

## **Chapter 108-22 Natural Hazard Areas**

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### **Sec 108-22-1 Purpose And Intent**

The purpose and intent of this chapter is to coordinate the application of natural hazards guidelines and standards, in order to protect the health, welfare and safety of the citizens of the city, and to minimize potential effects of natural and manmade hazards by identifying known hazardous areas. This portion of the chapter specifies the areas for which an environmental analysis shall be performed prior to development, the content of the analysis and the procedure by which development applications requiring the analysis are reviewed and processed.

The city recognizes individual property rights and shall make every effort to balance the right of the individual property owner with the health, welfare, safety and the common good of the general public.

### **Sec 108-22-2 Potential Hazards**

The following potential hazards have been identified:

#### *Surface-fault ruptures.*

Surface faulting has been identified as a potential hazard in the city. Maps have been produced delineating the known area where a hazard may exist from surface fault ruptures. Broad subsidence of the valleys accompanying surface faulting may affect areas several miles away from the fault. These effects are not considered here, but are covered in subsection (c) of this section.

Studies along the Wasatch fault have indicated that during a "characteristic" earthquake which produces surface faulting, offsets of six feet or more may occur on the main trace of the fault zone. This offset will result in formation of a near-vertical scarp, generally in unconsolidated surficial deposits, that begin to ravel and erode back to the material's angle of repose (33—35 degrees) soon after formation. Antithetic faults west of the main trace may also form, generally exhibiting a lesser amount of offset, but sometimes as much as several feet. The zone between these two faults may be complexly faulted and tilted with offset along minor faults of several inches or more.

Based upon this data, it is difficult, both technically and economically, to design a structure to withstand six feet or more of offset through its foundation. Thus, avoidance of the main traces of the fault is the principal risk reduction technique that can be reasonably taken.

No critical facility (excluding transportation lines or utilities which by their nature may cross active faults) or structure designed for human occupancy shall be built astride an active fault. If a fault is discovered in the excavation for such a structure, a geologic hazard study and report, as provided in section 108-22-3 of this Land Use Code, is required. In some areas adjacent to the main trace but still within the zone of deformation, avoidance may not be necessary. Less damaging (smaller) offsets of less than four inches and tilting may occur, and structural measures may be taken to reduce casualties and damage. However, structural damage may still be great, and buildings in the zone of deformation may not be safe for occupants following a large earthquake.

Due to the scale used to map these zones, there is not enough detail to delineate all fault traces and zones of deformation at a particular location; therefore, site-specific plans, studies, and reports shall be required, as provided in section 108-22-3 of this Land Use Code, for development in or adjacent to the delineated areas.

Building setbacks shall be a minimum of 50 feet from an active fault trace. A reduction in the setback may be considered if the report presents evidence to justify a reduction acceptable to the land use authority, after recommendation from the city engineer.

#### *Landslide.*

Landslides, historically, have been one of the most damaging geologic processes occurring in Weber County. Most active landslides, and most older slides, have been mapped. The maps identify areas of landslides and slopes which are potentially unstable under static (non-earthquake) conditions, and are especially vulnerable under conditions of high to abnormally high precipitation, heavy snowmelt, or excessive water application due to landscape watering, irrigation, or septic system discharge. Landslides can damage structures, roads, railroads and power lines. Furthermore, landslides may rupture canals, aqueducts, sewers and water mains, all of which can add water to the slide plane and promote further movement. Flooding may also be caused.

Many methods have been developed for reducing a landslide hazard. Proper planning and avoidance is the least expensive measure, if landslide-prone areas are identified early in the planning and development process. Care in site grading with proper compaction of fills and engineering of cut slopes is a necessary follow-up to good land use planning.

Where avoidance is not feasible, various engineering techniques are available to stabilize slopes, including de-watering (draining), retaining structures, piles, bridging, weighting or buttressing slopes with compacted earth fills and drainage diversion. Since every landslide and unstable slope has differing characteristics, any development proposed within an identified landslide hazard area shall require the submittal and review of a study and report, as provided in section 108-22-3. The study and report shall address slope stability (including natural or proposed cut slopes), evaluate slope-failure potential, effects of development and recommendations for mitigative measures. Slope stability analysis shall include potential for movement under static, development-induced and earthquake-induced conditions as well as likely groundwater conditions. No earthwork may commence on any property requiring a geo-technical report until such time as said

report has been reviewed, determined as sufficient by the City Engineer, or to require additional information/study. Any proposed engineering or other recommendation from the report shall be considered as conditions of approval, and shall be implemented.

*Tectonic subsidence.*

Tectonic subsidence, also called seismic tilting, is the warping, lowering and tilting of a valley floor that accompanies surface-faulting earthquakes on normal (dip slip) faults such as the Wasatch fault zone. Inundation along the shores of lakes and reservoirs and the ponding of water in areas with a shallow water table may be caused by tectonic subsidence. Certain structures which require gentle gradients or horizontal floors, particularly wastewater treatment facilities and sewer lines, may be adversely affected.

Because subsidence may occur over large areas (tens of square miles), it is generally not practical to avoid the use of potentially affected land except in narrow areas of hazard due to lake shoreline flooding. For gravity-flow structures such as wastewater treatment facilities that are within areas of possible subsidence, it is advisable to consider the tolerance of such structures to slight changes in gradient. Some structures may have to be releveled after a large-magnitude earthquake. Critical facilities which contain dangerous substances should have safety features to protect the structure, its occupants and the environment from both tilting and flooding.

Flooding problems along lakes from tectonic subsidence shall be reduced using standard techniques such as raising structures above expected flood levels and dikes can be built. Development adjacent to lakes or reservoirs shall be prohibited within three feet of elevation above projected lake levels to protect against natural rises from wet periods, storm waves and earthquake-induced seiching, as well as hazards associated with tectonic subsidence.

Rises in the water table accompanying tectonic subsidence may cause water to pond, flood basements and disrupt buried facilities in areas of shallow groundwater adjacent to the fault on the down dropped side.

The principal application of the identified tectonic subsidence areas is to make the public aware of the hazard and to indicate those areas where further study may be necessary. Site-specific tectonic subsidence reports and studies are recommended only for critical facilities in areas of potential lake-margin and ponded shallow groundwater flooding. However, certain vulnerable facilities such as high cost wastewater treatment plants and hazardous waste facilities should also consider potential tilting.

*Rock fall.*

Rock falls are a naturally occurring erosional process in mountain areas in Weber County. As development advances higher onto the bench areas and into the canyons the risk from falling rocks becomes greater. A primary mechanism responsible for triggering rock falls is water in outcrop discontinuities. Rock falls present a hazard because of the potential damage a large rock mass, traveling at a relatively high velocity, could cause to structures and personal safety. When new developments cannot be designed around a rock fall path, and hazard reduction measures must be considered, a study and report as provided in section 108-22-3, is required. Mitigation shall require design by a Utah licensed geotechnical engineer, and may include rock stabilization techniques such as bolting, cable

lashing, burying, and grouting discontinuities, removal or break-up of potential rock clasts, as well as deflection berms, slope benches, and rock catch fences to stop or at least slow down falling rocks. Strengthening a structure to withstand impact is an example of modifying what is at risk. Mitigation problems can arise when rock source areas are located on land not owned by the developer.

In areas where the rock fall hazard is present but very low, disclosure of a potential hazard to land owners and residents with an acknowledgment of risk and willingness to accept liability may be an acceptable alternative to avoidance or mitigation for single-family residences.

#### *Debris flows.*

Debris flows are mixtures of water, rock, soil and organic material (70—90 percent solids by weight) that form a muddy slurry much like wet concrete and flow down slope, commonly in surges or pulses, due to gravity. They generally remain confined to stream channels in mountainous areas, but may reach and deposit debris over large areas on alluvial fans at and beyond canyon mouths.

The county debris flow hazard maps were constructed from the boundaries of active alluvial fans and areas with slopes steeper than 30 percent. Any proposed development in areas identified as debris flow hazard areas shall be evaluated prior to approval of the proposed development. A study and report, as provided in section 108-22-3, shall be prepared by an engineering geologist for any development proposed in or adjacent to a debris flow hazard area and shall include:

An analysis of the history of debris flow at the site based on subsurface exploration to determine the nature and thickness of debris flow and related alluvial fan deposits. If, in the engineering geologist's professional opinion, geologic conditions have changed enough to render a debris flow inactive, the analysis may estimate the nature and approximate thickness of the debris flow and related alluvial fan deposits in lieu of subsurface exploration.

An analysis of the drainage basin's potential to produce debris flows based on the presence of debris slides and colluvium-filled slope concavities, and an estimate of the largest probable volumes likely to be produced during a single event.

An analysis of the stream channel to determine if the channel will supply additional debris, impede flow, or contain debris flows in the area of the proposed development.

An analysis of manmade structures upstream that may divert or deflect debris flows.

Recommendations concerning any channel improvements, flow modifications and catchment structures, direct protection structures or floodproofing measures, if necessary, in order to protect the development.

#### *Liquefaction areas.*

Earthquake ground shaking causes a variety of phenomena which can damage structures and threaten lives. One of these is termed soil liquefaction. Ground shaking tends to increase the pressure in the pore water between soil grains, which decreases the stresses between the grains. The loss of intergranular stress can cause the strength of some soils to decrease nearly to zero. When this occurs, the soil behaves like a liquid. When liquefaction

occurs, foundations may crack, buildings may tip, buoyant buried structures such as septic tanks and storage tanks may rise, and even gentle slopes may fail as liquefied soils and overlying materials move down slope.

Areas of potential liquefaction have been delineated and the following regulations and mitigation measures have been adopted in order to reduce the hazard and consequences. Areas of moderate to high liquefaction potential need not be avoided. Structural measures and site modification techniques are available to reduce a hazard. A site-specific liquefaction study and report shall be required pursuant to section 108-22-3, and shall be prepared by an engineering geologist and/or a state licensed geotechnical engineer and shall comply with the following:

Standard soil foundation study, for the proposed development, shall include liquefaction potential evaluation based upon depth to groundwater, soil types and ground failure hazard.

If liquefiable soils are present, standard penetration tests and/or cone penetration tests shall be required to determine critical accelerations needed to induce liquefaction.

The study and report shall include an accurate map of the area showing any proposed development, the location of bore holes and/or test pits, the site geology, and location and depths of any liquefiable soils noted, along with the probability of critical accelerations needed to induce liquefaction in these soils being exceeded for appropriate time periods.

The report shall include recommendations for hazard reduction techniques.

#### *Flood.*

The floodplain standards are written to minimize the loss of life and property when floods do occur, not to ban development outright from the floodplain. In the event the following provisions conflict with those in title 22 of the Ogden Valley CityCode, the most restrictive shall apply. The Federal Emergency Management Agency (FEMA) has produced official floodplain maps, depicting areas of potential stream flooding for major drainages in Weber County.

FEMA recommends that no new development be permitted in the 100-year floodplain unless:

Detailed engineering study and reports, as required by section 108-22-3, prepared by a state-licensed engineer, show that the proposed development will not increase the flood hazard to other property in the area. Recommendations shall be made for floodproofing or other mitigation techniques for development within flood hazard areas. (Site investigations for proposed development in lake-flooding areas near Great Salt Lake need only indicate the site elevation.

The proposed development is elevated above the 100-year flood base elevation.

For federally-insured loans, flood insurance is purchased from a company participating with the Federal Insurance Administration or a like private carrier.

The study and report, as may be required by section 108-22-3, shall consider the following: [Alluvial fans.] Alluvial fan flooding, which is not mapped under the FEMA program, may be a hazard on all active alluvial fans identified on debris flow

hazard maps. The hazard from such flooding shall be addressed and appropriate hazard reduction measures taken.

Sheet flow. Certain areas of the Ogden Valley have been identified and mapped as areas of sheet flow flooding. The hazard from such flooding shall be addressed and appropriate hazard reduction measures taken.

Other hazards.

As in many counties in the Western United States, development in the city is constrained by the presence of natural and manmade hazards. These hazards include, but are not limited to, avalanche, slope movement, soils categorized as having severe building limitations and slopes exceeding 30 percent.

Not all hazardous sites and conditions have been identified in the city. As a hazard or potential hazard becomes known, the city has discretion to require any study and report that is necessary to understand how the hazard or potential hazard may impact development. The study or report shall provide appropriate hazard mitigation measures.

**Sec 108-22-3 Studies And Reports Required**

*Requirement for a study and report.* Unless exempted in section 108-22-5, any application for development on a parcel of land within a natural hazard study area shall be submitted to the planning division with two hard copies and one electronic (pdf) copy of a site-specific natural hazard study and report, where required for such development according to the following chart:

| <b>Land Use<br/>(Type of Facility)</b>                   | <b>Liquefaction Potential<br/>High/<br/>Moderate</b> | <b>Landslide/<br/>Rock Fall/<br/>Debris Flow<br/>Study Area</b> | <b>Surface Fault<br/>Rupture Study<br/>Area</b> | <b>Tectonic<br/>Subsidence<br/>Study Area</b> | <b>Flood<br/>Study<br/>Area</b> | <b>Other<br/>Hazardous<br/>Areas</b> |
|--|--|---|---|---|---------------------------------|--------------------------------------|
| Critical facilities                                      | Yes  | Yes   | Yes   | Recommended                                   | Yes                             | As determined by the city engineer   |
| Industrial, commercial, or multifamily (4 or more units) | Yes  | Yes   | Yes   | No  | Yes                             | As determined by the city engineer   |
| Residential subdivisions                                 | No**   | Yes, unless otherwise provided by section 108-22-2(d)(2).       | Yes   | No  | Yes                             | As determined by the city engineer   |

|   |      |   |     |    |     |                                    |
|---|------|---|-----|----|-----|------------------------------------|
| Residential, single lots/multifamily (less than 4 units)  | No** | Yes, unless otherwise provided by section 108-22-2(d)(2). | Yes | No | Yes | As determined by the city engineer |
| ** Although no study and report is required, disclosure is required as described in section 108-22-4. |      |   |     |    |     |                                    |

Each natural hazard study and report shall be prepared by an engineering geologist. In the case of a snow avalanche hazard, the study and report shall be prepared by an experienced avalanche expert. The study and report shall be signed by the preparer and shall also include the qualifications of the preparer.

Each natural hazard study and report shall be site-specific and identify, to the extent practicable, all known or suspected potential natural hazard(s) originating on-site or off-site which present a reasonable likelihood of adversely affecting the particular property.

Each natural hazard study and report shall include a detailed site map (scale: one inch equals 200 feet or larger), showing the location and type of hazard with delineation of the recommended setback distances from the hazard and the recommended location for structures.

Each natural hazard study and report shall address the potential adverse effects of the hazard on the proposed development and occupants thereof in terms of the reasonable likelihood of potential damage.

Each natural hazard study and report shall contain recommendations for avoidance or mitigation of the identified adverse effects of the hazard consistent with the purposes set forth in section 108-22-1 of this chapter. The evidence on which recommendations and conclusions are based shall be clearly stated in the report.

Trench logs (scale: one inch equals five feet or larger), trench photos, aerial photographs, references with citations, and other supporting information, as applicable, shall also be included in each natural hazard study and report.

*Review of the study and report.* In order to fulfill the purposes of this chapter, the land use authority shall review any proposed development which requires preparation of a natural hazard study and report under this chapter to determine the possible risks to the safety of persons or property from a natural hazard.

Prior to consideration by the land use authority of any such development, the city engineer may submit the study and report, and, if applicable, site-specific plan, to outsourced qualified professionals for review and recommendation. Any cost for the review shall be paid by the applicant prior to any land use authority action.

The city engineer has discretion to reject the scope, techniques, methodology, conclusions, or specific types of information presented in the study and report if industry standards of care were not used. All conclusions of the study and report shall be supported by adequate data.

The city engineer shall prepare a final review and recommendation of an acceptable study and report, and, if applicable, site-specific plans, for the land use authority's consideration.

Whenever the land use authority determines that an area is subject to a natural hazard which presents an unreasonable risk to the safety of persons or property, including public streets, such area shall not be approved for development unless the applicant can demonstrate that such a risk can be reduced to a reasonable and acceptable level in a manner which has a minimum effect on the natural environment.

The land use authority may set requirements or conditions necessary to reduce the risks from a natural hazard as a condition to the approval of any development which requires preparation of a natural hazard study and report.

*Study and report verification.* The project engineering geologist shall submit with the study a signed and sealed verification letter stating that the study was conducted in accordance with industry standards of care, and that it complies with this Land Use Code and all other applicable laws. Written verification shall be provided from the issuer of professional errors and omissions liability insurance, in the amount of \$1,000,000.00, which covers the engineering geologist, and which is in effect on the date of preparation of all required studies and reports.

*Development design verification.* Whenever possible, avoidance of development in an area with an identified natural hazard is strongly encouraged. However, pursuant to requirements of this chapter, development in an area with an identified natural hazard shall be permitted when it is designed to mitigate, and is reasonably safe from, the identified hazard. Final design of the development shall not be accepted by the city unless:

The development's state licensed engineer, or, if applicable, engineers, provide(s) the city with a signed and sealed verification letter stating that, pursuant to the considerations, findings, recommendations, and conclusions of the development's engineering geologist's study and report, the development has been designed to mitigate, and is reasonably safe from, the identified hazard.

The development's engineering geologist submits a signed and sealed verification letter stating that the final design of the development adequately provides for the considerations, findings, recommendations, and conclusions of the study and report, and is reasonably safe from the identified hazard.

Written verification is provided from the issuer(s) of professional errors and omissions liability insurance, in the amount of \$1,000,000.00, which covers the engineering geologist and state licensed engineer(s), and which is in effect on the date of preparation of all required reports and certifications.

#### **Sec 108-22-4 Disclosure Required**

When a natural hazard report shows that a hazard exists which affects a particular parcel:

A copy of the report shall be kept for public inspection in the city planning division office.

A notice that runs with the land shall be recorded, and, if applicable, a note on the subdivision plat shall be required, which provide:

Notice that the parcel is located within a natural hazard study area;

Notice that a natural hazard study and report is available for public inspection in the city planning division office;

Notice that a hazard has been identified on the parcel and the type and severity of the hazard;

The professional who prepared the report, with his or her contact information; and  
Any restrictions on the use of the parcel required within the natural hazard report, or by the land use authority.

When a natural hazard report is not required, but where the parcel is located within a natural hazard study area, notice that the parcel is located within such an area shall be recorded running with the land and noted on the subdivision plat (if applicable), and shall be written in a form satisfactory to the city engineer and city attorney.

The natural hazard ordinance codified in this chapter and natural hazard map represent only those potentially hazardous areas known to the city, and shall not be construed to include all possible potential hazard areas. The natural hazards listed in this chapter may be amended as new information becomes available. The provisions of this chapter do not in any way assure or imply that areas outside its boundaries will be free from the possible adverse effects of a natural hazard. This chapter shall not create liability on the part of the city, any officer or employee thereof for any damages from a natural hazard that result from reliance on this chapter or any administrative requirement or decision lawfully made thereunder.

#### **Sec 108-22-5 Exemptions From Natural Hazard Study And Report**

The following are exemptions from natural hazard study and report requirement:

A proposed structure that is not a structure designed for human occupancy shall not be required to provide a natural hazard report; except a report shall be provided for a critical facility if required by section 108-22-3, or when otherwise required by the planning director or city engineer due to natural hazards conditions known to be in the area.

When clear evidence exists that no study and report is necessary, the planning director or city engineer may waive the requirement.

#### **Sec 108-22-6 Costs To Be The Responsibility Of The Developer/Applicant**

Any of the above described technical reports and/or studies shall be performed by qualified professionals on behalf of the applicant. The cost of outsourced qualified professionals used by the city to aid in the review required in section 108-22-3 is the responsibility of the applicant. Any other costs incurred in providing technical reports or testimony by qualified professionals or expert witnesses shall be solely the responsibility of the applicant and not the city.

#### **Sec 108-22-7 Change Of Use**

No change in use which results in the conversion of a building or structure not designed for human occupancy to one designed for human occupancy shall be permitted unless the building or structure complies with the provisions of this chapter.

### **Sec 108-22-8 Conflict Between Boundaries Of Study Area Or Identified Hazard**

Where there is a conflict between the boundaries of an identified natural hazard study area and actual field conditions, or where detailed investigations show that the identified hazard is not present within a particular area, the conflict shall be settled as follows:

The person disputing the natural hazard study area boundary shall submit technical and geologic evidence to support such claim to the city engineer in the form of a site-specific natural hazard report.

The city engineer may request outsourced qualified professionals to review the evidence and make a recommendation prior to making a final written decision concerning the dispute. The cost of the outsourced qualified professional's review shall be paid by the person disputing the boundary.

The city engineer may allow modifications to the boundary only if the evidence clearly and conclusively establishes that the natural hazard study area boundary location is incorrect, or that the identified hazard is not present within a particular area.

### **Sec 108-22-9 Appeals**

Except as allowed in subsection (b) of this section, an appeal of any written decision in the application of this chapter shall be appealed in accordance with title 102, chapter 3 Board of Adjustment, of this Land Use Code.

When a written decision provided under this chapter contains technical aspects, an applicant may request the city to assemble a panel of qualified professionals to serve as the appeal authority for the sole purpose of determining those technical aspects.

**State Law reference**—Related provisions, U.C.A. 1953, § 17-27a-703(2)

The technical aspects of the administration and interpretation of this chapter are decisions related to:

The acceptance or rejection of scope, techniques, methodology, conclusions or specific types of information presented in a study or report;

The review and recommendation of an acceptable study or report for the land use authority's consideration;

The interpretation or application of any technical provisions of a study or report that is required by this chapter; or

The modification of a natural hazard study area boundary.

Unless otherwise agreed by the applicant and city, if an applicant makes a request under this subsection, the city shall assemble the panel consisting of:

One qualified professional designated by the city;

One qualified professional designated by the applicant; and

One qualified professional chosen jointly by the city's designated qualified professional and the applicant's designated qualified professional.

A member of the panel may not be associated with the application that is the subject of the appeal.

The applicant shall pay for one half the cost of the panel in addition to the city's appeal fee. The panel shall be governed by the same appeal provisions of the board of adjustment provided in title 102, chapter 3 Board of Adjustment, of this Land Use Code.