

17-04 GEOLOGICALLY HAZARDOUS AREAS

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17-04.001 GEOLOGICALLY HAZARDOUS AREAS

"Geologically hazardous areas" include areas susceptible to erosion, sliding, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard. Such incompatible development may not only place itself at risk, but also may increase the hazard to surrounding development and use. Areas susceptible to one or more of the following types of hazards shall be designated as a geologically hazardous area: WAC 365-190080(4)(a).

- ☐ Erosion hazard;
- ☐ Landslide hazard;
- ☐ Seismic hazard;
- ☐ Mine hazard;
- ☐ Volcanic hazard; and
- ☐ Other geological events including mass wasting, debris flows, rock falls, and differential settlement.

17-04.010 EROSION HAZARD AREAS

Erosion hazard areas are at least those areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "moderate to severe," "severe," or "very severe" rill and inter-rill erosion hazard. See WAC 365-190-080(4)(c).

17-04.012 LANDSLIDE HAZARD AREAS

Landslide hazard areas are areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include areas susceptible because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors. A slope is delineated by establishing its toe and top and is measured by averaging the inclination over at least ten (10) feet of vertical relief. See WAC 365-190-080(4)(d)(ix).

Example of these may include, but are not limited to the following:

- A. Areas of historic failures, such as: See WAC 365-190-080(4)(d)(i)
- B. Those areas delineated by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" limitation for building site development;
- C. Those areas mapped by the Washington State Department of Natural Resources (slope stability mapping) as unstable (U) or class 3, unstable old slides (UOS) or class 4, or unstable recent slides (URS) or class 5; or
- D. Areas designated as quaternary slumps, earth-flows, mudflows, lahars, or landslides on maps published by the U.S. Geological Survey or Washington State Department of Natural Resources;
- E. Areas with all three of the following characteristics: See WAC 365-190-080(4)(d)(ii)
 1. Slopes steeper than fifteen percent (15%);

2. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
 3. Springs or ground water seepage.
- F. Areas that have shown movement during the Holocene epoch (from ten thousand years ago to the present) or that are underlain or covered by mass wastage debris of that epoch; See WAC 365-190-080(4)(d)(iii)
 - G. Slopes that are parallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials; See WAC 365-190-080(4)(d)(iv).
 - H. Slopes having gradients steeper than eighty percent (80%) subject to rock fall during seismic shaking; See WAC 365-190-080(4)(d)(v).
 - I. Areas potentially unstable because of rapid stream inclusion, stream bank erosion, and undercutting by wave action; See WAC 365-190-080(4)(d)(vi).
 - J. Areas that show evidence of, or are at risk from snow avalanches; See WAC 365-190-080(4)(d)(vii).
 - K. Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; See WAC 365-190-080(4)(d)(viii).
 - L. Any area with a slope of forty percent (40%) or steeper and with a vertical relief of ten (10) or more feet except areas composed of consolidated rock.

17-04.013 SEISMIC HAZARD AREAS.

Seismic hazard areas are areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting. One indicator of potential for future earthquake damage is a record of earthquake damage in the past.

Ground shaking is the primarily affected by [See WAC 365-190-080(4)(e)]:

- ☐ The magnitude of an earthquake;
- ☐ The distance from the source of an earthquake; and
- ☐ The type of thickness of geologic structure.

Settlement and soil liquefaction conditions occur in areas underlain by cohesionless, loose, or soft-saturated soils of low density, typically in association with a shallow ground water table.

17-04.014 MINE HAZARD AREAS.

Mine hazard areas are those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings. Factors that should be considered include: proximity to development. Depth from ground surface to the mine working, and geologic material. See WAC 365-190-080(4)(f)(ii).

17-04.015 VOLCANIC HAZARD AREAS.

Volcanic hazard areas are areas subject to pyroclastic flows, lava flows, debris avalanche, and inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity. See WAC 365-190-080(4)(f)(i).

17-04.016 OTHER HAZARD AREAS.

Geologically hazardous areas shall also include areas determined by the Planning Director to be susceptible to other geological events including mass wasting, debris flows, rock falls, and differential settlement.

17-04.020 CLASSIFICATION OF GEOLOGICALLY HAZARDOUS AREAS.

All geologic hazard areas should be classified according to the following categories for each geologic hazard type.

Classification	Documentation and Data Sources
Known or Suspected Risk	Documentation or projection of the hazard by a qualified professional exists.
Risk Unknown	Documentation or projection of the lack of hazard by a qualified professional exists, or data are not available to determine the presence or absence of a geological hazard.

17-04.030 MAPPING OF GEOLOGICALLY HAZARDOUS AREAS.

The approximate location and extent of geologically hazardous areas are shown on the adopted critical area maps. The adopted critical areas maps include maps as listed in DMC 17-01.060.

These maps are to be used as a guide for the City, project applicants, and/or property owners and may be continuously updated as new critical areas are identified. They provide best available information and are a reference in determining critical area designation(s).

17-04.040 ALLOWED ACTIVITIES – GEOLOGICALLY HAZARDOUS AREAS

Activities allowed in geologically hazardous areas:

- A. Erosion and landslide hazard areas. Except as otherwise provided for in this Chapter, only those activities approved and permitted consistent with an approved critical area report in accordance with this title shall be allowed in erosion or landslide hazard areas.
- B. Seismic hazard areas. The following activities are allowed within seismic hazard areas:
 - 1. Construction of new residential buildings with less than 2,500 square feet of floor area or roof area, whichever is greater, and which are residential structures.
 - 2. or used as places of employment or public assembly;
 - 3. Additions to existing single-story residences that are 250 square feet or less; and
 - 4. Installation of fences.
- C. Volcanic hazard areas. The following activities are allowed within volcanic hazard areas:
 - 1. Construction of new buildings with less than 2,500 square feet of floor area or roof area, whichever is greater, and which are not residential structures or used as places of employment or public assembly;
 - 2. Additions to existing residences that are 250 square feet or less; and
 - 3. Installation of fences.

17-04.050 ALLOWED ACTIVITIES – OTHER HAZARD AREAS.

The Planning Director may allow the following activities within other geologically hazardous areas, if the activity will not increase the risk of the hazard:

- A. Construction of new buildings with less than 2,500 square feet of floor area or roof area, whichever is greater, and which are not residential structures or used as places of employment or public assembly;
- B. Additions to existing residences that are 250 square feet or less; and
- C. Installation of fences.

17-04.060 QUALIFIED PROFESSIONAL

A critical areas report for a geologically hazardous area shall be prepared by an engineer or geologist, licensed in the state of Washington, with experience analyzing geologic, hydrologic, and ground water flow systems, and who has experience preparing reports for the relevant type of hazard.

17-04.062 CRITICAL AREA REPORT - GEOLOGIC REQUIREMENTS

The following areas shall be addressed in a critical area report for geologically hazardous areas:

- A. The project area of the proposed activity; and
- B. All geologically hazardous areas within two hundred (200) feet of the project area or that have potential to be affected by the proposal;
- C. The presence, nature, and location of wetlands, FWHCA's, and/or aquifer recharge zones.

17-04.063 GEOLOGICAL HAZARDS ASSESSMENT

- A. Critical Area Report – Required Information

A critical area report for a geologically hazardous area shall contain an assessment of geological hazards including the following site-and proposal-related information at a minimum:

- 1. Site, land clearing, and construction plans. The report shall include a copy of the site plans for the proposal showing:
 - a. The type and extent of geologic hazard areas, and any other critical areas, and buffers on, adjacent to, within two hundred (200) feet of, or that are likely to impact the proposal;
 - b. Proposed development, including the location of existing and proposed structures, fill, storage of

- materials, and drainage facilities, with dimensions indicating distances to the floodplain, if available;
- c. The topography, in two-foot contours, of the project area and all hazard areas addressed in the report; and
- d. Clearing limits;
- 2. Assessment of geological characteristics. The report shall include an assessment of the geologic characteristics of the soils, sediments, and/or rock of the project area and potentially affected adjacent properties, and a review of the site history regarding landslides, erosion, and prior grading. Soils analysis shall be accomplished in accordance with accepted classification systems in use in the region. The assessment shall include, but not be limited to:
 - a. A description of the surface and subsurface geology, hydrology, soils, and vegetation found in the project area and in all hazard areas addressed in the report;
 - b. A detailed overview of the field investigations, published data and references; data and conclusions from past assessments of the site; and site specific measurements, test. investigations, or studies that support the identification of geologically hazardous areas; and
 - c. A description of the vulnerability of the site to seismic and other geologic events;
- 3. Analysis of proposal. The report shall contain a hazards analysis including a detailed description of the project, its relationship to the geologic hazard(s), and its potential impact upon the hazard area, the subject property, and affected adjacent properties; a
- 4. Minimum buffer and building setback. The report shall make a recommendation for the minimum no-disturbance buffer and minimum building setback from any geologic hazard based upon the geo-technical analysis;
- 5. Incorporation of previous study. Where a valid critical areas report has been prepared within the last five (5) years for a specific site, and where the proposed land use activity and surrounding site conditions are unchanged, said report may be incorporated into the required critical area report. The applicant shall submit a hazards assessment detailing any changed environmental conditions associated with the site; and,
- 6. Mitigation of long-term impacts. When hazard mitigation is required, the mitigation plan shall specifically address how the activity maintains or reduces the pre-existing level of risk to the site and adjacent properties on a long-term basis (equal to or exceeding the projected lifespan of the activity or occupation). Proposed mitigation techniques shall be considered to provide long-term hazard reduction only if they do not require regular maintenance or other actions to maintain their function. Mitigation may also be required to avoid any increase in risk above the pre-existing conditions following abandonment of the activity.
- B. Critical Area Report - Additional Technical Information Requirements for Specific Hazards. Critical area reports for geologically hazardous areas must meet the requirements of this Section. Critical area reports for two or more types of critical areas must meet the report requirements for each relevant type of critical area.
 - 1. Erosion and landslide hazard areas. In addition to the basic critical area report requirements, the technical information for an erosion hazard or landslide hazard area shall include the following information at a minimum:
 - 2. Site plan. The critical area report shall include a copy of the site plan for the proposal showing:
 - a. The height of slope, slope gradient, and cross-section of the project area;
 - b. The location of springs, seeps, or other surface expressions of ground water on or within two hundred (200) feet of the project area or that have potential to be affected by the proposal;5 and
 - c. The location and description of surface water runoff features;
 - 3. Hazards analysis. The hazards analysis component of the critical areas report shall specifically include:
 - a. A description of the extent and type of vegetative cover;
 - b. A description of subsurface conditions based on data from site-specific explorations;
 - c. Descriptions of surface and ground water conditions, public and private sewage disposal systems, fills and excavations, and all structural improvements;
 - d. An estimate of slope stability and the effect construction and placement of structures will have on the slope over the estimated life of the structure;
 - e. An estimate of the bluff retreat rate that recognizes and reflects potential catastrophic events such

- as seismic activity or a one hundred-year storm event;
 - f. Consideration of the run-out hazard of landslide debris and/or the impacts of landslide run-out on down slope properties.
 - g. A study of slope stability including an analysis of proposed cuts, fills, and other site grading;
 - h. Recommendations for building siting limitations; and
 - i. An analysis of proposed surface and subsurface drainage, and the vulnerability of the site to erosion;
4. Geo-technical engineering report. The technical information for a project within a landslide hazard area shall include a geo-technical engineering report prepared by a licensed engineer or geologist licensed by the State that presents engineering recommendations for the following:
 - a. Parameters for design of site improvements including appropriate foundations and retaining structures. These should include allowable load and resistance capacities for bearing and lateral loads, installation considerations and estimates of settlement performance;
 - b. Recommendations for drainage and sub-drainage improvements;
 - c. Earthwork recommendations including clearing and site preparation criteria, fill placement and compaction criteria, temporary and permanent slope inclinations and protection, and temporary excavation support, if necessary; and
 - d. Mitigation of adverse site conditions including slope stabilization measures and seismically unstable soils, if appropriate;
 5. Erosion and sediment control plan. For any development proposal on a site containing an erosion hazard area, an erosion and sediment control plan shall be required.
 6. Drainage plan. The drainage plan should consider on-site septic system disposal volumes where the additional volume will affect the erosion or landslide hazard area;
 7. Mitigation plans. Hazard and environmental mitigation plans for erosion and landslide hazard areas shall include the location and methods of drainage, surface water management, locations and methods of erosion control, a vegetation management and/or replanting plan, and/or other means for maintaining long-term soil stability; and
 8. Monitoring surface waters. If the Planning Director determines that there is a significant risk of damage to downstream receiving waters due to potential erosion from the site, based on the size of the project, the proximity to the receiving waters, or the sensitivity of the receiving waters, the technical information shall include a plan to monitor the surface water discharge from the site. The monitoring plan shall include a recommended schedule for submitting monitoring reports to the City.
- C. Seismic hazard areas. In addition to the basic report requirements, a critical area report for a seismic hazard area shall also meet the following requirements:
1. The site map shall show all known and mapped faults within two hundred (200) feet of the project area or that have potential to be affected by the proposal.
 2. The hazards analysis shall include a complete discussion of the potential impacts of seismic activity on the site (for example, forces generated and fault displacement).
 3. A geo-technical engineering report shall evaluate the physical properties of the subsurface soils, especially the thickness of unconsolidated deposits and their liquefaction potential. If it is determined that the site is subject to liquefaction, mitigation measures appropriate to the scale of the development shall be recommended and implemented.
- D. Volcanic hazard areas.
- In addition to the basic report requirements, a critical area report for a volcanic hazard area shall also meet the following requirements:
1. Site plan. The site plan shall show all areas within two hundred (200) feet of the project area that have potential to be affected by pyroclastic flows, lahars, or mud and debris flows derived from volcanic events;
 2. Hazards analysis. The hazards analysis shall include a complete discussion of the potential impacts of volcanic activity on the site (for example, inundation by mud flows resulting from volcanic activity);
 3. Emergency management plan. The emergency management plan shall include plans for emergency building exit routes, site evacuation routes, emergency training, notification of local emergency management officials, and an emergency warning system.

E. Other Geologically Hazardous Areas.

In addition to the basic requirements, the Planning Director may require additional technical information to be submitted when determined to be necessary to the review the proposed activity and the subject hazard. Additional technical information that may be required, includes, but is not limited to:

1. Site plan. The site plan shall show all hazard areas located within two hundred (200) feet of the project area or that have potential to be affected by the proposal; and
2. Hazards analysis. The hazards analysis shall include a complete discussion of the potential impacts of the hazard on the project area and of the proposal on the hazard.

17-04.070 PERFORMANCE STANDARDS - GENERAL REQUIREMENTS

A. Alterations of geologically hazardous areas or associated buffers may only occur for activities that:

1. Will not increase the threat of the geological hazard to adjacent properties beyond pre-development conditions;
2. Will not adversely impact other critical areas;
3. Are designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than pre-development conditions; and
4. Are certified as safe as designed and under anticipated conditions by a qualified engineer or geologist, licensed in the state of Washington.

B. Critical facilities shall not be sited within geologically hazardous areas unless there is no other practical alternative.

17-04.072 PERFORMANCE STANDARDS - SPECIFIC HAZARDS

A. Erosion and landslide hazard areas. Activities on sites containing erosion or landslide hazards shall meet the standards of Performance standards -General requirements (Section 17-03.080) and the specific following requirements:

1. Buffer requirement. A buffer shall be established from all edges of landslide hazard areas. The size of the buffer shall be determined by the Planning Director to eliminate or minimize the risk of property damage, death, or injury resulting from landslides caused in whole or part by the development, based upon review of and concurrence with a critical area report prepared by a qualified professional.
2. Minimum buffer. The minimum buffer shall be equal to the height of the slope or fifty (50) feet, whichever is greater.
3. Buffer reduction. The buffer may be reduced to a minimum of ten (10) feet when a qualified professional demonstrates to the Planning Director's satisfaction that the reduction will adequately protect the proposed development, adjacent developments, and uses and the subject critical area.
4. Increased buffer. The buffer may be increased where the Planning Director determines a larger buffer is necessary to prevent risk of damage to proposed and existing development;

B. Alterations. Alterations of an erosion or landslide hazard area and/or buffer may only occur for activities for which a hazards analysis is submitted and certifies that:

1. The development will not increase surface water discharge or sedimentation to adjacent properties beyond pre-development conditions;
2. The development will not decrease slope stability on adjacent properties; and
3. Such alterations will not adversely impact other critical areas.

C. Design Standards. Development and land clearing within an erosion or landslide hazard area and/or buffer shall be designed to meet the following basic requirements unless it can be demonstrated that an alternative design that deviates from one or more of these standards provides greater long-term slope stability while meeting all other provisions of this Title. The requirement for long-term slope stability shall exclude designs that require regular and periodic maintenance to maintain their level of function. The basic development design standards are:

1. The proposed development shall not decrease the factor of safety for landslide occurrences below the limits of 1.5 for static conditions and 1.2 for dynamic conditions. Analysis of dynamic conditions shall be based on a minimum horizontal acceleration as established by the current version of the Uniform Building Code.
2. Structures and improvements shall be clustered to avoid geologically hazardous areas and other critical

- areas;
3. Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography;
 4. Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation;
 5. The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties;
 6. The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes; and
 7. Development shall be designed to minimize impervious lot coverage;
 8. Vegetation retention. Unless otherwise provided or as part of an approved alteration, removal of vegetation from an erosion or landslide hazard area or related buffer shall be prohibited;
 9. Seasonal restriction. Clearing shall be allowed only from May 1 to October 1 of each year provided that the City may extend or shorten the dry season on a case-by-case basis depending on actual weather conditions.
 10. Utility lines and pipes. Utility lines and pipes shall be permitted in erosion and landslide hazard areas only when the applicant demonstrates that no other practical alternative is available. The line or pipe shall be located above ground and properly anchored and/or designed so that it will continue to function in the event of an underlying slide. Stormwater conveyance shall be allowed only through a high-density polyethylene pipe with fuse-welded joints, or similar product that is technically equal or superior;
 11. Point discharges. Point discharges from surface water facilities and roof drains onto or upstream from an erosion or landslide hazard area shall be prohibited except as follows:
 - a. Conveyed via continuous storm pipe downslope to a point where there are no erosion hazards areas downstream from the discharge;
 - b. Discharged at flow durations matching pre-developed conditions, with adequate energy dissipation, into existing channels that previously conveyed stormwater runoff in the pre-developed state;
 - c. Dispersed discharge upslope of the steep slope onto a low-gradient undisturbed buffer demonstrated to be adequate to infiltrate all surface and stormwater runoff, and where it can be demonstrated that such discharge will not increase the saturation of the slope;
 12. Subdivisions. The division of land in landslide hazard areas and associated buffers is subject to the following:
 13. Land that is located wholly within a landslide hazard area or its buffer may not be subdivided. Land that is located partially within a landslide hazard area or its buffer may be divided provided that each resulting lot has sufficient buildable area outside of, and will not affect, the landslide hazard or its buffer.
 14. Access roads and utilities may be permitted within the landslide hazard area and associated buffers if the City determines that no other feasible alternative exists; and
 15. Prohibited development. Onsite sewage disposal systems, including drain fields, shall be prohibited within erosion and landslide hazard areas and related buffers.
- D. Seismic hazard areas. Activities proposed to be located in seismic hazard areas shall meet the standards of Section 17-03.080 Performance standards - General requirements.