2.0 Earth Resources

2.1 Setting Overview

Clark County is located along the western flank of the Cascade mountain range primarily within what is known as the lowlands of the Willamette-Puget Trough which sits between the Cascade Range to the east and the Coastal Range to the west. The general topography is characterized by upland foothill areas to the east that slope down toward the south and west toward the Columbia River.

Columbia River

photo courtesy Rod Orlando

The geology of the county is predominantly comprised of volcanic lava flows but also include sedimentary rock layers in the foothills of the Cascades as well as beneath the unconsolidated deposits of the lowland areas. The unconsolidated deposits include alluvial and fluvial materials along with some lake deposits and glacial drift. The oldest unit of unconsolidated materials is known as the Troutdale formation which consists chiefly of clay, silt, and fine sand with some areas of coarser sand and occasional gravel deposits. The upper member of the Troutdale formation consists of lightly to moderately cemented gravel. Basaltic lava flows overlie areas of the Troutdale formation and found largely in the foothills area with rocks that are generally heavily weathered. In the alluvial plains which include most of the farmland areas of the county, consist primarily of silt, sand, and gravel.

The coastline of the entire northwest is bordered by an active subduction zone where the Juan de Fuca plate is subducting, or being pushed, beneath the North American plate. Currently, the subduction zone is considered locked (that is, it is not slipping). Strain is therefore accumulating on the locked interface between the plates which can potentially be released at some point in the form of a significant earthquake. A rupture of the Cascadia subduction zone could occur in what is known as megathrust fault. The last rupture was on January 26, 1700. Geologic evidence suggests that the average recurrence of a magnitude 9.0 earthquakes along the Cascadia megathrust is about 500 years, but recurrence intervals vary, ranging from about 250 years to over 1,000 years. The effects of these earthquakes include strong ground shaking that goes on for several minutes, subsidence and/or uplift of coastal areas, liquefaction, and the triggering of landslides. Aftershocks can be both strong and numerous (possibly magnitude 7 or higher).

Soils of the county are based on the soil classification system developed by the Natural Resource Conservation Service (NRCS) completed by the NRCS in 1972. Since soil does not change rapidly, information from the 1972 survey can still be considered reliable, and as a result the findings presented in the 2007 FEIS findings would still be valid today.

The NRCS has classified the soils of Clark County into eight major soil associations:

- Sauvie-Puyallup, found in the bottomlands and flood plains;
- Hillsboro-Gee-Odne, Hillsboro-Dollar-Cove, and Lauren-Sifton-Wind River, found in terraces;
- Hesson-Olequa and Hesson-Olympic, found in uplands; and
- Cinebar-Yacolt and Olympic-Kinney, found in the foothills.

These soil associations have been further classified according to their ability to support different types of land uses, including urban development, agriculture and silviculture. The 1972 soil survey classifies some soils as having limitations to foundations, however it should be noted that there is an assumption that "the limitation ratings for residential foundations are for undisturbed soil and not for layers that have been mixed or reworked for fill material" (NRCS, 1972). In addition, according to the NRCS mapping and soil classifications, it is apparent that most of the county has some type of soil limitation related to septic systems. All septic systems within the county are reviewed prior to permitting by Clark County to ensure that they would function appropriately and that no contamination of surface or ground water is likely to occur.

Figure 2-1 shows agricultural soil capability in the county which remains based on the NRCS data from 1972 and unchanged from the analysis in the 2007 EIS. In general, much of the County contains prime farmland with scattered areas considered to be farmland of statewide importance. Figure 2-2 shows forest soil capability. The best soils for a wide range of agricultural uses are located in the lowlands along rivers, areas that have already received substantial urban development. Special crops, such as vineyards, may be grown on land with other than prime agricultural soils.

2.1.1 What has changed since 2007?

Geologic and Soil Conditions

In general, there has been no change to the soil or geologic conditions of the county since 2007. No new soil data has been released since 2007 that changes the general understanding of the soil conditions or surface geology in the county. In addition, seismic hazards are still present throughout the county and older structures built to outdated building codes are still the most vulnerable to damage and possible collapse. Countywide mapping shows liquefaction hazards remain concentrated in the flatland areas in the western part of the county, largely adjacent to surface waters and their flood zone areas due to associated high groundwater levels and potential coarse sandy deposits that can be susceptible to liquefaction. Landslide hazards, however, are more likely present in upland areas in the eastern part of the county, consistent with findings from 2007.

2.2 Environmental Impacts

2.2.1 What methodology was used to analyze impacts to earth resources from each of the alternatives?

The potential impacts related to earth resources (i.e., soils and geology including geotechnical and seismic hazards) were based on existing conditions and identified hazards that have been mapped throughout the county by the NRCS and the Washington Division of Geology and Earth Resources.

2.2.2 What are the impacts to earth resources from each alternative?

Alternative 1 – No Action Alternative

As described in the 2007 FEIS, the County includes areas where existing soil conditions are not suitable for development without implementing geotechnical methods such as conditioning of site soils, removal of weak soils, placement of engineered fill, and foundation design in order to prevent damage. Other hazards to development including unstable and steep slopes susceptible to landslides, groundshaking hazards from seismic activity, liquefaction hazards, lands with high erosion potential, and nearby volcanic activity are also present within the County. Much of the county also contains tight soils that are

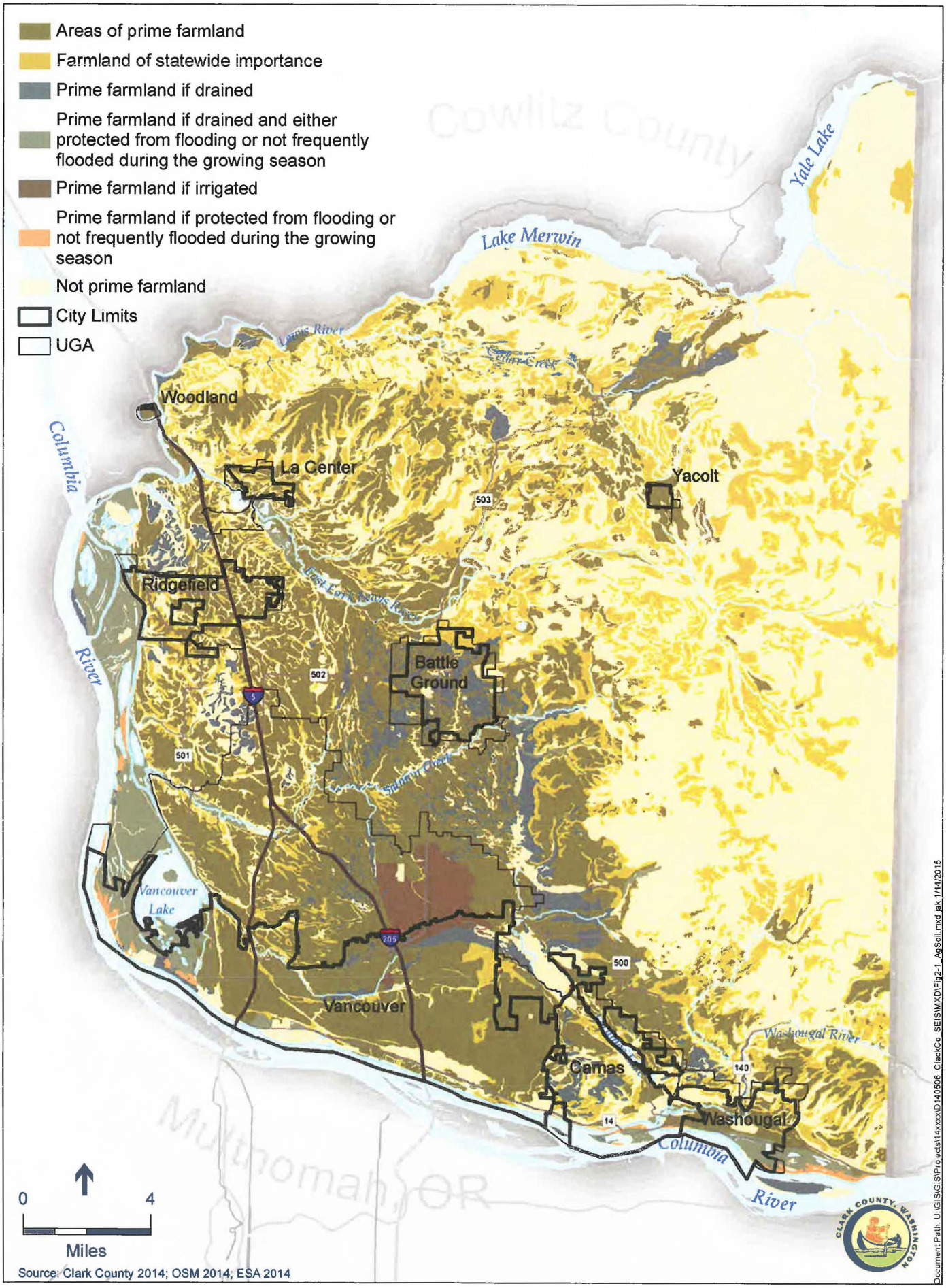

Figure 2-1: Soil Capabilities for Agricultural Use

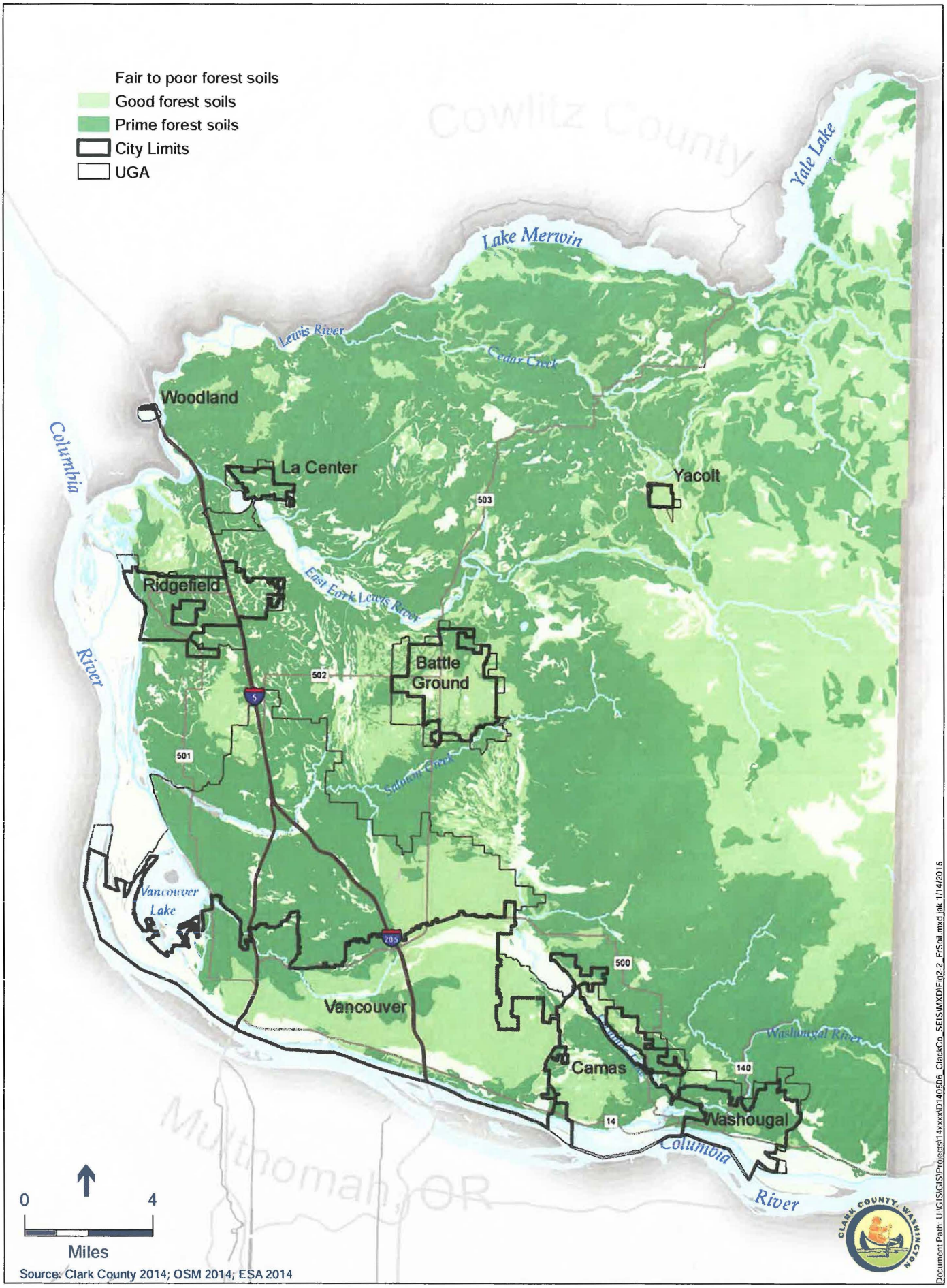

Figure 2-2: Soil Capabilities for Forest Use

not conducive to septic systems (Figure 2-3). However, with implementation of current geotechnical engineering practices in accordance with grading and building code requirements, these hazards can generally be addressed through site preparation and foundation design.

Soil characteristics also determine whether an area is particularly suited to agriculture or timber production. The GMA requires local jurisdictions to identify and protect agricultural and timber lands of long-term commercial significance. There have been no substantive changes to soils suitable for agriculture and timber with most of the western half of Clark County containing soils suitable for agriculture and nearly all of the county containing either prime or good forest soils. With no change to the UGAs under this Alternative, there would be no additional impacts related to prime soils and timber lands in addition to those identified in the 2007 FEIS.

East Fork Lewis River

photo courtesy S.Graham

Alternative 2 –Countywide Modifications

The rural and urban adjustments including policy changes, zoning changes, and growth boundary changes would overall accommodate a more moderate growth plan compared to the one adopted in 2007. As a result, there could be an overall reduction in new construction that could have been susceptible to some of the geotechnical and seismic hazards present in the County. However, some of the zoning changes that would reduce minimum lot size requirements could result in more structures in areas where these hazards (e.g., liquefaction or landslides) are present. Regardless, all construction, as noted above in Alternative 1 would be subject to grading and building code requirements which include measures to identify these hazards and provide recommendations to reduce the potential for adverse effects through implementation of geotechnical engineering techniques and practices in accordance with current building code requirements. As such, regardless of location, implementation of current grading and building code requirements would ensure that all new construction would reduce the potential for these hazards to adversely affect these improvements.

Alternative 2 would incorporate slightly reduced population growth rates which should result in reduced pressure to convert existing prime soil and forest areas. However, the reduced minimum lot areas under the revised zoning requirements create more divisible areas. Regardless, the GMA would still require local jurisdictions to identify and protect agricultural and timber lands of long-term commercial significance. Therefore, provided the reduced lot sizes do not result in conversions to other uses, there would be no additional impacts related to soils under this Alternative.

Alternative 3 – City UGA Expansion

Expansion of the city growth boundaries for Battle Ground, La Center, Ridgefield, and Washougal would result in increased development into largely undeveloped areas. Soil, geological, and seismic hazards are generally site specific and can only really be identified through site specific investigations. While hazards such as liquefaction, weak soils, and slope stability may be present in the proposed areas of expansion under this alternative, application of geotechnical measures such as site preparation through compaction of engineered fills, for example, and foundation design can reduce these hazards to less than significant levels.

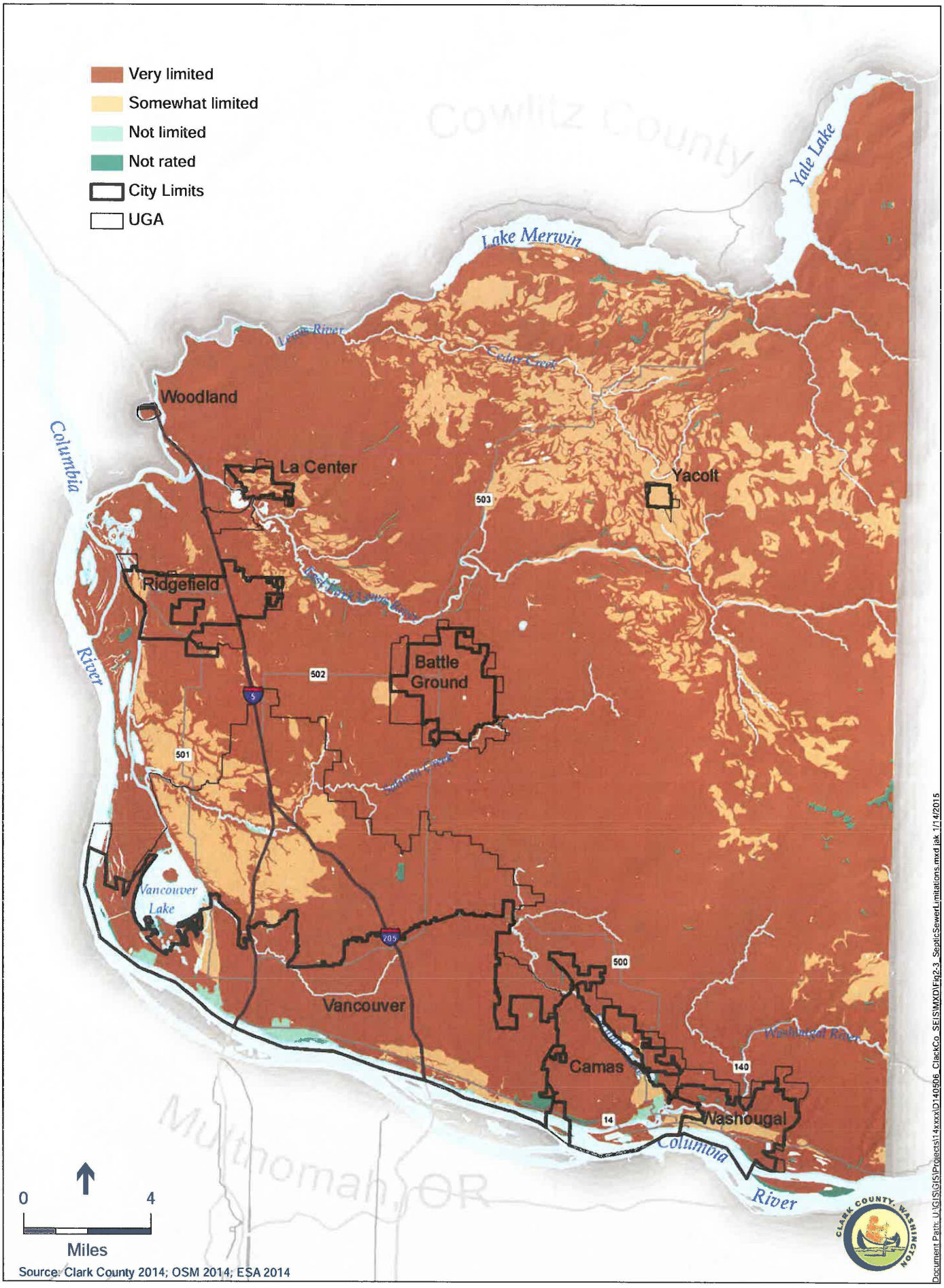

Figure 2-3: Soil Limitations to Septic Sewer Systems

Alternative 4 – Rural, Agriculture, and Forest Changes

Similar to Alternative 2, the rural and urban adjustments under this alternative include policy changes, zoning changes, and growth boundary changes to accommodate a more moderate growth plan compared to the one adopted in 2007. The creation of the "Rural Lands" designation, implemented by R-1, R-2.5, and R-5 zones, would reduce the size of most Rural zones. These reductions could result in more structures in areas where geotechnical hazards (e.g., liquefaction or landslides) are present. Regardless, all construction, as noted above in Alternative 1 would include measures to minimize these hazards through implementation of regulatory grading and building code requirements. As such, regardless of location, implementation of current grading and building code requirements would ensure that all new construction would reduce the potential for these hazards to adversely affect these improvements.

Although Alternative 4 would also incorporate reduced population growth rates compared to the 2007 plan, more lots would be created in resource lands which would increase pressure to convert existing prime soil and forest areas. Both agricultural and forest lot areas would have reductions in minimum lot size areas even further than that of Alternative 2. More divisible areas could potentially result in increased activities on these lots, but provided that reduced lot sizes do not result in conversions to other uses, there should be no substantive changes or impacts related to soils under this Alternative. The GMA still requires local jurisdictions to identify and protect agricultural and timber lands of long-term commercial significance.

How do the potential impacts between the alternatives compare?

Alternative 1 assumes a rate of growth that is higher than those provided in both Alternatives 2, 3 and 4, so in terms of proposed development, the risks and constraints of the county's earth resources would generally be reduced for Alternatives 2, 3, and 4. However, the proposed changes in zoning under Alternatives 2 and 4 could put pressure on prime soils and forest areas with the reduction of minimum lot sizes, more so with Alternative 4. Local protections of these land uses would still remain. Alternative 3 proposes expansion of UGAs for Battle Ground, La Center, Ridgefield, and Washougal, which contain areas considered to have weak soils for foundations. High landslide areas are found in all UGAs, but mostly within the La Center and Ridgefield UGAs. Implementation of grading and building code requirements are typically sufficient to provide foundation design that can minimize any damage that may occur as a result of the presence of these hazards.

Table 2-1 summarizes the earth resources impacts of the alternatives.

Table 2-1. Summary of Earth Resources Impacts by Alternative

Alternative 1 - No Action	Alternative 2 - Countywide Modifications	Alternative 3 - City UGA Expansion	Alternative 4 - Rural, Agriculture, and Forest Changes
Assumes higher rate of growth than Alternatives 2, 3 & 4, but all within currently developed areas and UGAs.	Second highest potential for impacts. Changes in zoning could put pressure on prime soils and forest areas with the reduction of minimum lot sizes. Local protections of these land uses would still remain. Individual projects on upzoned parcels could have individually small but cumulatively moderate impacts on prime soils and forest areas.	High hazard areas in proposed UGA expansion areas. Implementation of grading and building code requirements would provide mitigation.	Highest potential for impacts of all alternatives. Changes in zoning could put pressure on prime soils and forest areas with the reduction of minimum lot sizes. Local protections of these land uses would still remain. Individual projects on upzoned parcels could have individually small but cumulatively moderate impacts on prime soils and forest areas.

2.2.3 Are there adverse impacts that cannot be avoided?

Any new construction would be designed and built in accordance with current building code standards and seismic design criteria.

2.3 Mitigation

2.3.1 Are there mitigation measures beyond regulations that reduce the potential for impacts?

Compliance with project-specific SEPA conditions, if applicable, would mitigate potential impacts from individual development proposals. Proposals would also be required to comply with existing excavation, grading and building permits, as well as critical areas ordinances and other development codes.