

## Chapter 12.12 GEOLOGICALLY HAZARDOUS AREAS

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### **12.12.010 Designation of 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 geologically hazardous areas:

- (1) Erosion hazard;
- (2) Landslide hazard;
- (3) Seismic hazard;
- (4) Mine hazard;
- (5) Volcanic hazard; and
- (6) Other geological events including tsunamis, mass wasting, debris flows, rock falls, and differential settlement. (Ord. 21-05 § 2, 2005).

### **12.12.020 Designation of specific hazard areas.**

- (1) 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.
- (2) 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. Examples of these may include, but are not limited to, the following:
  - (a) Areas of historic failures, such as:
    - (i) Those areas delineated by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" limitation for building site development;
    - (ii) Those areas mapped by the Department of Ecology (Coastal Zone Atlas) or the 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

- (iii) Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the U.S. Geological Survey or Department of Natural Resources;
  - (b) Areas with all three of the following characteristics:
    - (i) Slopes steeper than 15 percent; and
    - (ii) Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
    - (iii) Springs or ground water seepage;
  - (c) Areas that have shown movement during the Holocene epoch (from 10,000 years ago to the present) or that are underlain or covered by mass wastage debris of that epoch;
  - (d) Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;
  - (e) Areas potentially unstable because of rapid stream incision, stream bank erosion, and undercutting by wave action;
  - (f) Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet except areas composed of consolidated rock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.
- (3) 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 primary cause of earthquake damage in Washington.
- (4) 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.
- (5) Volcanic Hazard Areas. Volcanic hazard areas are areas subject to pyroclastic flows, lava flows, debris avalanche, inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity.
- (6) 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. (Ord. 21-05 § 2, 2005).

**12.12.030 Classification of geologically hazardous areas.**

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

<b>Classification</b>	<b>Documentation and Data Sources</b>
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 geologic hazard.

(Ord. 21-05 § 2, 2005).

#### **12.12.040 Mapping of geologically hazardous areas.**

The approximate location and extent of geologically hazardous areas are shown on the adopted critical areas maps as referenced in BMC 12.08.090(4) and (5). (Ord. 21-05 § 2, 2005).

#### **12.12.050 Activities allowed in geologically hazardous areas.**

The following activities are allowed in geologically hazardous areas pursuant to BMC 12.08.160, Allowed activities, and do not require submission of a critical areas report:

- (1) Erosion and Landslide Hazard Areas. Except as otherwise provided for in this title, only those activities approved and permitted consistent with an approved critical areas report in accordance with this title shall be allowed in erosion or landslide hazard areas.
- (2) All Other Hazard Areas to Include Seismic, Mine, Volcanic and Other Hazard Areas. The following activities are allowed within all other hazard areas:
  - (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 single-story residences that are 250 square feet or less; and
  - (c) Installation of fences. (Ord. 21-05 § 2, 2005).

#### **12.12.060 Critical areas report – Additional requirements for geologically hazardous areas.**

- (1) Prepared by a Qualified Professional. A critical areas report for a geologically hazardous area shall be prepared by a geotechnical engineer or geologist, licensed in the state of Washington, with experience analyzing geologic, hydrologic, and ground water flow systems; or by a geologist who earns his or her livelihood from the field of geology and/or geotechnical analysis, with experience analyzing geologic, hydrologic and ground water flow systems, who has experience preparing reports for the relevant type of hazard.
- (2) Area Addressed in Critical Areas Report. The following areas shall be addressed in a critical areas report for geologically hazardous areas:
  - (a) The project area of the proposed activity; and
  - (b) All geologically hazardous areas within 200 feet of the project area or that have potential to be affected by the proposal.
- (3) Geotechnical Assessment. A critical areas report for a geologically hazardous area shall contain an assessment of geological hazards including the following site- and proposal-related information at a minimum:
  - (a) Site and Construction Plans. The report shall include a copy of the site plans for the proposal showing:

- (i) The type and extent of geologic hazard areas, and any other critical areas and buffers on, adjacent to, within 200 feet of, or that are likely to impact the proposal;
  - (ii) Proposed development, including the location of existing and proposed structures, fill, storage of materials, and drainage facilities, with dimensions indicating distances to the floodplain;
  - (iii) The topography, in two-foot contours, of the project area and all hazard areas addressed in the report; and
  - (iv) Clearing limits;
- (b) Assessment of Geological Characteristics. The report shall include an assessment of the geologic characteristics and engineering properties 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 taxonomic classification systems in use in the region. The assessment shall include, but not be limited to:
- (i) 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; and
  - (ii) 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
  - (iii) A description of the vulnerability of the site to seismic and other geologic events;
- (c) Analysis of Proposal. The report shall contain a geotechnical 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; and
- (d) 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 geotechnical analysis.
- (4) Incorporation of Previous Study. Where a valid geotechnical report has been prepared within the last five 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 areas report. The applicant shall submit a geotechnical assessment detailing any changed environmental conditions associated with the site.
- (5) Mitigation of Long-Term Impacts. When hazard mitigation is required, the mitigation plan shall specifically address how the activity maintains or reduces the preexisting 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 preexisting conditions following abandonment of the activity. (Ord. 21-05 § 2, 2005).

**12.12.070 Critical areas report – Additional requirements for specific hazards.**

In addition to the general critical areas report requirements of BMC 12.08.210, critical areas reports for geologically hazardous areas must meet the requirements of this section. Critical areas 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 areas report requirements, a critical areas report for an erosion hazard or landslide hazard area shall include the following information at a minimum:
  - (a) Site Plan. The report shall include a copy of the site plan for the proposal showing:
    - (i) The height of slope, slope gradient, and cross-section of the project area;
    - (ii) The location of springs, seeps, or other surface expressions of ground water on or within 200 feet of the project area or that have potential to be affected by the proposal; and
    - (iii) The location and description of surface water runoff.
  - (b) Geotechnical Analysis. The geotechnical analysis shall specifically include:
    - (i) A description of the extent and type of vegetative cover; and
    - (ii) An estimate of load capacity including surface and ground water conditions, public and private sewage disposal systems, fills and excavations and all structural development; and
    - (iii) 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; and
    - (iv) An estimate of the bluff retreat rate that recognizes and reflects potential catastrophic events such as seismic activity or a 100-year storm event; and
    - (v) Consideration of the run-out hazard of landslide debris and/or the impacts of landslide run-out on downslope properties; and
    - (vi) A study of slope stability including an analysis of proposed angles of cut and fill and site grading; and
    - (vii) Recommendations for building limitations, structural foundations, and an estimate of foundation settlement; and
    - (viii) An analysis of proposed surface and subsurface drainage, and the vulnerability of the site to erosion.
  - (c) 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. The erosion and sediment control plan shall be prepared in compliance with requirements set forth in Chapter 14.30 BMC;
  - (d) Drainage Plan. The report shall include a drainage plan for the collection, transport, treatment, discharge and/or recycling of water prepared in accordance with Chapter 14.30 BMC. The drainage plan should consider on-site septic system disposal volumes where the additional volume will affect the erosion or landslide hazard area.
  - (e) 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.

- (f) **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 critical areas report 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 of Buckley.
- (2) **Seismic Hazard Areas.** In addition to the basic report requirements, a critical areas report for a seismic hazard area shall also meet the following requirements:
- (a) The site map shall show all known and mapped faults within 200 feet of the project area or that have potential to be affected by the proposal.
  - (b) The geotechnical analysis shall include a complete discussion of the potential impacts of seismic activity on the site (for example, forces generated and fault displacement).
- (3) **Mine Hazard Areas.** In addition to the basic report requirements, a critical areas report for a mine hazard critical area shall also meet the following requirements:
- (a) **Site Plan.** The site plan shall delineate the following found within 200 feet of or directly underlying the project area, or that have potential to be affected by the proposal:
    - (i) The existence of mines, including all significant mine features, such as mine entries, portals, adits, mine shafts, air shafts, and timber shafts; and
    - (ii) The location of any nearby mines that may impact or be affected by the proposed activities; and
    - (iii) The location of any known sinkholes, significant surface depressions, trough subsidence features, coal mine spoil piles and other mine-related surface features; and
    - (iv) The location of any prior site improvements that have been carried out to mitigate abandoned coal mine features.
  - (b) **Geotechnical Analysis.** The geotechnical analysis shall include a discussion of the potential for subsidence on the site and classify all mine hazard areas within 200 feet of the project area, or that have potential to be affected by the proposal, as either moderate or severe.
- (4) **Volcanic Hazard Areas.** In addition to the basic report requirements, a critical areas report for a volcanic hazard area shall also meet the following requirements:
- (a) **Site Plan.** The site plan shall show all areas within 200 feet of the project area that have the potential to be affected by pyroclastic flows, lahars, or mud and debris flows derived from volcanic events;
  - (b) **Geotechnical Analysis.** The geotechnical 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); and
  - (c) **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.
- (5) **Other Geologically Hazardous Areas.** In addition to the basic report requirements, the planning director may require additional information to be included in the critical areas report when determined to be necessary to the review of the proposed activity and the subject hazard. (Ord. 21-05 § 2, 2005).

**12.12.080 Performance standards – General requirements.**

- (1) Alterations of geologically hazardous areas or associated buffers may only occur for activities that:
  - (a) Will not increase the threat of the geological hazard to adjacent properties beyond predevelopment conditions; and
  - (b) Will not adversely impact other critical areas; and
  - (c) Are designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than predevelopment conditions; and
  - (d) Are certified as safe as designed and under anticipated conditions by a qualified engineer or geologist licensed in the state of Washington.
- (2) Critical Facilities Prohibited. Critical facilities shall not be sited within geologically hazardous areas unless there is no other practical alternative. (Ord. 21-05 § 2, 2005).

**12.12.090 Performance standards – Specific hazards.**

- (1) Erosion and Landslide Hazard Areas. Activities on sites containing erosion or landslide hazards shall meet the following requirements:
  - (a) Buffer Required. A minimum buffer of 25 feet shall be established from all edges of erosion or landslide hazard areas.
    - (i) Increased Buffer. The planning director may increase the buffer requirement up to a distance equal to the height of the slope in order to minimize the risk of property damage, death or injury resulting from erosion and landslides caused in whole or part by the development, based upon review of and concurrence with a critical areas report prepared by a qualified professional.
    - (ii) Buffer Reduction. The buffer may be reduced to a minimum of 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.
  - (b) Alterations. Alterations of an erosion or landslide hazard area and/or buffer may only occur for activities for which a geotechnical analysis is submitted and certifies that:
    - (i) The development will not increase surface water discharge or sedimentation to adjacent properties beyond predevelopment conditions; and
    - (ii) The development will not decrease slope stability on adjacent properties; and
    - (iii) Such alterations will not adversely impact other critical areas.
  - (c) Design Standards. Development 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:
    - (i) 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; and
- (ii) Structures and improvements shall be clustered to avoid geologically hazardous areas and other critical areas; and
  - (iii) 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; and
  - (iv) Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation; and
  - (v) The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties; and
  - (vi) The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes; and
  - (vii) Development shall be designed to minimize impervious lot coverage.
- (d) Vegetation Shall Be Retained. 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.
- (e) Seasonal Restriction. Clearing shall be allowed only from May 1st to October 1st of each year; provided, that the city of Buckley may extend or shorten the dry season on a case-by-case basis depending on actual weather conditions, except that timber harvest, not including brush clearing or stump removal, may be allowed pursuant to an approved forest practice permit issued by the city of Buckley or the Department of Natural Resources.
- (f) 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 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 a similar product that is technically equal to or superior.
- (g) 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:
- (i) 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; or both of the following:
  - (ii) Conveyed via continuous storm pipe downslope to a point where there are no erosion hazard areas downstream from the discharge; and
  - (iii) Discharged at flow durations matching predeveloped conditions, with adequate energy dissipation, into existing channels that previously conveyed stormwater runoff in the predeveloped state; or
  - (iv) ~~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.~~

- (h) Subdivisions. The division of land in erosion and landslide hazard areas and associated buffers is subject to the following:
  - (i) Land that is located wholly within an erosion or landslide hazard area or its buffer may not be subdivided. Land that is located partially within an erosion or 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 erosion or landslide hazard or its buffer. Adequate building space means that each newly created lot shall maintain a minimum buildable lot area outside of the erosion or landslide hazard area which totals 75 percent of the minimum lot size area for the zoning district where located; and
  - (ii) Access roads and utilities may be permitted within the erosion or landslide hazard area and associated buffers if the city of Buckley determines that no other feasible alternative exists.
- (i) Prohibited Development. On-site sewage disposal systems, including drain fields, shall be prohibited within erosion and landslide hazard areas and related buffers.
- (2) Seismic Hazard Areas. Activities proposed to be located in seismic hazard areas shall meet the standards of BMC 12.12.080, Performance standards – General requirements.
- (3) Mine Hazard Areas.
  - (a) Subdivisions. The division of land in mine hazard areas and associated buffers is subject to the following:
    - (i) Land that is located wholly within a mine hazard area or its buffer may not be subdivided. Land that is located partially within a mine hazard area or its buffer may be divided; provided, that each resulting lot has sufficient buildable area outside of, and will not affect, the mine hazard or its buffer. Adequate building space means that each newly created lot shall maintain a minimum buildable lot area outside of the mine hazard area which totals 75 percent of the minimum lot size area for the zoning district where located; and
    - (ii) Access roads and utilities may be permitted within the mine hazard area and associated buffers if the city of Buckley determines that no other feasible alternative exists.
  - (b) Reclamation Activities. For all reclamation activities, including grading, filling, and stockpile removal, as-built drawings shall be submitted to the city of Buckley in a format specified by the planning director.
- (4) Volcanic Hazard Areas. Activities on sites containing areas susceptible to inundation due to volcanic hazards shall require an evacuation and emergency management plan.
- (5) Other Hazard Areas. Activities on sites containing or adjacent to volcanic or other geologically hazardous areas shall meet the standards of BMC 12.12.080, Performance standards – General requirements. (Ord. 21-05 § 2, 2005).