3.2 GEOLOGY AND SOILS

This section describes the geology and soils of the La Center Interchange and Ridgefield Interchange Sites.

3.2.1 SETTING – LA CENTER INTERCHANGE SITE

The La Center Interchange Site lies within Clark County, which is situated in the Puget-Willamette Lowland approximately 16 miles north of Portland, Oregon. The Lowland extends from Puget Sound into west-central Oregon, and lies between the Cascade Range to the east and the Coast Range to the west. The physiography of the region is dominantly a nearly flat, modestly dissected surface developed on basin-fill sediments from the late Miocene and younger (USGS, 2004a).

TOPOGRAPHY

The La Center Interchange Site lies within the northern region of the Portland Basin, described below, and near the confluence of the Lewis River and the Lower Columbia River. The topography of the area is generally level due to agricultural grading and road construction modifications. The project site has gentle slopes in the southeast quadrant; however, the slopes in the remaining three quadrants transition from gentle slopes at the top of the hill to steep slopes adjacent to the unnamed stream. The slopes range from approximately 0% to 40%, with 95% of the project site ranging from 0% to 10% slopes. Elevations of the project area range from approximately 166 feet above mean sea level (amsl) in the northeast corner of the site to 265 feet amsl at NW 319th Street. **Figure 3.2-1** shows the elevation contours of the project site.

GEOLOGIC SETTING

The project site lies within the northern region of the Portland Basin, which is a structural depression in the central Puget-Willamette Lowland. The Portland Basin is the northernmost of several sediment-filled structural basins that collectively constitute the Willamette Valley segment of the Puget-Willamette Lowland.

Surficial deposits on the project site are grouped as Quaternary alluvial deposits and consist of cataclysmic flood deposits and fine-grained facies from the Pleistocene. These deposits include unconsolidated clay, silt, and fine to medium sand. The area is composed largely of quartz, feldspar, and conspicuous muscovite, which indicate deposition by the Columbia River rather than by local streams.

Quaternary alluvial sedimentation occurred in the region due to climatic variation, including mountain glaciation, sea-level fluctuation, and inundation by great Missoula Floods. Episodes of cataclysmic flooding during the last glacial maximum in late Pleistocene time were the result of ice dam failure in Glacial Lake Missoula, which released floods that coursed down the Columbia River

Figure 3.2-1

into the Portland Basin (USGS, 2004a). During each flood, suspended loads of fine sand and silt settled out of the temporarily ponded floodwaters, collectively building up deposits of laminated micaceous sediments.

SOILS

Project Area Soils

In the *Geotechnical Feasibility Study – La Center Casino* prepared by Geocon Northwest (Attachment 7 to **Appendix F**, Vol. I of the DEIS), the subsurface conditions of the La Center Interchange Site were found to consist of the following:

A. Topsoil – approximately 5 inches of organic root mat with a tilled zone extending approximately 18 inches from the surface.
B. Silt – below the tilled zone, a deposit of silt with variable percentages of clay and sand extends to approximately 12.5 feet below the surface. In general, the silt zone is stiff in the upper 5 feet with an underlying softer layer.
C. Clay – below the silt, a stiff to very stiff clay layer extends to a depth of between 23 and over 42 feet below the surface. In some locations, gravel is present within the clay layer.
D. Sandy Silt – below the clay, a stiff deposit of sandy silt exists. Total depth of the sandy silt was not determined by the on-site testing.

As seen in the soil profile, the predominant soil types on site consist of silts and clays. Due to the small particle sizes of silts and clays, stormwater runoff that flows over these soils often results in highly turbid water, which is not amenable to treatment by settling. This is not only due to the low relative density of the particles, but also to their electro-charged surfaces, which discourage aggregation (Olson Engineering, 2006a).

During the Geotechnical Study prepared by Geocon Northwest (Attachment 7 to **Appendix F**, Vol. I of the DEIS) groundwater was encountered at depths ranging from 2 feet to over 15 feet. Therefore, groundwater seepage could occur during excavation due to the tight nature of the soil. Due to the high groundwater and nature of the soil, optimum moisture contents were found to range from approximately 10% to 15% above optimum soil moisture content for compaction (Olson Engineering, 2006b).

The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), has mapped the project area as being underlain by three main soil types: Gee Silt Loam (GeB, GeD, GeE, GeF), Odne Silt Loam (OdB), and Cove Silty Clay Loam (CvA). **Figure 3.2-2** displays these soils in relation to the project area. A brief description of each soil type is listed below.

Figure 3.2-2

Gee Silt Loam

- **GeB** – The slopes of GeB are moderate to short and are undulating, ranging from 0% to 8% slope. These soils have a slow runoff and moderate permeability. In a typical profile, the surface layer of GeB is very dark grayish-brown silt loam about 9 inches thick. The subsurface layer is dark grayish-brown silt loam about 5 inches thick. Below this is mottled, dark grayish-brown and dark-brown silt loam about 8 inches thick. The next layer, to a depth of 72 inches, is firm mottled, dark brown silty clay loam. Approximately 73% of the project site contains this soil, which is considered prime farmland as classified by the NRCS. NRCS farmland categories are explained in further detail in **Section 3.9,** Land Use. Prime farmland is considered to have the best possible features to sustain long-term productivity.
- **GeD** – This soil is similar to GeB except that the surface layer is 1 to 3 inches thinner. Sidehill seeps are common on these slopes in winter and spring. Surface runoff is medium, and the erosion hazard is moderate. Less than 1% of the project site contains this soil along the northwestern boundary of the property. This soil is of Statewide importance as classified by the NRCS. Farmland of statewide importance includes farmland similar to prime farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture.
- **GeE** – This soil is similar to GeB except that the surface layers of GeE are 2 to 4 inches thinner and the slope ranges from 20% to 30%. Surface runoff is medium to rapid and the erosion hazard is moderate to severe if the surface is left bare. Approximately 1% of the project site contains this soil along the western boundary of the property.
- **GeF** – This soil is similar to GeB except that the surface layers of GeF are 2 to 4 inches thinner and the slope ranges from 30% to 60%. Surface runoff is medium to very rapid, and the erosion hazard is moderate to very severe if the surface is left bare. Approximately 3% of the project site contains this soil along the northwestern boundary of the property.

Odne Silt Loam

- **OdB** – This soil is generally found in concave areas such as drainageways or depressions within areas of Gee soils. In most places, the slope is 1%, but can range from a 0% to 5% slope. These soils have a slow runoff and moderate permeability. OdB soils are loamy soils underlain by compact subsoil at a depth of 16 to 24 inches. Due to poor drainage and slow permeability, the compact subsoil limits effective root penetration to a depth of less than 30 inches. A typical profile of the surface layer is about 10 inches thick. It is mottled, dark-gray silty clay loam in the lower part. The subsurface layer is firm, mottled, gray silt loam about 9 inches thick. The next 8 inches are of very firm, mottled, dark gray silty clay loam that overlies 6 inches of firm, mottled, dark gray clay loam. Below this, to a depth of 50 inches, is mottled dark-gray loam. Approximately 21% of the La Center Interchange Site contains this soil.

Cove Silty Clay Loam

- **CvA** – This soil has a slope ranging from 0 to 3% and is commonly found in concave drainageways and in large, flat, old lakebeds. This soil is poorly drained and very slowly permeable, often creating ponding in winter unless drainage is provided. Tillage is difficult and the available water capacity and fertility are low. No hazard of erosion exists. A typical profile of the surface layer is very dark gray silty clay about 4 inches thick. Below this is firm clay about 32 inches thick. It is black in the upper part and very dark gray and mottled in the lower part. The underlying material, to a depth of 54 inches, is mottled, light olive-gray gravelly silty clay loam. Approximately 1% of the La Center Interchange Site contains this soil type along the southwestern boundary of the property.

Clark County Soils Survey

The NRCS published a separate Land Capability Classification System soils survey for Clark County in 2004. In this soil survey, soils are grouped according to Soils Capability Class. A Soils Capability Class indicates limitations for practical use for food, fiber, or forage production. Classes are designated by Roman numerals I through VIII, with additional coding by subclass indicated by lower case letters. Class I is the least restricted with Class VIII being severely limited and nearly precluded from use for commercial crop production. Prime farmland soils are those located on land that has a combination of physical and chemical characteristics best suited to produce forage, feed, food, and other crops.

Based on information from the NRCS Clark County Soils Survey (2004), Soils Capability Classes on the project site range from III to VI. The Soils Capability Classes are defined in **Table 3.2-1** for the soils occurring on the La Center Interchange Site.

SEISMIC CONSIDERATIONS

The State of Washington is situated at a convergent continental margin, which is the collisional boundary between two tectonic plates. More than 1,000 earthquakes occur in the State annually, and at least 20 damaging earthquakes have occurred in Washington during the past 125 years. Within Washington, the Cascade Range is the foundation of an active volcanic arc associated with the under-thrusting of oceanic lithosphere beneath North America along the Cascadia subduction zone. The Cascadia subduction zone, which is the convergent boundary between the North American plate and the Juan de Fuca plate, lies approximately 750 miles offshore to the west of Clark County. The two plates are converging at a rate of about 3 to 4 centimeters (cm) per year. In addition, the northward-moving Pacific plate is pushing the Juan de Fuca plate north, causing complex seismic strain to accumulate and abruptly release in the form of earthquakes.

TABLE 3.2-1
LA CENTER INTERCHANGE SITE SOIL LIMITATIONS

SOILS	FACTOR					
	Depth	**Permeability**	**Drainage**	**Erosion**	**Runoff**	**Capability Class**
Cove (CvA) 0-3% slope	Nearly level	Very slow	Poor to very poor	No hazard	Slow to ponded	Vw-1
Gee (GeB) 0-8% slope	Deep	Slow to very slow	Moderate to well	Slight	Slow	IIIe-4
Gee (GeD) 10-20% slope	Deep	Moderate to very slow	Somewhat poor to well drained	Slight to moderate	Slow to medium	IIIe-1
Gee (GeE) 20-30% slope	Deep	Moderate to very slow	Moderate to well	Moderate to severe	Medium to rapid	IVe-4
Gee (GeF) 30-60% slope	Moderate to deep	Very slow to very rapid	Moderately well to excessive	Moderate to severe	Medium to rapid	VIe-3
Odne (OdB) 0-5% slope	Deep	Very slow	Poor	No hazard	Slow to very slow	IVw-1

NOTES: Capability Classes: Class I soils have few limitations that restrict their use, Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices, Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both, Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both, Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use, Class VI soils have severe limitations that make them generally unsuitable for cultivation, Class VII soils have very severe limitations that make them unsuitable for cultivation. Capability subclasses: (e) main limitation is risk of erosion unless close-growing plant cover is maintained, (w) water in or on the soil interferes with plant growth or cultivation. Capability units: (1) soil character, (3) degree of artificial ground modification, (4) degree of slope.

Source: NRCS, 2004.

The La Center Interchange Site is located within the Portland Basin, which has been interpreted as a pull-apart basin located in the releasing step-over between two right-lateral fault zones. These fault zones are thought to reflect regional transpression and dextral shear within the Coast Range in response to oblique subduction along the Cascadia subduction zone (USGS, 2004b). Measurements of seismic intensity, seismic magnitude, liquefaction, and lateral spreading associated with these fault zones are described below. Seismic hazards corresponding to the measurements are discussed thereafter.

Seismic Intensity: the Modified Mercalli Intensity Scale

Seismic intensity is a measure of the strength of shaking experienced in an earthquake. The Modified Mercalli Intensity Scale (MMIS) is a common measure of earthquake effects due to ground shaking intensity. The MMIS is an arbitrary ranking of intensity based on observed effects from an earthquake and does not have a mathematical basis. The MMIS is composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, expressed by Roman numerals (**Table 3.2-2**). The "intensity" reported generally decreases the farther the location is removed from the earthquake epicenter. The lower numbers of the MMIS generally describe the manner in which people feel the earthquake. The higher numbers of the scale define observed

TABLE 3.2-2
MODIFIED MERCALLI INTENSITY SCALE

Intensity Value	Intensity Description	Average Peak Acceleration
I.	Not felt except by a very few persons under especially favorable circumstances.	< 0.0015 g
II.	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.	< 0.0015 g
III.	Felt quite noticeably indoors, especially on upper floors of buildings, but many persons do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.	< 0.0015 g
IV.	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.	0.015 g-0.02 g
V.	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.	0.03 g-0.04 g
VI.	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.	0.06 g-0.07 g
VII.	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.	0.10 g-0.15 g
VIII.	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motorcars disturbed.	0.25 g-0.30 g
IX.	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.50 g-0.55 g
X.	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	> 0.60 g
XI.	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 0.60 g
XII.	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 0.60 g

NOTES:
g is gravity = 980 centimeters per second squared.

Source: Bolt, 1988.

structural damage that could accompany an earthquake (USGS, 1989). Intensities ranging from IV to X could cause moderate to significant structural damage.

The damage level represents the estimated overall level of damage that will occur for various MMIS intensity levels. The damage, however, will not be uniform. Some buildings will experience substantially more damage than this overall level, and others will experience substantially less damage. The age, material, type, method of construction, size, and shape of a building all affect its performance (ABAG, 1998). In addition, geologic factors of a particular site strongly influence the intensity of an earthquake – sites on soft ground or alluvium experience intensities two to three values higher than sites on bedrock (USGS, 1997). Maximum peak ground acceleration intensities at both the La Center Interchange and Ridgefield Interchange Sites are expected to cause MMIS VII ground shaking. Ground shaking effects of this intensity include moderate structural damage to ordinary buildings, but negligible damage to buildings of good design and construction.

Magnitude: The Richter Magnitude Scale

The Richter scale is the best known scale for measuring the magnitude of earthquakes. The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. The Richter scale is not used to express damage.

Since the Richter scale has a logarithmic base, an earthquake with a recording of magnitude 7 signifies a disturbance with ground motion 10 times as large as an earthquake with a recording of magnitude 6. However, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value. Richter's original methodology is no longer used because it does not give reliable results when applied to earthquakes with a magnitude greater than 7 and it was not designed for earthquakes recorded with epicenters 600 kilometers away or farther. A "moment magnitude" scale is currently used by seismologists to provide a measure that differentiates between the largest earthquakes and was designed to be consistent with the Richter scale. Consequently, the relative Richter scale is still used but more precise measurements such as the moment magnitude are now used to calculate the magnitude of an earth-shaking event (USGS, 2003).

Liquefaction

Soil liquefaction can occur in seismic conditions. Liquefaction is the temporary transformation of saturated, non-cohesive material from a relatively stable, solid condition to a liquefied state as a result of increased soil pore water pressure. Soil pore water pressure is the water pressure between soil particles. Liquefaction can occur if three factors are present: seismic activity, loose sand or silt, and shallow ground water. Liquefaction potential has been found to be greatest where the groundwater is within a depth of 50 feet or less, and submerged loose, fine sands occur within that depth. Liquefaction potential decreases with increasing grain size and clay and gravel content, but increases as the ground acceleration and duration of shaking increases.

According to the Washington State Department of Natural Resources (WSDNR), Division of Geology and Earth Resources (DGER), the La Center Interchange Site and surrounding vicinity have a low to very low susceptibility to liquefaction (WSDNR, 2003). However, the WSDNR maps are regional and may not be suitable for site-specific analysis. Subsurface testing at the La Center Interchange Site, documented in the Geotechnical Study prepared by Geocon Northwest (Attachment 7 to **Appendix F**, Vol. I of the DEIS), reveals soils to be a matrix of silty loam with a high moisture content, and an intermediate layer of stiff clay. Piezometer testing shows shallow groundwater. Three borings were made, revealing groundwater at depths of 2.6 feet, 2.8 feet and 7.5 feet.

Liquefaction potential is considered in terms of the magnitude of a seismic event. The site-specific conditions lend liquefaction susceptibility to the La Center Interchange Site in a seismic event of magnitude 10.0 or greater. The St. Helens Fault Zone (SHZ) passes under Mount St. Helens, 40 miles to the northeast of the La Center Interchange Site. A gap and a step in the SHZ under Mount St. Helens causes the crust to pull apart inside the gap, creating a zone of weakness where volcanic material can reach the surface. Scientists predict that the St. Helens Seismic Zone in the Southern Washington Cascade Mountains is capable of producing an earthquake with a magnitude of approximately 7.0 on the Richter scale (WDGER, 2005), which would be reduced through attenuation over 40 miles. Since a maximum moment magnitude of 10.0 is not predicted on-site, WSDNR's assessment is confirmed when considering regional seismic characteristics in addition to site-specific soil and groundwater conditions. Therefore, the La Center Interchange Site and surrounding vicinity have a low to very low liquefaction susceptibility.

Lateral Spreading

Lateral spreading typically occurs during a seismic event in the form of horizontal ground displacement toward an open face, and is typical where the ground surface is relatively flat, and comprised of alluvium or depositional sediment. This movement in soils is generally due to failure along a weak sublayer that is formed within an underlying liquefied layer. Cracks develop within the weakened material, while blocks of soil move laterally toward the free face.

Site Seismicity

The closest active fault or fault zone to the La Center Interchange Site is the Lacamas Lake Fault, located about 10 miles west-southwest. Seismic reflection of the Lacamas Lake Fault suggests that the most recent seismic event predates the latest Pleistocene age of great Missoula Floods deposits in the area. Scientists have concluded that the Lacamas Lake Fault is potentially active and have mapped the fault as a possible seismogenic fault (Personius, 2002b). The Portland Hills Fault is located approximately 15 miles southwest and is also considered potentially active (USGS, 2004b).

In addition, recent research has identified seismic conditions related to the nearby Cascadia subduction zone (WDGER, 2005). Known as inter-plate earthquakes, these occur along the interface between tectonic plates. Evidence for earthquakes of considerable magnitude along the Cascadia subduction zone has been brought forward in recent research (WDGER, 2005). Such earthquakes are evidenced to be of magnitudes potentially higher than 9.0 on the Richter scale, and to occur every 550 years on average. Recurrence intervals appear to be irregular. Some events are suggested to have been spaced at approximately 100 years, while others had a 1,100 year spread. The most recent event originating at the Cascadia subduction zone reportedly affected Washington approximately 300 years before present (BP).

Clark County was previously classified as being within Zone 2B of the Uniform Building Code (UBC) until recent studies indicated that a greater potential exists for seismic activity in the region. To accommodate the increased threat, the State of Washington adopted a more stringent requirement that construction meet Zone 3B seismic safety requirements (Clark County, 2003). As noted above, the St. Helens Seismic Zone in the Southern Washington Cascade Mountains is capable of producing an earthquake with a magnitude of approximately 7.0 on the Richter scale, which would be reduced through attenuation over 40 miles.

VOLCANIC HAZARD

Future volcanic activity that may affect the project site is confined to Mount St. Helens. Mount St. Helens has deposited large quantities of volcanic debris into the Lewis River valley and its tributaries throughout its 50,000-year history. Tephra is a general term for fragments of volcanic rock and lava regardless of size that are blasted into the air by explosions or carried upward by hot gases in eruption columns or lava fountains. Major hazards of tephra fall are the impact of falling fragments, suspension of abrasive fine particles in the air and water, and the burial of structures, transportation routes, and vegetation (USGS, 1995). According to USGS Volcanic-Hazard Zonation for Mount St. Helens, Washington (1995), the percentage probability of accumulation of 10 or more centimeters of tephra from a large eruption is between 1% and 2%. No hazard of pyroclastic flow from Mount St. Helens exists for the project site due to its removed distance.

MINERAL RESOURCES

The geology of the region consists essentially of four major groups of deposits: Paleogene bedrock, middle Miocene lava flows of the Columbia River Basalt Group, late Miocene to Pliocene alluvial sedimentary rocks that previous researchers have assigned to the Troutdale Formation, and Quaternary deposits (USGS, 2004a). The mineralogical profile described here supports mineral resources limited to non-metallic industrial materials, chiefly sand and gravel used for construction purposes. Abundant sand and gravel resources are available from unconsolidated alluvial deposits along the East Fork Lewis River, and from large gravel pits that have been excavated in the reach of the river above River Mile 7 (USGS, 2004a). No mining activity has been reported on or in the vicinity of the La Center Interchange or Ridgefield Interchange Sites.

No identified mineral resources (i.e., gravel and/or sand) exist within the La Center Interchange Site other than the soils identified above (Clark County, 2003).

3.2.2 SETTING – RIDGEFIELD INTERCHANGE SITE

TOPOGRAPHY

The Ridgefield Interchange Site lies on moderately level slopes in the flat alluvial valley of the East Fork Lewis River. The topography of the area is generally level due to agricultural grading and road construction modifications. The project site has gentle slopes with the majority of the site sloping towards the drainage course that runs through the site from the southeast corner to the northwest corner. The steeper gradients are situated along the east and west sides of the drainage course. Elevations of the project area range from approximately 250 feet to 300 feet amsl. **Figure 3.2-3** shows the elevation contours of the Ridgefield Interchange Site.

GEOLOGIC SETTING

The Ridgefield Interchange Site is located 2 miles south of the La Center Interchange Site and also lies within the northern region of the Portland Basin within the Puget-Willamette Lowland. Surficial deposits on the Ridgefield Interchange Site are similar to those found on the La Center Interchange Site and also consist of cataclysmic flood deposits and fine-grained facies (Quaternary deposits) from the Pleistocene period (USGS, 2004a).

SOILS

Project Area Soils

The USDA NRCS has mapped the project area as being underlain by three main soil types: Gee Silt Loam (GeB), Odne Silt Loam (OdB), and Hillsboro soils (HoB, HoA, and HlA). **Figure 3.2-4** displays these soils in relation to the Ridgefield Interchange Site. Brief descriptions of Gee Silt

Figure 3.2-3

Figure 3.2-4

Loams and Odne Silt Loams are included in **Section 3.2.1**. Descriptions of the three Hillsboro soils occurring on the Ridgefield Interchange Site are listed below.

Hillsboro Silt Loam

- **HoB** – This soil has a slope ranging from 3% to 8% and is the dominant soil in the southwestern part of the County. The relief is gently undulating, and the soil is well drained, moderately permeable, and easily tilled. Surface runoff is slow, and the erosion hazard is slight. In a typical profile the surface layer is dark brown silt loam about 7 inches thick. The next layer is about 48 inches thick. In sequence from the top, the upper 17 inches are friable, dark-brown silt loam; the next 16 inches are friable, dark grayish-brown heavy silt loam; and the lower 15 inches are friable, dark grayish-brown silt loam. The next layer, to a depth of 86 inches, is dark grayish-brown silt loam. Approximately 7% of the Ridgefield Interchange Site contains this soil on the northern boundary of the property.
- **HoA** – This soil has a slope ranging from 0% to 3% and is very similar to HoB. Surface runoff is very slow, and no hazard of erosion exists. Approximately 5% of the Ridgefield Interchange Site contains this soil on the northern boundary of the property. This soil is considered prime farmland as classified by the NRCS.

Hillsboro Loam

- **HlA** – This soil has 0% to 3% slopes and is similar to HoB, except that the surface layer is 1 to 3 inches thicker, and the texture is loam to a depth of about 36 inches, sandy loam between a depth of 36 and 48 inches, and sand between a depth of 48 and 62 inches. Surface runoff is very slow, and the hazard of erosion is none to slight. Less than 1% of this soil occupies the Ridgefield Interchange Site. This soil is considered prime farmland as classified by the NRCS.

Clark County Soil Survey

The capability classes occurring on the Ridgefield Interchange Site are defined in **Table 3.2-3.** Soils Capability Classes on the Ridgefield Interchange Site range from I to IV (NRCS, 2004). **Section 3.9,** Land Use discusses agricultural land associated with the Ridgefield Interchange Site.

SEISMICITY

Seismic hazards at the Ridgefield Interchange Site are similar to those of the La Center Interchange Site due to their close proximity. The closest active faults or fault zones are the same as those found for the La Center Interchange Site. The Lacamas Lake Fault is the closest known fault zone, located approximately 10 miles west-southwest. The Portland Fault is located approximately 15 miles southwest and the Cascadia Subduction Zone is located approximately 750 miles offshore to the west.

TABLE 3.2-3
RIDGEFIELD INTERCHANGE SITE SOIL LIMITATIONS

SOILS	FACTOR					
	Depth	**Permeability**	**Drainage**	**Erosion**	**Runoff**	**Capability Class**
Gee (GeB) 0-8% slope	Deep	Slow to very slow	Moderate to well	Slight	Slow	IIIe-4
Odne (OdB) 0-5% slope	Deep	Very slow	Poor	No hazard	Slow to very slow	IVw-1
Hillsboro (HoB) 3-8% slope	Deep	Moderate	Well	Slight	Slow	IIe-1
Hillsboro (HoA) 0-3% slope	Deep	Moderate	Well	None to Slight	Very Slow	I-2
Hillsboro [Silt] (HIA) 0-3% slope	Deep	Moderate	Well	None to Slight	Very Slow	I-2

NOTES: See **Table 3.2-1** for Notes.

Source: NRCS, 2004.

Clark County was classified within Zone 2B of the UBC, which means that there is a probability of a major earthquake (Clark County, 2003). Recent studies indicate a greater potential for seismic activity in the region than was previously thought, and the State of Washington has adopted a requirement that construction meet Zone 3B seismic safety requirements.

Soil liquefaction may also occur in seismic conditions. However, as described above for the La Center Interchange Site, the surrounding vicinity, which includes the Ridgefield Interchange Site, has a low to very low susceptibility to liquefaction (WSDNR, 2003).

VOLCANIC HAZARD

Future volcanic activity that may affect the Ridgefield Interchange Site is confined to Mount St. Helens, which could possibly deposit large quantities of volcanic debris in the form of tephra during a major eruption. Hazards associated with tephra fall are the impact of falling fragments, suspension of abrasive fine particles in the air and water, and the burial of structures, transportation routes, and vegetation (USGS, 1995). According to USGS Volcanic-Hazard Zonation for Mount St. Helens, Washington (1995), the percentage probability of accumulation of ten or more centimeters of tephra from a large eruption is between 1% and 2%. No hazard of pyroclastic flow from Mount St. Helens exists for the Ridgefield Interchange Site due to its removed distance.

MINERAL RESOURCES

No identified mineral resources (i.e., gravel and/or sand) exist within the Ridgefield Interchange Site other than the soils identified above (Clark County, 2003).