The purpose of this section is to disclose and analyze the potential impacts associated with the geology of the project site and general vicinity, and to analyze issues such as the potential exposure of people and property to geologic hazards, landform alteration, and erosion. There were no comments received during the NOP comment period related to this environmental topic.

Information in this section is derived primarily from the following:

- Geotechnical Report: SPI Cogeneration Facility (CGI Technical Services Inc., June 2007) (**Appendix I**);
- Hydrogeologic analysis for Expansion of Cogeneration Plant at Sierra Pacific Industries Anderson Facility (Lawrence & Associates, 14 December 2007);
- Screening Level Environment Site Assessment: Sierra Pacific Industries (SPI) Proposed Cogeneration Plant (Hanover Environmental Services Inc., 14 September 2009) (**Appendix H**);
- Shasta County General Plan (Shasta County, 2004);
- City of Anderson General Plan (City of Anderson, May 2007);
- Literature prepared by the California Division of Mines and Geology;
- Information from the U.S. Natural Resources Conservation Service; and
- Mapping published by the U.S. Geologic Survey.

3.5.1 ENVIRONMENTAL SETTING

REGIONAL AND LOCAL GEOLOGY

The project site is located in the northern Sacramento Valley at the northern margin of the Great Valley Physiographic province. The Great Valley province is bordered to the north by the Klamath and Cascade Physiographic provinces, to the east by the Cascade and Sierra Nevada Physiographic provinces, to the west by the Klamath and Coast Range Physiographic provinces, and to the south by the Transverse Range Physiographic province.

The Sacramento Valley is a late Mesozoic forearc basin that formed contemporaneously with, and between the accretionary trench deposits of the Franciscan Complex to the west, and an eastern magmatic arc complex, the roots of which are exposed in the Sierra Nevada Mountains. The region has experienced orogenic uplift, faulting, and subsequent erosion as the valley was inundated by the ancestral Pacific Ocean.

The exposed granite of the Sierra Nevada mountain range represents the eroded edge of a tilted block of crystalline rocks known as the Sierra Nevada Batholith. The Sierra Nevada Batholith is a series of granitic plutons that range in age from Jurassic to Cretaceous. The plutons intruded sedimentary and volcanic rocks of Ordovician to Late Jurassic age.

The Sierra Nevada mountains locally are the bedrock upon which the Great Valley sequence rests, in other locations, mudflows and lahars of the Pliocene Tuscan Formation and younger volcanics rocks cover the granitic bedrock, which plunges beneath the Great Valley sequence at the eastern margin of the Central Valley.

The Great Valley sequence is a very thick accumulation of sediments forming an asymmetric structural trough or syncline, with the axis of the trough west of the apparent surface axis of the present valley surface. The trough has been filled with as much as 10 vertical miles of sediment in the Sacramento Valley (the Great Valley Sequence), and these sediments range in age from Jurassic to Holocene. The Great Valley sequence rests on basement rocks consisting of metamorphosed sedimentary and volcanic rocks of Ordovician to Late Jurassic age (Helly and Harwood, 1985). Sediment thicknesses located in the project area at the northern margin of the Great Valley have been projected to be less than one mile (Hackel, 1996).

FAULTS AND SEISMICITY

The State of California designates faults as active, potentially active, and inactive depending on the recency of the movement that can be substantiated for a fault. Fault activity is rated as follows:

Fault Activity Rating	Geologic Period of last Rupture	Time Interval (years)
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

The California Geologic Survey (CGS) evaluates the activity rating of a fault in fault evaluation reports (FER). FERs compile available geologic and seismologic data and evaluate if a fault should be zoned as active, potentially active, or inactive. If an FER evaluates a fault as active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquake Hazard Act (AP). AP Special Study Zones require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a project site.

No faults are known to traverse the project site (Jennings, 1994; Hart & Bryant, 1997; Strand, 1977). However a number of regional and local faults traverse the project region. The most significant of these faults is the potentially active Battle Creek fault, located about 9 miles south of the site (Jennings, 1994). The closest fault mapped to the site is the inactive Bear Creek fault, located about 6 miles southeast of the site. The closest active fault, as zoned by the State, is the Foothill Fault System, located about 19 miles south-southeast of the site.

In addition to the continental faulting noted above, the project area rests above the Cascadia subduction zone. West of the site, off the coast of California the oceanic crust of the Gorda plate is being subducted beneath the continental crust of the Pacific Plate, in an area known as the Gorda Escarpment. The descending ramp caused by that subduction, called the Cascadia Subduction zone, extends beneath the project area at a depth of about 20 to 25 miles. That ramp is capable of storing elastic stress that periodically causes earthquakes that could affect the project area.

Table 3.5-1 presents fault location information data collected from the California Geologic Survey database (Blake, 1999a).

TABLE 3.5-1: FAULTS INFLUENTIAL TO PROJECT AREA

FAULT NAME	DISTANCE		SEISMOLOGY PARAMETERS	
	MILES	KILOMETERS	UPPER BOUND EARTHQUAKE(M_W)	FAULT ACTIVITY RATING
Battle Creek	9.3	15.0	6.5	PA
Foothills Fault System	18.5	29.8	6.5	A
Rate for NE California	29.3	47.2	7.3	A
Hat Creek-MacArthur	48.2	77.8	6.7	A
Great Valley 1	55.1	88.6	6.7	PA
Lake Mountain	61.1	98.3	6.8	A

*SOURCE: GEOTECHNICAL INVESTIGATION (CGI TECHNICAL SERVICES INC., 2007)- **APPENDIX I***

HISTORIC SEISMICITY

Northern California is a seismically active area that has been subjected to numerous historical earthquakes. A search of historical earthquakes occurring between 1800 and 1999, listed in the CGS catalog, was performed for a 100-mile radius around the project site (Blake, 1999b). That search found that 207 earthquakes have occurred within that area. Of those earthquakes, only 44 with moment magnitudes (M_w) of 5 or greater, and 2 with M_w 6 and one with M_w 6.5 or greater have occurred in the search area. The largest earthquake to affect the area was a M_w 6.5 that occurred on December 21, 1954. The closest earthquake to affect the site was a M_w 4.5 that occurred approximately 6.2 miles from the site on April 16, 1904. The most recent significant earthquake to affect the project area was a local Richter magnitude (M_L) 5.2 earthquake that occurred on November 26, 1998.

PROJECT SITE CONDITIONS

The proposed facility is located on a property that has been used as a sawmill and wood processing facility for decades. As a result, there are past and present infrastructure improvements located throughout the area. Remnants of past improvements adjacent to the proposed facility and the Area of Potential Improvement (API) include large log ponds that are located to the northwest and southeast of large concrete footings associated with a dismantled boiler located northwest of the site. Current improvements located to the immediate northeast and southeast of the project facility are an existing fuel shed and cogeneration plant, respectively.

The site resides within the flood terrace of the Sacramento River, which is located immediately northeast of the site and parallels the site's northeast border. The topographic expression of the site has a gentle slope of about 1 to 2 percent to the northeast with an average elevation of about 420 feet above mean sea level. Disrupting the relatively level site are depressions formed by old log ponds and several surface drainage ditches.

Surface drainage across the site occurs as sheet flow into the surrounding log ponds and drainage ditches where it is eventually conveyed to the Sacramento River.

Site Geology and Geologic Structure

The footprint of the proposed facility and associated improvements is located on top of a prominent flood terrace adjacent to the Sacramento River. According to Fraticelli, et al (1987), this flood terrace is composed of sediment belonging to the Modesto Formation. The Modesto Formation is of Pleistocene age, is commonly found bordering river channels in the area and is generally described as being composed of tan to light gray gravely sand, silt and clay.

In September of 2007, CGI Technical Services Inc. performed a subsurface investigation consisting of five test pits and five soil borings at the site. Borings DH-2 & DH-3 and test pits TP-1 and TP-4 were performed within the proposed footprint of the cogeneration facility.

The subsurface investigation reported fill consisting of wood debris and interbedded clayey silt with gravel and cobbles at depths of 0-14.5 and 0-3 feet below ground surface in test pits TP-1 and TP-4 respectively. Modesto formation native soils consisting of sandy gravels and cobbles were reported in test pits TP-1 and TP-4 from 14.5-15 (total depth) and from 3-4.5 (total depth) feet below ground surface respectively.

Soil Borings DH-2 and DH-3 reported fill consisting of wood debris and interbedded clayey silt with gravel and cobbles at depths of 0-9 and 0-12.5 feet below ground surface respectively. Modesto Formation native soils consisting of gravely sand with cobbles and clayey sand with gravel grading to sandy gravel with cobbles were reported in soil borings DH-2 and DH-3 from 9-20 and from 15-20 feet below ground surface respectively. Riverbank Formation native material consisting of clayey gravel to silty gravel with cobbles was encountered from 20 feet below ground surface to a total depth 21 feet in both borings.

The site is located within thick sequences of alluvium derived by the Sacramento River and adjacent watercourses. No near-surface faults or folds have been mapped at the project site (Strand, 1997). The closest mapped fault is located about 6 miles southeast of the site and is known as the Bear Creek Fault that trends away from the project site with a southwest to northeast orientation.

Based on the CGI Technical Services Inc. subsurface investigation, the structural orientation of the local bedding is roughly horizontal, with minor internal structures consisting of dipping cross beds.

Aerial Photographic Review

Historical aerial photographs were reviewed to determine past site conditions of the API and surrounding properties. Photographs covering the years 1952, 1963, 1974, 1981, 1998 and 2005 were available for review. The results of the review are discussed below by year, and the aerial photographs are included as Exhibit 3.5-1 at the end of this section.

1952 Scale: 1"=555'

In the 1952 aerial photograph, the API contains vacant land. There are no visible structures on the API. Dirt roads are visible adjacent west and south of the API. The eastern portion of the API appears to contain a portion of a log holding pond with the remainder of the API as bare ground. The adjoining property to the west appears to be a log staging area. The primary use of the subject and surrounding properties appear to be a lumber mill facility in this aerial photograph.

1963 Scale: 1"=333'

The 1963 aerial photograph, the API contains stacks of staged logs. Surrounding uses appear as a pond with floating logs (south and east), lumber mill structure (north), dirt road access (west). Similar to the 1952 photograph the API remains structurally undeveloped and primary uses appear to be for staging lumber products.

1974 Scale: 1"=541'

No significant changes are visible on the project site in relation to the 1963 aerial photograph discussed above.

1981 Scale: 1"=666'

In the 1981 aerial photograph, the API remains relatively unchanged from the previous photographs. The previously mentioned ponds appear to have reduced in size.

1998 Scale: 1"=666'

No significant changes are visible on the project site in relation to the 1981 aerial photograph discussed above.

2005 Scale: 1" = 604'

No significant changes are visible on the project site in relation to the 1998 aerial photograph discussed above. Staged equipment and lumber products are clearly visible in this photograph.

Preliminary Soil Description

Soil types on the project site were determined through a review of the version 7, September 26, 2008, U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) *Custom Soil Resource Report for Shasta County, California*. Soils on the site are shown in Figure 3.5-1 and consist of:

- Churn gravelly loam (CfA), well drained, 0-3 percent slopes. The churn gravelly loam typically consists of a surface layer of gravelly loam about 40 inches thick. The subsoil, consists of stratified gravelly loam to gravelly clay loam from 40-60 inches below ground surface.; and

- Cobbly alluvial land (Ck), excessively drained with 0-5 percent slopes. The Cobbly alluvial land typically consists as a layer of very cobbly loamy sand to 60 inches below ground surface.

Groundwater Conditions

Productive groundwater zones beneath the site and vicinity occur in the Tehama and Tuscan Formations. Wells in the vicinity of the site range in depth from less than 100 feet below ground surface (older domestic wells) to generally about 500 feet below ground surface: and pump from the Tehama or younger formations (DWR). Generally, water in the Tehama Formation occurs in a semi confined to confined condition.

At the site, the large wells which supply the existing cogeneration facility (well 2a) and pond make-up water (wells 1 and 2a) are completed in the aquifer extending from 148 to at least 285 feet below ground surface. Groundwater generally moves west to east towards the Sacramento River in the site vicinity.

Groundwater was encountered in explorations made at the site at an average depth of about 10 feet below ground surface. However, the depth to groundwater is expected to vary throughout the year and from year to year. Intense and long duration precipitation, modification of topography and cultural land uses such as water well usage, on site waste disposal systems, and water diversions can contribute to fluctuations in groundwater levels.

3.5.2 REGULATORY SETTING

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 Standards Code (CBSC) 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 CBSC, the state provides a minimum standard for building design and construction. The CBSC 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 was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The main purpose of the Act is to prevent the construction of buildings used for human occupancy on active faults.

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.

As of September 2009, the Shasta County area had not been mapped under the Seismic Hazards Mapping Act, because the state targeted higher risk areas, such as the San Francisco Bay area.

LOCAL

County of Shasta General Plan

The Health and Safety Element of the Shasta County General Plan includes several objectives and policies to reduce the risks to the community from seismic and other geologic hazards.

The following presents the safety policies regarding seismic and other geologic hazards included in the general plan:

SG-a Development proposals for critical or high density structures, as defined in the Uniform Building Code, located within a half mile of any fault identified as an Earthquake Fault Zone by the California Division of Mines and Geology shall include a geologic study of potential fault rupture. Geologic studies which are undertaken shall be performed by a registered geologist according to general guidelines of the California Division of Mines and Geology. Proposals for critical structures, as defined in the Uniform Building Code, within the study area shall include a site-specific seismic hazards evaluation, including ground motion criteria for the design of new buildings and structures.

SG-b In order to minimize development that would be endangered by landslides, geological investigations by a registered geologist or a geological engineer will be required on all subdivision and/or developments where the preliminary staff report indicates the possibility of landslides on or adjacent to the development. A landslide map shall be developed and maintained as these reports are accumulated for reference by the development sponsors.

SG-e When soil tests reveal the presence of expansive soils, engineering design measures designed to eliminate or mitigate their impacts shall be employed.

Shasta County Grading Ordinance

The Shasta County Grading Ordinance, included in the Shasta County Zoning Plan (Shasta County, 2003) sets forth regulations concerning grading, excavating, and filling. The Shasta County Grading Ordinance, amongst other thresholds, prohibits movement of earth materials in excess of 250 cubic yards or which disturbs 10,000 square feet of surface area without a grading permit from the County. The grading permit must include an approved grading plan provided by the project applicant, and it must set forth terms and conditions of grading operations that conform to the County's grading standards. The permit also requires the project applicant to provide a permanent erosion control plan that must be implemented upon completion of the project. Ongoing maintenance of erosion control measures is required for the duration of the project and for three years after completion of the project, unless the project is released earlier by the enforcing officer designated by the County Board of Supervisors.

3.5.3 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 and soils 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; or
- 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.

The IS/NOP prepared for this project concluded that potential impacts associated with rupture of known earthquake faults, strong seismic shaking, seismically-induced landslides, soil erosion/loss of topsoil, expansive soils, and septic systems posed no impact. Therefore, these topics will not be further addressed in this Draft EIR.

IMPACTS AND MITIGATION MEASURES

Impact 3.5-1: The proposed project would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving unstable soils and seismic-related ground failure, including liquefaction. (Less than Significant with Mitigation)

The soils present on the project site have the potential to become unstable due to liquefaction as a result of a seismic event. Seismic settlement, or liquefaction, can occur in both saturated and unsaturated granular soils. Liquefaction is the sudden, short-term transformation of saturated soil from a solid to a liquefied state caused by the build-up of excess pore water pressure, especially during earthquake-induced cyclic loading.

Groundwater was first encountered in explorations made at the site at an average depth of about 10 feet below ground surface. The groundwater levels at the project site are considered to be relatively high, and the project site is underlain in areas by fill consisting of wood debris and interbedded clayey silt with gravel and cobbles and Pleistocene flood basin deposits. While the site is located within a relatively seismically inactive area, the presence of nearby faults, groundwater levels, and soil types present on the project site indicate that a risk of soil instability associated with seismic settlement and liquefaction exist.

The California Building Code requires that geotechnical engineering studies be undertaken for any development in areas where potentially serious geologic risks exist. The geotechnical study performed for the proposed project indicated a potential risk associated with liquefaction. Given the soil types present on the project site and the relatively high groundwater table, the risk for seismic settlement and/or liquefaction is considered to be a **potentially significant** impact.

MITIGATION MEASURES

Mitigation Measure 3.5-1*: In accordance with the California Building Code (Title 24, Part 2) Section 18O4A.3 and A.5, a, liquefaction and seismic settlement potential shall be addressed in the final design level geotechnical engineering investigations prior to approval of site plans or issuance of a grading permit.*

The County's Building Division of the Department of Resource Management shall ensure that all the pertinent sections of the California Building Code are adhered to in the construction of buildings and structures on site, and that all appropriate measures are implemented in order to reduce the risk of liquefaction and seismic settlement to acceptable levels prior to the issuance of a Building Permit.

The final engineering plans for all proposed structures, foundations and utility trenches shall be prepared by a qualified engineer, and shall implement the recommendations and measures included in the Geotechnical Report: SPI Cogeneration Facility (CGI Technical Services Inc., June 2007). The measures shall address seismic settlement and liquefaction and shall include, but are not limited to:

- *Over-excavation and removal of existing soils,*
- *Placement of compacted engineered fill beneath and around building pads,*
- *Implementation of soil stabilization methods,*
- *Dewatering of soils,*
- *Moisture conditioning and soil compaction, and*
- *Trench stabilization.*

SIGNIFICANCE AFTER MITIGATION

Implementation of MM 3.5-1 will reduce this impact to **less than significant** by requiring implementation of measures that would stabilize the soils that will underlay the proposed development.

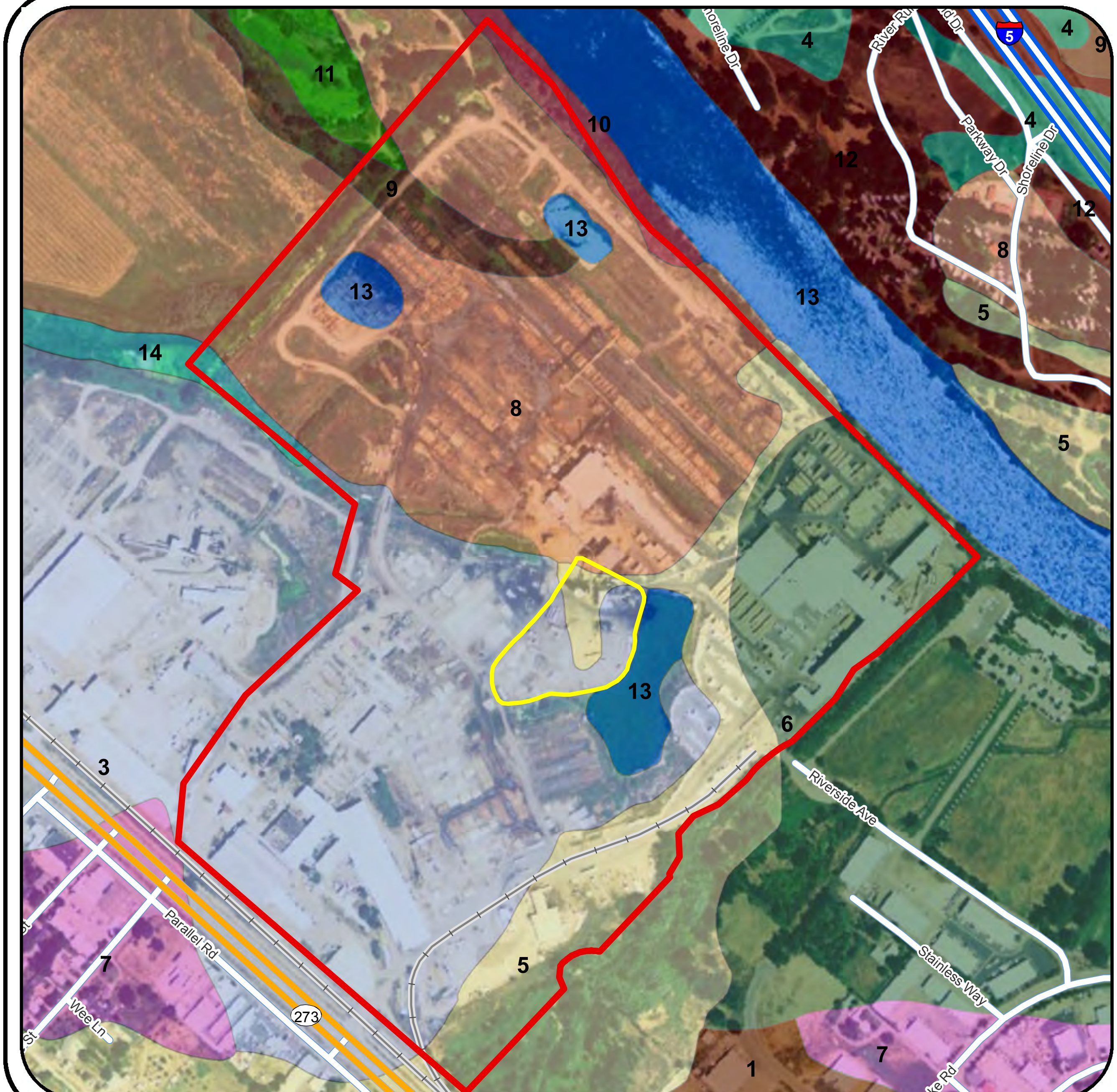

Figure 3.5-1. Soils Map

- 1 - Anderson gravelly sandy loam
- 2 - Churn gravelly loam, 0-3% slopes
- 3 - Churn gravelly loam, deep, 0-3% slopes
- 4 - Cobbly alluvial land
- 5 - Cobbly alluvial land, frequently flooded
- 6 - Honcut loam
- 7 - Honcut gravelly loam
- 8, - Reiff fine sandy loam, 0-3% slopes
- 9 - Reiff fine sandy loam, deep, 0-3% slopes
- 10 - Reiff gravelly fine sandy loam, deep, 0-3% slopes
- 11 - Tujunga loamy sand, 0-3% slopes
- 12 - Tujunga loamy, 3-8% slopes
- 13 - Water
- 14 - Wet alluvial land
- SPI Site Boundary
- Area of Proposed Improvements

0 250 500 1,000 Feet

1:7,500

De Novo Planning Group

A Land Use Planning, Design, and Environmental Firm

Soil data source: USDA Natural Resources Conservation Service Soil Data Mart. Road Data Source: ESRI StreetMap North America Aerial Photo Source: ArcGIS Online Resource Center. Parcel Data Source: Shasta County GIS. Map date: June 28, 2010.

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SPI Anderson Sawmill
Riverside Avenue
Redding, CA 96007

Inquiry Number: 2566195.5
August 18, 2009

Exhibit 3.5-1

The EDR Aerial Photo Decade Package

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDRs professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography August 18, 2009

Target Property:

Riverside Avenue
Redding, CA 96007

Year	***Scale***	***Details***	***Source***
1952	Aerial Photograph. Scale: 1"=555'	Flight Year: 1952	Robinson
1963	Aerial Photograph. Scale: 1"=333'	Flight Year: 1963	CH2M Hill
1974	Aerial Photograph. Scale: 1"=541'	Flight Year: 1974	Nasa
1981	Aerial Photograph. Scale: 1"=666'	Flight Year: 1981	CH2M Hill
1998	Aerial Photograph. Scale: 1"=666'	Flight Year: 1998	USGS
2005	Aerial Photograph. 1" = 604'	Flight Year: 2005	EDR


INQUIRY #: 2566195.5
YEAR: 1952
= 555'
N
EDR Environmental Data Resources Inc


INQUIRY #: 2566195.5
YEAR: 1963
= 333'
N
EDR Environmental Data Resources Inc


INQUIRY #: 2566195.5
YEAR: 1974
= 541'
N


INQUIRY #: 2566195.5
YEAR: 1981
= 666'
N
EDR Environmental Data Resources Inc

INQUIRY #: 2566195.5

YEAR: 1998

= 666'

N

EDR Environmental Data Resources Inc


INQUIRY #: 2566195.5
YEAR: 2005
= 604'
N

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