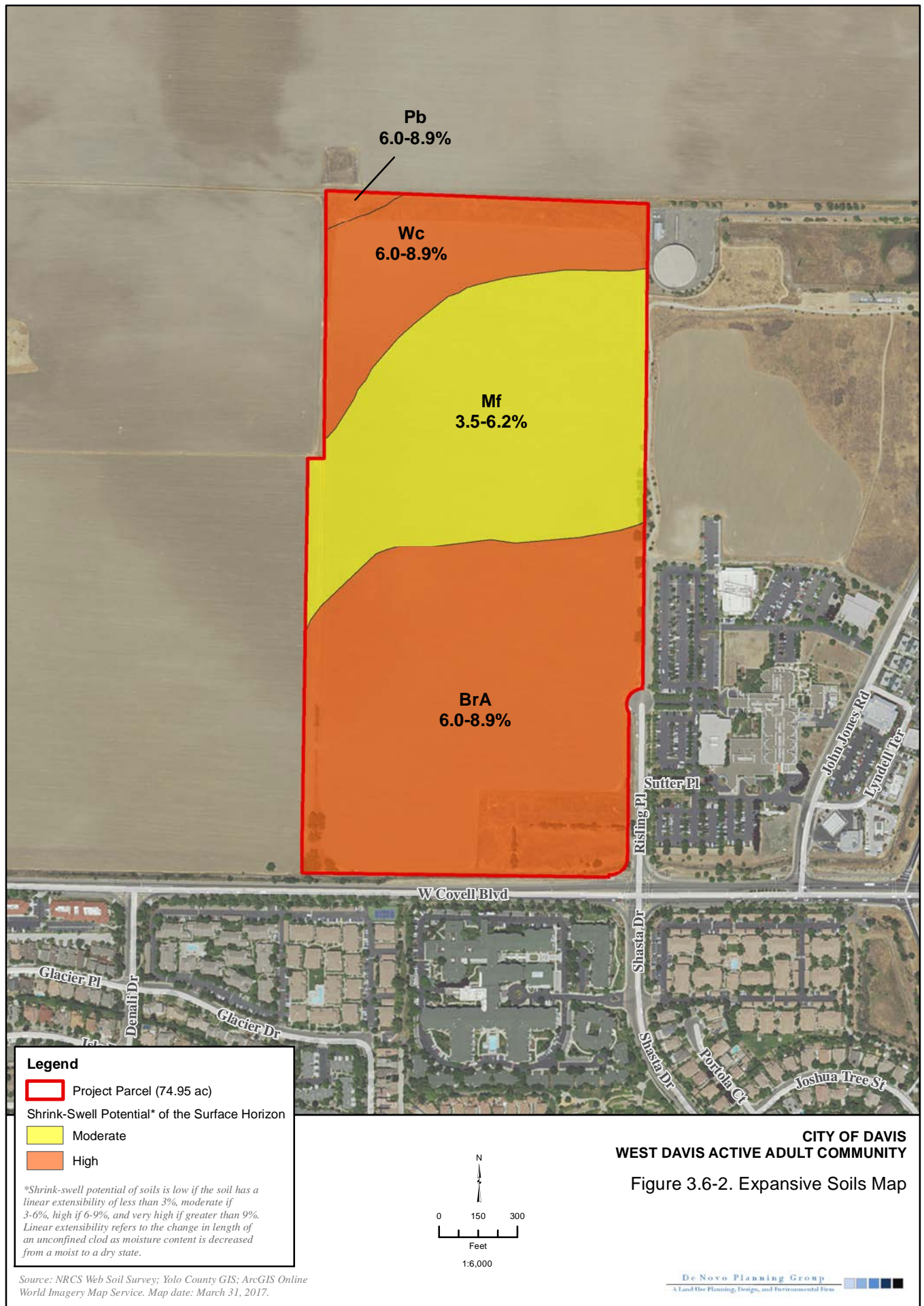
Expansive soils are those that undergo volume changes as moisture content fluctuates; swelling substantially when wet or shrinking when dry. Soil expansion can damage structures by cracking foundations, causing settlement and distorting structural elements. Expansion is a typical characteristic of clay-type soils. Expansive soils shrink and swell in volume during changes in moisture content, such as a result of seasonal rain events, and can cause damage to foundations, concrete slabs, roadway improvements, and pavement sections.

According to the *Preliminary Geotechnical Assessment* (ENGEO, 2014), based on a geologic review and review of limited subsurface data, expansive soil may be encountered in the project site. In general, surface soil appeared to be silty clay with moderate to high plasticity. It is noted that the conclusions made in the *Preliminary Geotechnical Assessment* (ENGEO, 2014) are solely professional opinions and are valid for a period of no more than two years from the date of report issuance (October 20, 2014).

Implementation of Mitigation Measures 3.6-3 would reduce risk from expansive soils by requiring submittal of a design-level geotechnical engineering report. Implementation of the proposed project would have a ***less than significant*** impact relative to this topic.

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