



TO: Thurston County Planning Commission

FROM: Claire Swearingen, Associate Planner

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SUBJECT: Geologically Hazardous Areas: BAS and Concepts

Introduction

This memo provides background on geologic hazard areas to support the Planning Commission's upcoming work sessions. Geologic hazard areas are locations where the conditions or structure of the soil or earth create a potential hazard for people and property. They are one of five categories of critical areas that the County regulates in its Critical Areas Ordinance (CAO).

These areas may be at risk for landslides, erosion, volcanic lahar flows, or seismic soil liquefaction. Some development is allowed in volcanic and seismic hazard areas, but it is limited and conditioned in order to protect human safety. Development in areas made potentially hazardous by mining activity requires technical reports and must meet additional requirements to ensure safety. Development near marine bluffs and other landslide hazard areas is protected by preserving an undisturbed vegetated buffer to ensure slope stability.

The Washington Department of Natural Resources (WA DNR) is the primary source of state guidance for geologically hazardous areas. Other agencies, such as the US Geological Survey (USGS) and Thurston Regional Planning Council (TRPC) also publish relevant documents. Many of the most important publications for geologically hazardous areas are in the form of GIS mapping resources, but other studies and hazard or resiliency plans are also important.

For these areas, regulating development through the CAO is one piece of a larger natural hazards mitigation effort to protect people from landslides, earthquakes, mine hazards, and volcanic hazards. Newly published mapping resources from DNR include a LiDAR-based landslide map, which displays areas previously affected by landslides or at risk for future landslides with a very high level of accuracy and precision. Because regulating geologically hazardous areas relies so heavily on GIS mapping, it's important that the CAO refer to the most accurate and precise mapping resources available.

The CAO should also reflect hazard mitigation efforts, such as TRPCs *Hazard Mitigation Plan for the Thurston Region*, which includes hazard assessments for earthquakes, landslides, and volcanic lahar events. Another important aspect for regulating geologic hazards is planning for the effects of climate change. The severity and frequency of landslides can be affected by sea level rise, intense heavy rainfall events, and wildfires, all of which are natural events connected to climate change. This issue is reflected in WA DNR's *Plan for Climate Resilience*, and by ensuring that the CAO reflect the most up-to-date mapping and risk assessments from WA

DNR, we can ensure improved safety for Thurston County residents at risk of adverse effects from climate change.

2 Definitions

The definitions below are based on the current CAO to provide context for this report. These definitions could be subject to change as part of the CAO update process.

2.1 Erosion Hazard Areas

Erosion hazard areas are land characterized by soil types that are subject to severe erosion when disturbed. These include, but are not limited to, those identified by the United States Department of Agriculture Soil Conservation Service Soil Classification System with a water erosion hazard of "severe" or "high." These areas may not be highly erodible until or unless the soil is disturbed by activities such as clearing or grading.

2.2 Landslide Hazard Areas

Landslide hazard areas generally include areas which are potentially subject to risk of landslide due to a combination of geologic, topographic, and/or hydrologic factors; and where the vertical height is fifteen feet or more, excluding those wholly manmade slopes created under the design and inspection of a geotechnical professional. The following areas, at a minimum, are considered to be subject to landslide hazards:

A. Any area with a combination of:

1. Slopes of fifteen percent or steeper; and
2. Impermeable subsurface material (typically silt and clay), frequently interbedded with granular soils (predominantly sand and gravel); and
3. Springs or seeping groundwater during the wet season;

B. Slopes of forty percent or greater;

C. Any areas located on a landslide feature which has shown movement during the Holocene Epoch (post glacial) or which is underlain by mass wastage debris from that period of time;

D. Known hazard areas, such as areas of historic failures, including areas of unstable, old and recent landslides;

E. Breaks between landslide hazard areas shall be considered part of the landslide hazard area under the following condition: The length of the break is twice the height or less than the height of the slope below or above the break, whichever is greater; and the combined height is fifteen feet or more. When this condition is present, the upper and lower landslide hazard areas and the break shall be combined into one landslide hazard area.

2.3 Marine Bluff Areas

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"Marine bluff" means all the shorelines of Puget Sound, excluding the Nisqually Delta which extends from Luhr Beach easterly to the center of the Nisqually River. "Marine bluff hazard area" means the following:

A. Those marine bluffs which have a vertical height of fifteen feet or more, including the upland area which lies within two hundred feet of the top of the marine bluff; or

B. Those marine bluffs mapped as "unstable"(U), "unstable recent landslide" (URS), unstable old landslide" (UOS) or "intermediate stability" (I) on the maps of the Coastal Zone Atlas of Washington; Volume 8 Thurston County (1980), including the upland area which lies within two hundred feet of the top of the marine bluff; provided that bluffs less than fifteen feet high and determined stable on an individual parcel basis by the approval authority may be excluded.

C. Known hazard areas, such as areas of historic failures or areas with active bluff retreat that exhibit continuing sloughing of bluff sediments resulting in a steep bluff face.

D. Breaks between marine bluff hazard areas shall be considered part of the marine bluff hazard area under the following condition: The length of the break is twice the height, or less, than the height of the slope below or above the break, whichever is greater, and the combined height is fifteen feet or more. When this condition is present, the upper and lower marine bluff hazard areas and the break shall be combined into one marine bluff hazard area.

E. Any other marine area that does not meet the criteria above may still be considered a landslide hazard area.

2.4 Seismic Hazard Areas

Seismic hazard areas include areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, surface faulting, settlement or soil liquefaction, such as artificial fill areas, and areas underlain by glaciolacustrine deposits and/or glacial outwash; or areas mapped as having liquefaction susceptibility by the Washington Department of Natural Resources.

2.5 Volcanic Hazard Areas

Volcanic hazard areas are areas subject to pyroclastic flows, lava flows and inundation by debris flows, mud flows or related flooding resulting from geologic or volcanic events of Mount Rainier, as mapped by United States Geological Survey. The boundaries on these maps are approximately located, and areas outside of the boundaries should not be regarded as hazard-free.

2.6 Mine Hazard Areas

Mine hazard areas are directly underlain by, adjacent to, or directly affected by mine workings such as adits (mine entrances), gangways (tunnels), drafts or air shafts.

3 Functions and Values Provided by Geologic Hazard Areas

Erosion and Environmental Factors

Many erosion hazard areas, landslide hazard areas, and coastal bluffs overlap with riparian areas, or areas of interface between land and water. These areas have a strong impact on the quality of aquatic habitats, and there are many biological and ecological processes that these areas contribute to. Erosion is a natural process that plays an important role in shaping the landscape and provides necessary sediment to streams. It can, however, be disrupted by human activity, causing unwanted or high-intensity erosion events which threaten stream health and soil stability. The impacts of erosion on soil stability can threaten human life and safety, and the safety of structures and property. Increased erosion due to landscape disturbance, vegetation removal, and increased impervious areas can threaten the quality of aquatic habitat, including necessary habitat for salmonids. Many marine bluffs also act as feeder bluffs, providing necessary sand and gravel to beaches. Feeder bluffs can be protected by avoiding development nearby, and encouraging the landward relocation of existing structures. It's important to note that many marine bluffs and other areas near bodies of water fall under the jurisdiction of the Shoreline Master Program (SMP).

Vegetation quality and cover is one of the most important landscape features for mitigating risk and impacts associated with erosion hazards. Vegetation can assist with healthy infiltration of surface stormwater into the ground, slowing the movement of stormwater runoff while stabilizing soils that may otherwise be prone to erosion. When vegetation is removed, stormwater can move quickly over exposed soil, picking up sediment and forming rills and gulleys. Vegetation also enhances slope stability to decrease the risks of hazardous erosion and landslide events. Many slope areas also provide habitat areas to a variety of species.

Protection Strategies and Permitting

Human Life, Safety, and Property

Nearly all geologically hazardous areas present a risk to human life, safety, and property. Erosion, marine bluff, mine, and landslide hazard areas are all at risk of dangerous ground failure or slide events. Seismic hazard areas become a risk in an earthquake event, when the soils could be destabilized or liquefied by the movement of an earthquake. Lahar hazard areas represent the potential paths for a lahar flow (a river of molten rock and mud) from an eruption event on Mt. Rainier (Mt. Tahoma). Scientific information, including soil inventories, LiDAR maps, and case studies of other hazard events such as the 2014 Oso landslide, can be used to mitigate the risks presented by these types of hazards. New LiDAR-based landslide maps from WA DNR provide precise information about the location of landslide risks. This data can help County make better determinations about permitting requirements on a given parcel.

Protection Strategies

Protection strategies for geologically hazard areas include applying resources and data at the site-specific level to avoid or mitigate hazards. For some areas, especially landslide hazard areas, this may mean avoiding placing development in high-risk locations identified by mapping

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resources or by a geotechnical professional. Maintaining or establishing a vegetated buffer near the top and toe of a slope can help prevent loss of life or property in a slide event. In some cases, such as lahar and seismic hazard areas, education and awareness are more appropriate tools. One option may be to require applicants to sign a recorded acknowledgement that the property is in a hazard area, and to educate people on hazard preparedness and mitigation. To avoid loss of important infrastructure, certain critical facilities should not be placed in hazard-prone areas.

A primary concern for permitting near erosion, landslide and coastal bluff hazard areas is determining the level of geological investigation needed to ensure the construction won't have negative safety or environmental impacts. To ensure consistency and transparency, code and policy should provide a clear path for incoming applicants, so that applicants know what to expect and can plan to submit the correct reports. One solution, which could reduce expenses to applicants and improve permitting timelines, is to allow reconnaissance-level geotechnical reports if the proposed development is outside of a set standard buffer for a given geologically hazardous area, and to make use of the new WA DNR landslide hazard mapping to determine when and where higher levels of geological investigation are necessary.

Climate Change Impacts

Climate change may impact geologically hazardous areas in many ways. An increased frequency of intense rainfall events can worsen the risk presented by landslide hazard areas, and make slide events more likely. Coastal bluffs can face increased erosion risk due to sea level rise, and slopes near rivers and streams may be eroded by channel migration, which is affected by a variety of climatological changes. More frequent and intense wildfires create greater erosion and landslide risk due to vegetation loss. A priority recommendation from DNR's Plan for Climate Resilience is the use of improved, LiDAR-based data, which is now available for Thurston County.

Discussion and Decision Points

The list below provides examples of points for discussion and feedback, but considerations regarding geologic hazard areas aren't limited to this list. Any points of interest or feedback generated by discussion with the Planning Commission may be included in the code development process.

- Regulating hazardous areas while maintaining both safety and flexibility
- Deciding how and when staff determines when a full geotechnical report is required
- Deciding how and when to defer to geotechnical engineering reports regarding site safety, while ensuring no net loss of ecological functions
- Tools for increasing awareness of hazards

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- Current code requires the recordation of an acknowledgement of risk and responsibility with the County Auditor for properties developed in lahar hazard areas. This process could be expanded to other geologically hazardous areas
- Use of new science and data tools
- Reflecting the updated LiDAR mapping from WA DNR
- Using these tools to help both staff and applicants navigate the permitting process with ease, consistency, and transparency

Selected Best Available Science Resources

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BAS Resources from Other Jurisdictions

[Pierce County Critical Areas Ordinance Gap Analysis](#)

[Skagit County Best Available Science Review](#)

[Kitsap County Best Available Science Summary Report](#)

[City of Langley Best Available Science and Gap Analysis](#)