

City of Creswell Natural Hazards Mitigation Study



June 2007

**Partial funding for this project was provided by the
Oregon Department of Land Conservation and Development**

Prepared For:
City of Creswell
Department of Land Conservation and Development

Prepared By:
Lane Council of Governments

Table of Contents

Introduction and Community Profile

Study Goals
Community Profile – Population, Employment and Housing
Community Profile – Education and Quality of Life
Population and Employment Projections
Anticipated Growth Patterns

Hazard Assessment Guidelines

Definition of a Hazard Assessment
Federal Requirements for a Hazard Assessment
Hazard Assessment Mapping Methodology

The Creswell Process

Procedural Outline
Plan Development Participation
Formal Review Process and Continued Public Involvement
Plan Adoption
Community Assets

Potential Hazards Profile and Assessment

Flooding
Earthquake
Severe Weather Events
Multiple Hazard Comprehensive Plan Recommendations

Risk Analysis

Conclusion

Appendices

Appendix A. Sources
Appendix B. Creswell Development Code Chapter 2.7, Flood Plain Overlay

Tables

Table 1. Federal Criteria for Hazard Assessment
Table 2. Significant Flood Events
Table 3. Acres of Floodway and Flood Plain in the Urban Growth Boundary by Plan Designation
Table 4. Natural Hazards Comprehensive Plan Policy Recommendations

Maps

Assets
Flood Hazards
Plate Tectonics in the Pacific Northwest
Geology

INTRODUCTION AND COMMUNITY PROFILE

The purpose of the City of Creswell Natural Hazards Mitigation Study (Study) is to use qualified, objective methods to determine risks of damage from a natural hazard event and design Comprehensive Plan policy recommendations to protect citizens, critical facilities, infrastructure, and property from these risks. The first step in planning for these natural hazards is to identify the potential hazards that exist in a community. As understanding about the hazards in an area grows, it is also important to understand the spatial extent of these potential hazards. The spatial representation of potential hazard events allows an analysis of how existing land uses could be impacted by a hazard. Incorporating projected land uses into this analysis enables a community to see how growth and land use changes can be directed to minimize property damage and loss of life. The second level is an assessment of vulnerability and involves applying hazard identification with an inventory of property and population exposed to a hazard. The final step is a risk analysis, which involves using mathematical models and estimating the damage, injuries, and financial losses. This step is not a part of this planning study.

Study Goals

The study goals: 1) provide guidance in developing specific policies, 2) explain why the City of Creswell is undertaking a natural hazards mitigation study process, and 3) describe what the City wants the results of this process to be, which include:

- Protect Life and Property
- Increase Public Awareness
- Establish and Provide Effective Emergency Services
- Meet State and Federal Guidelines

Community Profile – Population, Employment and Housing

The City of Creswell, located in the southern part of the Willamette Valley where the foothills of the coast and Cascade Ranges begin to merge, is approximately 10 miles south of the Eugene-Springfield metropolitan area along the Interstate 5 corridor. As Creswell has grown, it has evolved from a farming community into a dynamic city with multiple ties to the metropolitan area. Population has grown from 1,199 in 1970 to 4,500 in 2006. Creswell's growth rate has typically outpaced both Lane County and State of Oregon, and Creswell's share of population in Lane County grew from 0.6 percent in 1970 to 1.3% in 2006. In 2005, Creswell's UGB contained 1,326 acres with 975 of this acreage inside the city limits. Nearly 47 percent of all land inside the UGB is designated for residential use. Thirteen percent is designated for commercial uses, 10 percent is designated for resort commercial uses, and 11 percent is designated for industrial uses.¹ Creswell's largest employment industries are in four sectors: Government, Manufacturing, Retail Trade, and Accommodation and Food Service.

Creswell's housing stock today consists primarily of single-family homes. Approximately two-thirds of the housing within the UGB is single-family detached, 15 percent is manufactured dwellings in parks, and 11 percent is multi-family. The median value of owner-occupied units was lower than that of Lane County although these values may reflect the higher percentage of manufactured dwellings in parks, which do not include the land as part of the unit. Recent development in Creswell since 2000 has included higher end dwellings in the vicinity of the

¹ Creswell Economic Opportunities Analysis, March 2005

Emerald Valley resort, east of Interstate 5. The City of Creswell had a higher percentage than Lane County of owners than renters, even though median contract rent was lower in the City of Creswell.²

Community Profile – Education and Quality of Life

Lane County School District 40 serves the City of Creswell and a surrounding district of about 69 square miles. There are three schools; all located within the city limits: Creslane Elementary School, Creswell Middle School, and Creswell High School.

The City's location along the Central Oregon & Pacific rail line, state Highway 99 and Interstate 5 (I-5) has had tremendous influence on the City. The new I-5 overpass will improve east-west accessibility for cars, bicycles and pedestrians. Creswell is also home to the Creswell Airport, often called Hobby Field after one of the five aviation enthusiasts who built the airfield, Walter "Hobby" Hobbensiefken. The airport is located on a 101-acre site on the east side of Creswell.

The Creswell community is close-knit with pride in their schools, city government and location. The median age was 31.7 years, nearly five years younger than that of all Lane County.³ Creswell hosts and enjoys numerous events throughout the year, including the 4th of July celebration, Harvest Dinner, All-Class Reunion, and the December Downtown Tree Lighting Ceremony. An overall community vision was proposed in 2004 by an economic development committee stating *The City of Creswell, with its economically viable downtown; small, clean industries; cohesiveness; and beautiful setting, will continue to serve the commerce, educational and recreational needs of the community and the rural area surrounding Creswell. The City values and will continue to build upon its close-in rural location for economic, cultural and recreational purposes.*

Population and Employment Projections

Creswell's significant population increase is projected to continue in the upcoming years. Population forecasts show that Creswell is expected to grow faster than any city in Lane County except Coburg over the 2004-2025 period.⁴ Lane County coordinated population projections for the City of Creswell, adopted in February 2005, forecast that 7,300 people will live within Creswell's city limits in 2025. The Buildable Lands Inventory and Transportation System Plan Update are using a projection of 7,572 people in the year 2027.

Creswell's proximity to larger urban areas and location on I-5, along with its small-town character, are primary comparative advantages for economic growth in Creswell. An analysis of national, regional and local economic conditions and trends, and Creswell's comparative advantages imply the following for economic development in Creswell⁵:

- The Creswell Airport may help Creswell attract businesses engaged in the manufacture and service of aircraft, avionics, and related equipment.
- Creswell's semi-rural setting, access to I-5, and workforce availability make Creswell attractive for businesses in manufacturing, such as the manufacture of RVs and related equipment, high-tech electronics, food processing, industrial equipment, recreational

² U.S. Bureau of Census, 2000 data

³ U.S. Bureau of Census, 2000 data

⁴ Coburg will be installing its first sewer system, which is projected to relieve pent-up demand for development and will lead to a substantial population increase

⁵ Creswell Economic Opportunities Analysis, March 2005

equipment, and other specialty manufacturing, and/or businesses in warehousing and transportation.

- Creswell's attractive semi-rural area could make it a location for software design, engineering, research, and other professional services that are attracted to high-quality settings.

Employment is currently dominated by Commercial uses (53 percent), followed by Industrial (33 percent) and Public (14 percent). It is anticipated that Creswell will receive an increasing share of employment growth in Lane County as it becomes a more fully developed community and growth from spillover caused by increasingly crowded conditions in Eugene and Springfield. Almost 900 jobs are expected to be added to the Creswell UGB between 2003 and 2025 in Commercial, Industrial and Public land use types.

Anticipated Growth Patterns

Current zoning/comprehensive plan designations indicates that 51 percent of land in the Creswell UGB will be used for residential purposes, 25 percent for commercial, 14 percent for industrial, and the remaining 10 percent for parks or public facilities. A recently completed *Preliminary Evaluation of Potential Urban Growth Boundary Expansion Areas* indicates that the City of Creswell will face some challenging decisions regarding where it expands its UGB.

State statute requires the City to look at exception land first.⁶ The areas that may best meet Creswell's need for land to support employment uses may be located on Highway 99 north of the current UGB. This area may be desirable because of the access provided by Highway 99 and the visibility of these areas from I-5, particularly land east of Highway 99. If the "North" study area (identified as lands north and west of the existing UGB, west of I-5 and Highway 99, contiguous with the existing UGB on the north and west side) is included in a UGB expansion, areas designated for employment uses might be extended to the western portion of this study area to create a commercial/industrial district. A transition from existing and new commercial and industrial uses to existing and new residential uses should be provided.

In addition, the Economic Opportunities Analysis identified land near the Creswell Airport as providing an opportunity for airport-related uses, which are expected to be a growth industry in Oregon. Inclusion of land near the airport for employment uses may justify inclusion of the exceptions areas at the north end of the Airport East study area for efficiency and serviceability. Interest has been expressed in developing higher end homes with access to the airport for planes owned by these homeowners.

As noted above, the Economic Opportunities Analysis identified Creswell's small-town character and lifestyle as its primary comparative advantage for economic development. In this context, study areas west of I-5 may be appropriate for residential development as they would extend Creswell's traditional residential areas and allow access to schools without crossing I-5.⁷

⁶ ORS 197.298

⁷ Preliminary Evaluation of Potential Urban Growth Boundary Expansion Areas, ECONorthwest, July 2005

HAZARD ASSESSMENT GUIDELINES

Definition of a Hazard Assessment

Conducting a hazard assessment can provide information on the location of hazards, the value of existing land and property in hazard locations, and an analysis of risk to life, property, and the environment that may result from natural hazard events. Hazard assessments are subject to the availability of hazard-specific data. The three levels of a hazard assessment are as follows:

- 1) **Hazard Identification.** The first step is to identify the types of potential hazards, the geographic extent and intensity of the hazards, and the probability of their occurrence. Maps are frequently used to display the hazard identification data. The FEMA report⁸ helped in identifying the natural hazards that are especially relevant in and around the City of Creswell. Staff started with a long list of hazards including wildfires, tornados, landslides, volcanoes, drought, flooding, earthquakes, and severe weather events. After a review of historical records, communication with other City staff, and through the use of FEMA worksheets, staff narrowed the list to three primary hazards based on what posed the greatest danger to the people and property in Creswell, which include flooding, earthquakes, and severe weather events. Staff then used background data, historical records, and local knowledge to target these three hazards and develop Comprehensive Plan policies that address the associated risks.
- 2) **Vulnerability Assessment/Inventorying Assets.** This step takes the information gained during the hazard identification and combines it with an inventory of the existing (or planned) property and population exposed to a hazard. A complete listing of the community assets exposed to each hazard is located in the “Community Assets” section. A more detailed description of the vulnerability of these assets is located in the specific hazard sections.
- 3) **Risk Analysis/Estimating Potential Losses.** This is the most rigorous and detailed step. It involves estimating the damage, injuries, and financial losses likely to be sustained in a geographic area over a given period of time. This level of analysis involves using mathematical models. The two major components of risk analysis are the magnitude of the harm that may result and the likelihood of the harm occurring. Describing vulnerability in terms of dollar losses provides the community and the state with a common framework in which to measure the effects of hazards on assets. Unfortunately, there is insufficient data and funding to conduct a risk analysis for the natural hazards affecting Creswell. However, this need is identified in the action items and a complete risk assessment will be conducted when the resources are available.

Federal Requirements for a Hazard Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201.6(c)(2) include a requirement for hazard assessment. This hazard assessment requirement is intended to provide information that will help communities to identify and prioritize mitigation activities that will reduce losses from the identified hazards. Table 1 that follows shows the federal criteria for hazard assessment and how the City of Creswell Natural Hazards Mitigation Study meets some of those criteria.

⁸ Understanding Your Risks: Identifying Hazards and Estimating Losses, FEMA

Table 1. Federal Criteria for Hazard Assessment

Section 322 requirement	How is this addressed?
Identifying Hazards	The City of Creswell has mapped the hazard areas for wildfire, flood, landslide, and earthquake.
Profiling Hazard Events	The hazard sections of the Creswell Natural Hazard Mitigation Study provide an overview of all of the historic large-scale hazard events affecting the city.
Assessing Vulnerability: Identifying Assets	Community assets and critical infrastructure are documented that would be vulnerable to natural hazards.
Risk Analysis	Due to funding and data limitations, the City of Creswell was not able to complete a risk analysis for each hazard event.
Analyzing Development Trends	The Community Profile section of this plan provides a description of the development trends in the City of Creswell. Other planning projects can also be used to fulfill these requirements.

Hazard Assessment Mapping Methodology

The City of Creswell developed maps for this plan using GIS layers and supporting data provided by Lane Council of Governments (LCOG). These maps display the hazard areas associated with natural disasters. Information developed by LCOG and other government agencies was used to create the most accurate maps using the best available data. Maps addressing specific hazards are integrated throughout the document.

THE CRESWELL PROCESS

One of the objectives of this Study is to provide a list of Comprehensive Plan policy recommendations that will assist the City of Creswell in reducing risk and preventing loss from future hazard events. The Study includes resources and information to assist the city government, residents, public and private sector organizations, and others in planning for natural hazards.

Procedural Outline

Preliminary research was conducted by staff to determine the best approach to natural hazards mitigation planning. Staff relied on the Federal Emergency Management Agency (FEMA) “Understanding Your Risks: Identifying Hazards and Estimating Losses” publication that is a part of the “State and Local Mitigation Planning How-To Guide” series. The following sections directly address the steps recommended by FEMA. Staff also referenced mitigation plans from other jurisdictions in the region.

The Study maintenance program includes monitoring, evaluating, and reviewing the Study on a periodic basis to ensure that it is up to date.

Plan Development Participation

The Study is a collaborative effort between the City of Creswell and local stakeholders. The Creswell Citizen Involvement Committee (CIC) was formed to provide guidance and direction on updating the Comprehensive Plan including this Study process. Members of the CIC include:

- Alan Brown, City Councilor and Chamber of Commerce
- Carol Campbell, Lane Library District
- Jane Christensen, Creswell Citizen
- Sheila Hale, Parks Board
- William McCoy, City Councilor
- Jim Mercer, Creswell Citizen
- Ron Petitti, Mayor, Parks Board
- Lloyd Safley, Planning Commission
- Kathy Thompson, Creswell Citizen
- Mike Ufford, Planning Commission

Formal Review Process and Continued Public Involvement

The Study should be evaluated periodically to determine the effectiveness of programs and to reflect changes in land development programs that may affect mitigation priorities. City staff will be responsible for conducting a review of the Study.

City staff will review the policy recommendations to determine their relevance and ensure they are meeting current federal, state, and local regulations. City staff will also review the hazard assessment portion of the Study to determine if the findings are still accurate and to include any new data available regarding the hazards.

The City of Creswell will continue to involve the community in the natural hazards mitigation planning process. The public should be able to submit comments on the Study to the City. Copies of the Plan will be kept at City Hall and may be placed online at www.ci.creswell.or.us.

Plan Adoption

The Creswell City Council is responsible for adopting the Study since it has the authority to develop and adopt public policy regarding natural hazards. The City of Creswell addresses statewide planning goals and legislative requirements through its Comprehensive Plan, Development Code, and Building Codes. The Study provides recommendations that are tied to the goals of the existing plans and programs. The City of Creswell will be able to implement action items through existing programs and procedures, as well as apply for additional assistance for projects requiring funding currently outside existing programs.

Community Assets

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and environmental integrity of the City of Creswell. The list below outlines the types of critical facilities and infrastructure within the City of Creswell.

Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- City Hall
- Creswell Community Center
- Creswell Fire Station
- City Public Works Shop
- Water Treatment Facility
- Wastewater Treatment Plant
- Sheriff's Office
- Recreation Center (note: at this time the building is vacant)

Essential Facilities: Those facilities and infrastructure that supplement response efforts.

- Creswell High School
- Creslane Elementary School
- Creswell Middle School
- LTD Park and Ride
- Creswell Recreation Center
- Creswell Library
- Creswell Clinic (PeaceHealth)
- Creswell Post Office

Critical Infrastructure: Infrastructure that provides services for the City of Creswell.

- Telephone Lines
- Gas Lines
- Power Lines
- Transportation Networks
- Bridges
- Railroad
- Water Treatment, Storage, and Distribution Lines

- Wastewater Collection
- Cell Phone Towers
- Cable/Fiber Lines

Vulnerable Populations: Locations serving populations that have special needs or require special consideration.

- South Willamette Veterinary Clinic
- Creswell Veterinary Hospital
- Creswell Care Center
- Creswell Christian Child Care Center
- Growing Place Pre-School and Child Center
- Head Start of Lane County
- Over in the Meadow Child Care Center
- Cresview Villa
- Awesome Care Inc. (outside Urban Growth Boundary)
- Class 2 Adult Foster Care: Mi Casa es Su Casa, Kilwien Residential Care Home, Porch Sitters Manor, Luthe's Adult Foster Care, Avalon House

Economic Assets & Population Centers. *Economic Assets* are those businesses that employ large numbers of people, and provide economic activity. *Population Centers* usually are aligned with economic centers, and will be of particular concern for evacuation/notification during a hazard event.

- Creswell Middle School
- Creslane Elementary School
- Creswell High School
- Creswell Christian School
- Creswell Airport
- Ray's Food Place
- Bi-Mart
- Best Western Creswell Inn
- Emerald Valley Resort
- Arco AM/PM Gas Station
- 76 Gas Station
- Siuslaw Bank
- Southern Oregon Federal Credit Union
- City Hall
- City Public Works Shop
- City Library (also listed under Essential Facilities)

Environmental Assets: Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic and functional service for the community.

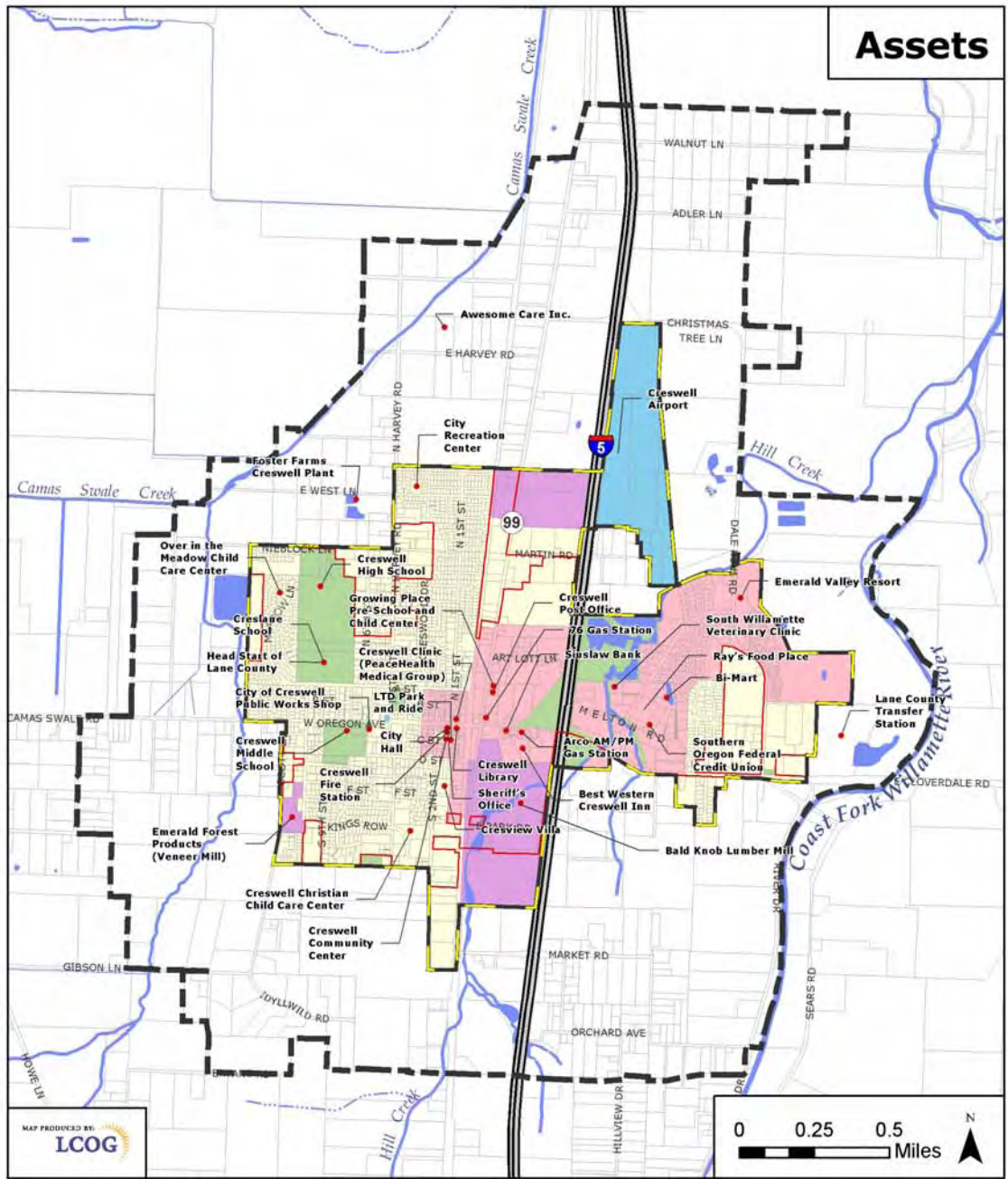
- Harry Holt Memorial Park
- Garden Lake Park
- Cinderella Park (County)
- Emerald Valley Golf Course (private)
- Creswell Butte conservation easement
- Hazelwood Linear Park
- Willamette River and Willamette River Greenway
- Camas Swale Creek

- Hill Creek
- Hill Creek Wetlands
- Emerald Valley Park and Greenway (private)

Hazardous Materials: Those sites that store, manufacture, or use potentially hazardous materials.

- Foster Farms – Creswell Plant (closed as of summer 2007)
- Lumber Mill (Bald Knob Land and Timber Company)
- Emerald Forest Products
- Arco AM/PM Gas Station
- 76 Gas Station
- Lane County Transfer Station
- Creswell Airport

Most of the assets listed above are displayed on the following map.



Legend

- | | |
|-----------------------|--|
| Study Area | Residential |
| Urban Growth Boundary | Commercial |
| City Limits | Industrial |
| Tax Lots | Park, Recreation, Open Space |
| Assets | Public Facilities / Government |
| | Comprehensive Plan Designations |

Printing Date: July 25, 2007

POTENTIAL HAZARDS PROFILE AND ASSESSMENT

The first step in doing a mitigation study involves answering the question, “What kinds of natural hazards pose a threat to the community and how bad can it get?” There are three major hazard risks for the City of Creswell; flooding, earthquakes, and severe winter storms. These hazards are described below. Maps are used to profile the extent of each specific hazard.

After identifying and profiling potential hazard events, the second fundamental question behind natural hazard mitigation planning is, “What assets in the community will be affected by the hazard event?”⁹ This section is designed to assess which community assets are exposed to each hazard. The assessment builds off the hazard identification and profile to gain a clear picture of which assets and populations are vulnerable.

The final step in hazard mitigation planning, risk analysis and estimating losses, is described in the next section.

Flooding

FEMA defines a flood as “A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.” Floods are the most prevalent hazard in the United States.¹⁰ The City of Creswell’s proximity to surface water features indicates that flooding poses a significant hazard.

Flooding Profile

According to the State of Oregon Natural Hazards Mitigation Plan, “Flood risk or probability is generally expressed by frequency of occurrence. The probability of flooding is measured as the average recurrence interval of a flood of a given size and is stated as the percent chance that a flood of a certain magnitude or greater will occur in any given year. FEMA’s NFIP is based on the risk associated with the “base flood” occurring. The base flood is a flood that has a 1% chance of occurring in any year or a 26% chance of occurring during the life of a traditional 30-year home mortgage.”

There are many historic instances of flood events in Lane County. The table that follows outlines the flood events in the region.

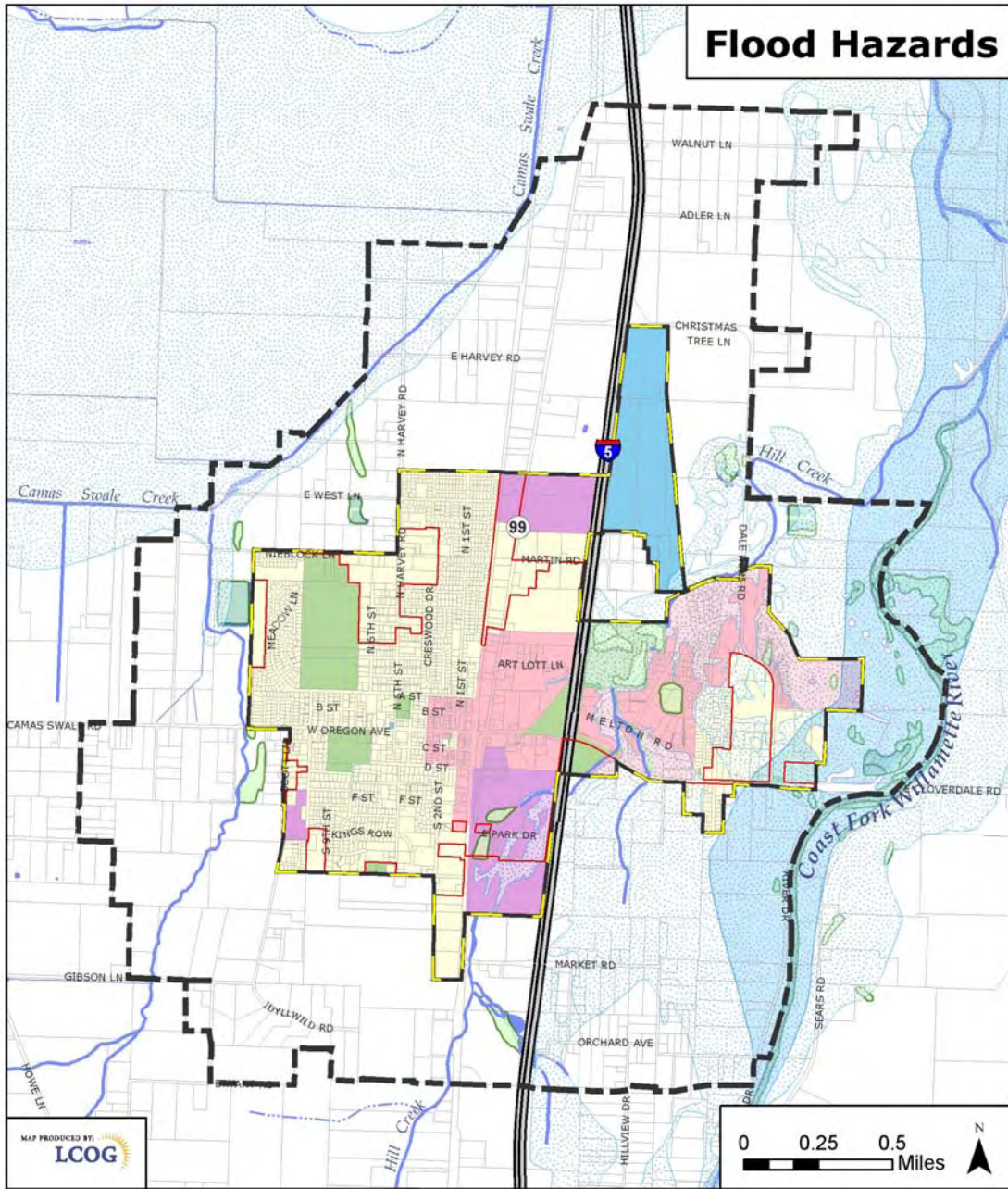
⁹ FEMA
¹⁰ FEMA

Table 2: Significant Flood Events

Date	Location	Notes	Type of Flood
Dec. 1861	Willamette Basin and Coastal Rivers	Two weeks of heavy rain. Every town on the Willamette was flooded or washed away. 635,000 cfs at Portland.	Rain on snow and snow melt
Feb. 1890	Willamette Basin and Coastal Rivers	Second largest known flood in the Willamette Basin. Almost every large bridge washed out.	Rain on snow
Dec. 1937	Western Oregon	Flooding followed by heavy rains. Considerable highway flooding and landslides.	Rain on snow
Jan. 1953	Western Oregon	Widespread flooding in western Oregon accompanied by windstorm.	Rain on snow
Dec. 1964 to Jan. 1965	Willamette Basin	Record flooding throughout Willamette Basin. Two intense storms. \$34 million in damages.	Rain on snow
Jan. 1974	Western Oregon	Flooding followed by wet, heavy snow and freezing rain. Nine counties receive disaster declaration.	Rain on snow
Dec. 1978	Western Oregon	Heavy rain, snowmelt, saturated ground. One fatality in the region.	Rain on snow
Feb. 1986	Entire State	Severe statewide flooding. Rain and melting snow. Numerous homes flooded and highways closed.	Snowmelt
Feb. 1987	Western Oregon	Mudslides. Damaged highways and homes.	Rain on snow
Feb. 1996	Entire State	Deep snow pack, warm temperatures, record-breaking rains. Flooding, landslides, and power outages.	Rain on snow
Nov. 1996	Entire State	Record-breaking precipitation. Local flooding and landslides.	Rain on snow

Source: OR-SNHMP: Mid/Southern Willamette Valley Hazards Assessment

The Flood Hazards map that follows displays the major water features, floodway, and 100-year flood plain in and around the City of Creswell.



Legend

- | | | |
|-----------------------|---------------------|---------------------------------|
| Study Area | Hydrologic Features | Comprehensive Plan Designations |
| Urban Growth Boundary | Floodway | Residential |
| City Limits | 100-year Floodplain | Commercial |
| Tax Lots | NWI Wetlands | Industrial |
| | Perennial Streams | Park, Recreation, Open Space |
| | Water | Public Facilities / Government |

Both Camas Swale Creek and the Coast Fork Willamette River have extensive flood plains. As is displayed on the map, the areas east of Interstate 5 are most susceptible to flood events. The majority of the flood plain for Camas Swale Creek is north of the existing city limits.

A failure of either the Cottage Grove or Dorena Dam would cause significant flooding in the area, far beyond the measured extent of a naturally occurring flood event.

Vulnerability Assessment

Community assets located in the 100-year flood plain include the Creswell Water Treatment Facility, a portion of the Wastewater Treatment Facility, portions of the Bald Knob Timber Company Mill, Emerald Valley Golf Course, Emerald Valley Park and Greenway, Garden Lake Park, Middle Fork of the Willamette River, Camas Swale Creek, Hill Creek wetlands, and portions of Hill Creek. The 100-year flood plain is extremely close to Ray’s Food Place and Bi-Mart on the east side of I-5.

Staff performed an analysis based on existing GIS layers. The following chart displays the amount of land and the Comprehensive Plan designation for the land located in the floodway and 100-year flood plain.

Table 3: Acres of Floodway and Flood Plain in the UGB by Plan Designation

Plan Designation	Acres in Floodway (gross)	Acres in 100-year Flood Plain (gross)
Undesignated	0	10.2
Commercial	8.1	96.0
Industrial	0	19.7
Park, Rec., Open Space	0.5	36.4
Public Facilities/ Government	0	2.2
Residential	18.2	46.9
TOTAL	26.8	211.4

As the map displays, the majority of the southeast quadrant of the Study Area, to the south and east of the existing UGB, is within the 100-year flood plain. If development were to be located here, extra precautions should be taken to protect life and property.

Comprehensive Plan and Development Code Sections: Flooding

The City of Creswell currently has five policies in its 1982 Comprehensive Plan related to Statewide Planning Goal 7, Areas Subject to Natural Disasters and Hazards. All five of the existing policies are related to flooding and the actions that will be taken by the City to protect property and life. Section 3.C.5(a) – 3.C.5(e) is listed below.

- a) *The City shall prohibit intensive development in close proximity to tributary streams and low areas and maintain such areas in open space.*
- b) *The City shall permit improvements in the floodplain subject to appropriate city, county and federal ordinances and regulations.*
- c) *The City shall ensure adequate provision is made or is available for accessibility of emergency vehicles and services during potential future flooding.*

- d) *All development within the flood hazard area, as identified in the Creswell Flood Hazard Map, shall be subject to the flood plain subzone and the conditional use permit process. Additionally, as designated on the Comprehensive Plan Diagram, some lands within the flood hazard are subject to the resort commercial subzone and the planned unit development permit process.*
- e) *Development in close proximity to tributary streams and low areas shall be protected by the application of the flood plain subzone and will be maintained as open space.*

The City of Creswell addresses flood hazards in the Creswell Development Code Chapter 2.7, Flood Plain Overlay. This Chapter is included as Appendix B.

Flood Mitigation: Comprehensive Plan Recommendations

The recommendations below provide direction on specific ways that the City of Creswell can amend and update their Comprehensive Plan to address flood risks. In addition to the policy recommendations specific to flooding, there are a number of policy recommendations that address multiple hazards. These are included in the last section of this chapter.

The policy recommendations are designed to address a number of broader objectives including:

- Protect public investments and key facilities
- Educate/inform the public
- Participate in federal insurance and flood damage prevention programs
- Maintain channels to effectively convey stormwater
- Ensure compliance with specific flood mitigation design guidelines
- Maintain open space in low areas and near tributary streams

Existing policy 5(d) in the Creswell Comprehensive Plan addresses these objectives and policy 5(d) can be slightly modified to more effectively address these concerns as described below:

- Keep existing Comprehensive Plan policy 5(d) in Section III(C)
- Modify Comprehensive Plan policy 5(e) in Section IIIC to state “Development in close proximity to tributary streams and low areas shall be protected by the application of the Flood plain subzone and, when possible, the City shall seek to acquire open space areas and access easements in these areas.

The City should consider replacing the existing policies with the following new policies:

- The City shall construct all public utilities and facilities to minimize or eliminate flood damage.
- The City shall ensure that, to the extent practicable, all public buildings, key facilities, and key infrastructure are located outside of the 100-year flood plain.
- The City shall provide opportunities for on-going public education about flood hazards and ways to mitigate.
- To reduce flooding by maintaining proper stormwater conveyance, the City shall secure dedications and easements for channel maintenance and stormwater conveyance as new development or redevelopment occurs.

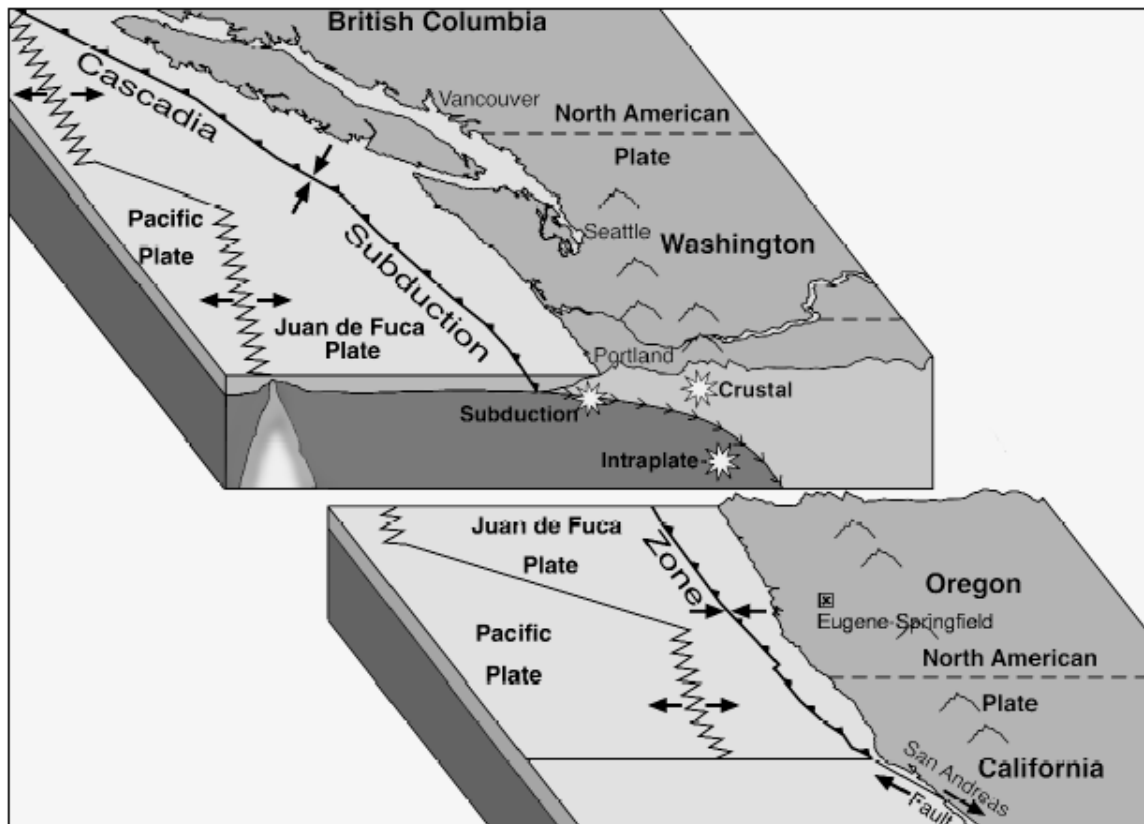
Earthquake

FEMA defines an earthquake as “A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth’s tectonic plates.”

Earthquake Profile

The probability of earthquake events in Creswell was determined using scientific data, historical occurrences, and local knowledge. The Oregon Department of Geologic and Mineral Industries (DOGAMI) has completed a study and prepared a map of the relative earthquake hazards in the Eugene-Springfield metropolitan area and other areas in western Oregon. They have not completed a study or map for the Creswell area. For this reason, information and findings from the Eugene-Springfield study were extrapolated and coupled with existing geologic data to determine earthquake hazards in Creswell. The figure below shows the plate tectonics in the region and the types of earthquakes that pose a threat to the Creswell area.

Plate Tectonics in the Pacific Northwest



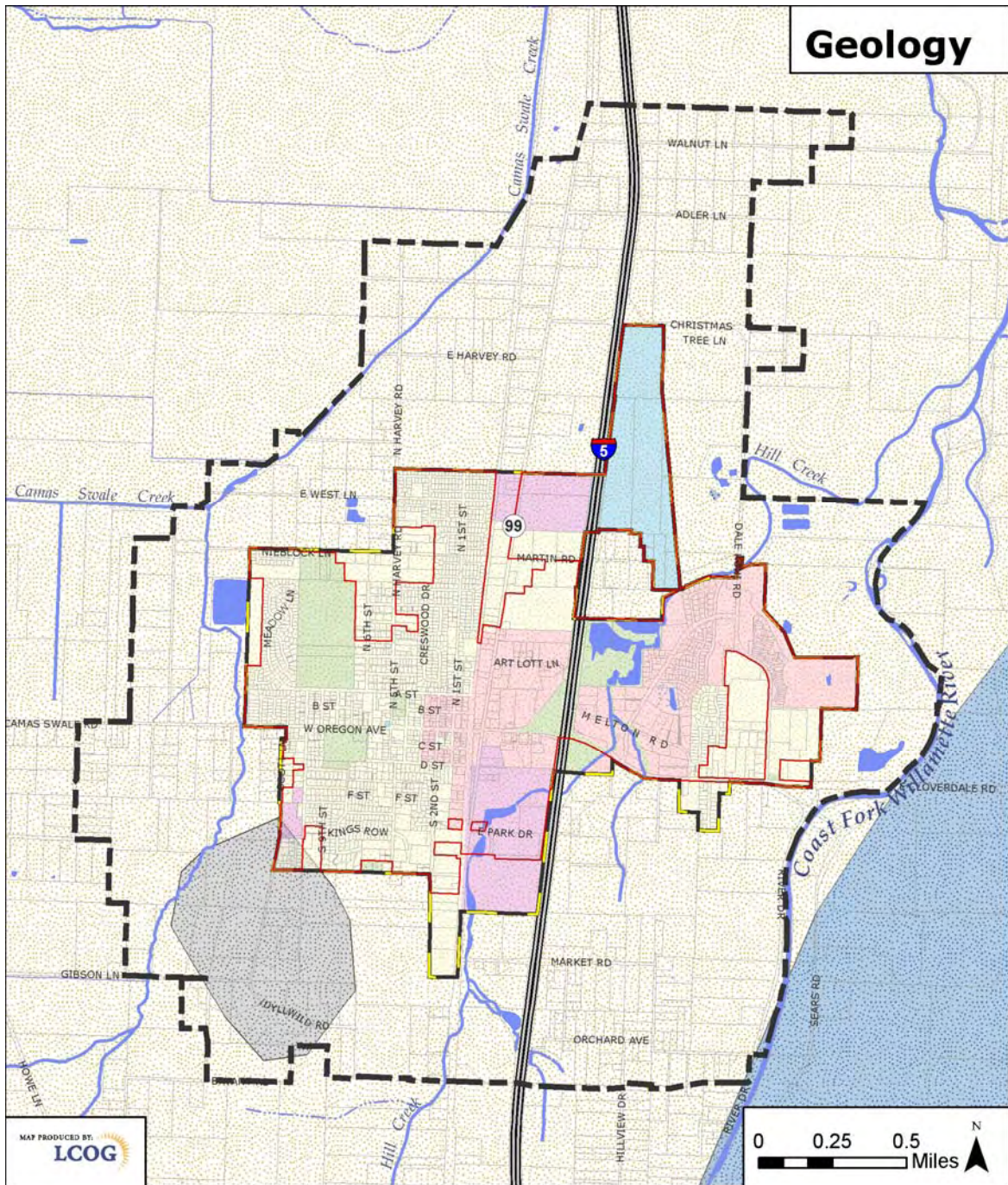
Source: DOGAMI and USGS, *Relative Earthquake Hazard Map for the Eugene-Springfield Metropolitan Area*, 2000.

There are three types of earthquakes that could impact the City of Creswell. Crustal, intraplate and subduction zone earthquakes threaten all of western Oregon to varying degrees. According to DOGAMI, the most severe impacts would be from shallow crustal or great subduction zone earthquakes.

Amplification, liquefaction, and landslides are the factors that generate the most damage in the event of an earthquake. The extent of these factors can be estimated beforehand by examining the geologic materials at the site.

Only one historic account of an earthquake event has been recorded that impacted Creswell. The Scotts Mills Earthquake on March 25, 1993, was felt from Seattle, Washington to Roseburg, Oregon.

The map that follows displays the geologic features in and around the City of Creswell. These features are described in the next section.



Legend

- Study Area
- Urban Growth Boundary
- City Limits
- Tax Lots

- Comprehensive Plan Designations**
- Residential
 - Commercial
 - Industrial
 - Park, Recreation, Open Space
 - Public Facilities / Government

- Geologic Features**
- Alluvial deposits (sand, gravel, & silt)
 - Fisher & Eugene Formations, mapped together
 - Basalt and andesite intrusions

Printing Date: June 19, 2007

Vulnerability Assessment

Almost all of the current land within the Creswell UGB is on flat alluvial deposits. The potential growth areas are also mainly flat alluvial deposits with the only exception being Creswell Butte, which is composed of basalt and andesite intrusions.

Based on more detailed studies in Eugene-Springfield and Cottage Grove, the hazard is relatively low compared to other areas. Aside from some "lateral spreading" that may occur along river banks, there has not been any evidence found of significant liquefaction potential in those two studies. The highest hazard levels are associated with landslide potential, of which Creswell has relatively little risk. High-rise buildings are especially susceptible to damage from earthquakes. The lack of high-rise buildings in Creswell mitigates risk of major losses.¹¹

Seismic evaluations and retrofits should focus on public safety facilities and critical infrastructure. This includes the fire station in downtown Creswell, the Sheriff's office, water and wastewater lines, water treatment facility, wastewater treatment plant, gas lines, and power lines.

An earthquake event could cause substantial damage to transportation networks and other infrastructure. In the case of bridge failures, emergency services to the portion of the city east of I-5 could be significantly delayed.

Relevant Comprehensive Plan and Development Code Sections: Earthquakes

The Comprehensive Plan does not currently contain any policies related to earthquake hazard mitigation.

The Creswell Development Code does not contain earthquake mitigation stipulations, but, as discussed below, new development in Creswell must meet International Building Code earthquake design standards.

Earthquake Mitigation: Comprehensive Plan Recommendations

The earthquake mitigation objectives outlined below provide broad direction on policies that can be implemented to reduce risk and prevent loss from earthquake events. The objectives are followed by specific policy language. In addition to the policy recommendations specific to earthquakes, there are a number of policy recommendations that address multiple hazards. These are included in the last section of this chapter.

The objectives for the earthquake policies include:

- Ensure that structures are designed and built according to seismic standards
- Evaluate site-specific development for earthquake hazards
- Protect public investments and key facilities
- Educate/inform the public

Currently, there are no policies that address the earthquake risk in Creswell. The following policies can be included in the Comprehensive Plan to protect property and reduce losses from an earthquake event.

¹¹ Personal Communication with Bill Clingman, Registered Geologist.

- The City shall implement ongoing public education efforts and public/private partnerships to raise awareness of seismic threats and build support for earthquake hazard reduction activities
- The City shall periodically assess the seismic damage potential to public facilities
- A retrofit prioritization process will be undertaken to determine retrofit activities needed for public safety facilities and other city-owned infrastructure
- The City shall incorporate seismic considerations into the design and construction of public facilities and infrastructure
- The City shall incorporate a review of geotechnical conditions into the evaluation of development applications
- The City shall continue to adopt and implement the most recent version of the International Building Code's seismic standards

Severe Weather Events

This category includes windstorms, winter storms, severe thunderstorms, and prolonged extreme weather conditions. According to FEMA, “Heavy snowfall and extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia.” (2007). Windstorms can cause damage to trees, power lines, and other utility services and can be intensified with the presence of heavy rain or ice. Severe thunderstorm can cause wind or hail damage and lead to flooding.

Severe Weather Event Profile

Winter storm events in Creswell are estimated based on historical occurrences, meteorological data, and local knowledge. Although the probability of a major storm is relatively low it is important to incorporate these considerations to protect life and property as the City grows. The possibilities include ice storms, hailstorms, severe winter storms, excessive rainfall, and strong winds.

Severe weather hazards can be especially troublesome where trees are in close proximity to utility and power lines as well as near roads and houses.

Vulnerability Assessment

Severe storms can be life threatening, cause major infrastructure damage, and can be difficult to manage in terms of response and recovery. Winter storms can cover the road networks with snow and ice, impeding transportation to schools and medical facilities. Winter storms and windstorms can topple trees, down power lines, and causes widespread power outages. Local utilities and the Public Works department could be strained during a severe storm event as they work to clear roads, repair or replace power distribution and/or transmission lines, and maintain telephone lines for communication.

Relevant Comprehensive Plan and Development Code Sections: Severe Weather Events

The current Comprehensive Plan does not currently contain any policies regarding severe weather events hazard mitigation.

Severe Weather Event Mitigation: Comprehensive Plan Recommendations

These recommendations provide direction on specific ways that the City of Creswell can amend and update its Comprehensive Plan to address risks from severe weather events. In addition to the policy recommendations specific to severe weather events, there are a number of policy recommendations that address multiple hazards. These are included in the last section of this chapter.

The objectives addressed by the policy recommendations include:

- Effectively recover after a storm event
- Reduce damage from fallen trees
- Ensure that structures are designed and built to withstand severe weather events

Suggested policies that the City can adopt to effectively reduce damage and ensure recovery following a severe weather event follow.

- The City shall develop a comprehensive strategy for clearing debris from public and private property
- The City shall develop coordinated management strategies for hazardous tree removal
- The City shall continue to adopt the most recent version of the International Building Code's storm standards

Multiple Hazard Comprehensive Plan Recommendations

The objectives and policies listed below are designed to address natural hazard risks in a comprehensive manner. Implementation of these policies will go beyond a single hazard. The objectives addressed by the multi-hazard policies include:

- Distribute natural hazard and vulnerability information and Incorporate new hazards information as it becomes available
- Reduce risk through both regulatory and non-regulatory measures
- Address emergency situations in a comprehensive manner
- Monitor and evaluate implementation of these policies

New policies that achieve these objectives are listed below. Existing policy 5(c) in Section III(C) addresses these objectives and should be retained.

- The City shall monitor the implementation of these natural hazard mitigation policies and adjust implementation mechanisms accordingly.
- The City shall publicly disclose new and updated hazard information as it becomes available. The City shall also incorporate updated hazard information into the Comprehensive Plan policies and any other relevant plans, policies, and procedures.
- The City will establish appropriate hazard mitigation strategies through a combination of regulatory mechanisms and non-regulatory approaches such as education and incentives.
- The City shall develop an Emergency Operations Plan including designated emergency routes and snow removal plans. The Plan shall be coordinated in concert with Lane County and Oregon Emergency Management.

RISK ANALYSIS

A risk analysis is an in-depth look at the value of at-risk property and facilities. The risk analysis provides jurisdictions with specific numbers regarding the losses that may be associated with a hazard event. Although this Study gives a general picture of the potential losses in Creswell, a detailed risk analysis could not be completed due to lack of information, funding, and time. The focus of this Study was to develop a better understanding of the natural hazard risks in the Creswell vicinity and provide Comprehensive Plan policy recommendations.

One of the primary recommendations of this report is to expand on the findings in this Study to develop specific mitigation actions *outside* of Comprehensive Plan policies. The policy recommendations are designed to guide future efforts and target actions to address specific concerns.

CONCLUSION

The Comprehensive Plan policy recommendations are located in the body of this report within each section describing a specific hazard. The table below provides a complete list of the policies along with information about the hazard and objective it is addressing, and its desired affect.

Table 4: Natural Hazards Comprehensive Plan Policy Recommendations

Hazard	Objective	Suggested Comprehensive Plan Language
Flooding	Protect public investments and key facilities	<ul style="list-style-type: none"> ▪ The City shall construct all public utilities and facilities to minimize or eliminate flood damage. ▪ The City shall ensure that, to the extent practicable, all public buildings, key facilities, and key infrastructure are located outside of the 100-year flood plain.
	Public education	The City shall provide opportunities for on-going public education about flood hazards and ways to mitigate.
	Participate in federal insurance and flood damage prevention programs	The City shall participate in federal flood mitigation programs, such as FEMA's National Flood Insurance Program, comply with applicable standards, and seek opportunities to be involved in future flood protection programs.
	Maintain channels to effectively convey stormwater	To reduce flooding by maintaining proper stormwater conveyance, the City shall secure dedications and easements for channel maintenance and stormwater conveyance as new development or redevelopment occurs.
	Ensure compliance with specific flood mitigation design guidelines	[Keep existing Comprehensive Plan policy 5(d) in Section III(C)]
	Maintain open space in low areas and near tributary streams	Modify Comprehensive Plan policy 5(e) in Section IIIC to state "Development in close proximity to tributary streams and low areas shall be protected by the application of the Flood plain Subzone and, when possible, the City shall seek to acquire open space areas and access easements in these areas.

Table 4: Natural Hazards Comprehensive Plan Policy Recommendations (cont.)

Hazard	Objective	Suggested Comprehensive Plan Language
Earthquake	Public education	Implement on-going public education efforts and public/private partnerships to raise awareness of seismic threats and build support for earthquake hazard reduction activities.
	Protect public investments and key facilities	The City shall periodically assess the seismic damage potential to public facilities.
		Retrofit activities for fire and police station shall be the highest priority.
		Seismic considerations shall be incorporated into the design and construction of public facilities and infrastructure.
	Evaluate site-specific development for earthquake hazards	The City shall incorporate a review of geotechnical conditions into the evaluation of development applications.
Ensure that structures are designed and built according to seismic standards	The City shall continue to adopt and implement the most recent version of the International Building Code's seismic standards.	
Severe Weather Events	Ensure that structures are designed and built to withstand severe weather events	The City shall continue to adopt the most recent version of the International Building Code's storm standards.
	Reduce damage from fallen trees	The City shall develop coordinated management strategies for hazardous tree removal.
	Effectively recover after a storm event	The City shall develop a comprehensive strategy for clearing debris from public and private property.

Table 4: Natural Hazards Comprehensive Plan Policy Recommendations (cont.)

Hazard	Objective	Suggested Comprehensive Plan Language
Multiple Hazard	Address emergency situations in a comprehensive manner	<ul style="list-style-type: none"> ▪ [Keep existing Comprehensive Plan policy 5(c) in Section III(C)] ▪ The City shall develop an Emergency Operations Plan including designated emergency routes and snow removal plans. The Plan shall be coordinated with Lane County and Oregon Emergency Management.
	Reduce risk through both regulatory and non-regulatory measures	The City will establish appropriate hazard mitigation strategies through a combination of regulatory mechanisms and non-regulatory approaches such as education and incentives.
	Distribute natural hazard and vulnerability information and Incorporate new hazards information as it becomes available	The City shall publicly disclose new and updated hazard information as it becomes available. The City shall also incorporate updated hazard information into the Comprehensive Plan policies and any other relevant plans, policies, and procedures.
	Monitor and evaluate implementation of these policies	The City shall monitor the implementation of these natural hazard mitigation policies and adjust implementation mechanisms accordingly.

Appendix A. Sources

City of Albany Comprehensive Plan

City of Lebanon Comprehensive Plan

Cottage Grove Natural Hazards Mitigation Plan

Creswell Parks and Open Space Plan

Creswell Economic Opportunities Analysis

Creswell Comprehensive Land Use Plan

Creswell Development Code

Oregon Department of Geology and Mineral Industries. "Relative Earthquake Hazard Map for the Eugene-Springfield Metropolitan Area", 2000.

Federal Emergency Management Agency (FEMA) "Understanding Your Risks: Identifying Hazards and Estimating Losses", part of the "State and Local Mitigation Planning How-To Guide" series

Oregon Natural Hazards Workgroup. "Planning for Natural Hazards: Comprehensive Plan Review"

Appendix B. Creswell Development Code Chapter 2.7 – Flood Plain (FP) Overlay

Chapter 2.7 — Flood Plain (FP) Overlay

Sections:

- 2.7.100 Purpose**
- 2.7.200 Designation of Special Flood Hazard Areas**
- 2.7.300 Designation of the Administrator**
- 2.7.400 Provisions for Flood Hazard Reduction**
- 2.7.500 Review of all Proposed Construction Required**
- 2.7.600 Criteria and Standards**
- 2.7.700 Site Investigation Report**
- 2.7.800 General Requirements**
- 2.7.900 Grading, Excavating and Filling - General Requirements**
- 2.7.910 Variances**
- 2.7.920 Fees**

2.7.100 Purpose

The FP Flood Plain Overlay designation shall be applied in any zone hereinafter set forth where the area is subject to inundation by flooding shall be shown on the Creswell Flood Hazard Map and the Creswell Zoning Map, which designate regulated floodways and areas subject to a one (1) percent or 100-year flood. Its purpose is to minimize property loss, danger of injury and health hazards. To accomplish such purposes, floor elevations will be established by the City prior to issuing any building permits.

- A. The Flood Plain Overlay establishes special concern requirements for the placement and construction of buildings and development site improvements in areas that may be subject to flooding or surface water in order to safeguard the life and health of people in the area of the general public.
- B. The Flood Plain Overlay shall be any zone in combination with the symbol "FP" as an overlay district of special concern. (For example, R/FP means a Residential Zone with combining Flood Plain District regulations.)
- C. The regulations governing the /FP Overlay shall be those of the zone in which it lies and additionally, the provisions of this Section applicable to the development.

The degree of flood protection required by this Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man made or natural causes. This Ordinance does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This Ordinance shall not create liability on the part of the City of Creswell, any officer or employee thereof, or the Federal Insurance Administration, for any flood damages that result from reliance on this Ordinance or any administrative decision lawfully made hereunder.

2.7.200 Designation of Special Flood Hazard Areas

- A. The area of Creswell's jurisdiction within the flood hazard area identified by the Federal Insurance Administration in a scientific and engineering report entitled "The Flood Insurance Study for Lane County Oregon and incorporated cities, dated June 2, 1999, with accompanying Flood Insurance Maps, is hereby adopted by reference and declared to be a part of this Ordinance. The Flood Insurance Study is on file at the Creswell City Hall. The City Council may adopt subsequent Flood Insurance Maps and studies and make them applicable without a change to this Ordinance.
- B. In areas where base flood elevations have not been provided in accordance with Section A above, the City Administrator shall obtain, review, and reasonably utilize any base flood elevation and floodway data available from a Federal, State or other source, in order to administer this Section. When only approximate flood information is available, the property owner shall be cautioned that the property is within an identified flood hazard area.

2.7.300 Designation of the Administrator

The City Administrator has the authority to make all necessary inquiries and determinations to obtain assurances that compliance with this Section is achieved. In areas of special flood hazard, the City Administrator may review all development proposals to determine that the requirements of this Section have been satisfied and that all necessary permits have been obtained from those Federal, State, or local governmental agencies from which prior approval is required, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C 1334. Where applicable, a requirement to obtain such permits can be made a condition for approval of any application within areas of flood hazard.

2.7.400 Provisions for Flood Hazard Reduction – Land Use Review Permits

All structures being erected, repaired, or relocated in areas of special flood hazard must first obtain a land use review permit. The degree of flood hazard will dictate precautions that must be taken to protect the structure and contents from base flood levels unless exempted by the current state building code or amendments. A land use review permit shall be obtained before construction or development begins within any area of special flood hazard established in Section 2.7.2 A. The land use review permit shall be for all structures including manufactured homes and for all development including fill and other activities.

Where elevation data is not available either through the Flood Insurance Study or from another authoritative source, applications for land use review permits shall be reviewed to assure that proposed construction will be reasonably safe from flooding. The test of reasonableness is a local judgment and includes use of historical data, high water marks, photographs or past flooding, etc., where available. Failure to elevate at least two feet above grade in these zones may result in higher insurance rates.

2.7.500 Review of All Proposed Construction Required

Notwithstanding any other provision of this Ordinance, any proposed construction or development within any area of special flood hazard shall require review to assure compliance with the provisions of Sections 2.7.600 through 2.7.900 of this Ordinance. Review to assure compliance with the provisions of Sections 2.7.600 through 2.7.900 of this Ordinance shall include a conditional use permit process for all development proposed within any area of special flood hazard as identified in the Creswell Flood Hazard Map. Where other review is required, (i.e., site review or conditional use review triggered by the base zone) the determination of compliance with the standards of Sections 2.7.600 through 2.7.900 may be combined with and made part of that review.

2.7.600 Criteria and Standards

Land Use Review Permits (Type I), Site Review Approval (Type III), Conditional Use Permits (Type III) and other land use approvals for development within the flood hazard area may be approved by the City Administrator, the Planning Commission or the City Council (whichever is appropriate) after determination that:

- A. The proposed development site will not during potential future flooding be so inundated by flood water so as to result in injury to property or to the health, safety and welfare of residents or potential residents of the immediate area as well as the general public (for example those that might be exposed to flood damage by needing to travel on roads through areas experiencing flooding or those who might suffer impacts from debris carried by flood waters).
- B. All new construction, relocation or substantial improvements of structures within "FP" areas shall have the lowest floor (including basement and mechanical systems) elevated to at least one (1) foot above the 100-year flood level. Non-residential structures may be floodproofed in lieu of the elevation of the lowest floor. Flood proofing plans shall be prepared by an engineer licensed by the State of Oregon to practice civil or structural engineering.
- C. No improvements are proposed that will have a serious tendency to change the flow of surface water during potential future flooding so as to endanger the health, safety and welfare of residents or potential residents or other property in the area.
- D. That emergency vehicles such as ambulances, police and fire will have access to the site during occurrence of any such flooding, for the purpose of evacuating residents or inhabitants of any residential structures or living quarters within the Flood Plain area.
- E. The lowest floor elevation, (including basement and mechanical systems) foundation elevation, ground elevation or top of floodproofing elevation required in conjunction with building permit issuance shall be certified in mean sea level datum by a Land Surveyor and the certification filed with the City Recorder. The certifications must be filed within 30 days of completion of that part of the structure to be certified. An unsatisfactory certification will not be accepted. Failure to comply will represent a Creswell Code infraction.
- F. All new construction and substantial improvements shall be constructed by methods and practices that minimize flood damages and shall be constructed with materials and utility equipment resistant to flood damage. Electrical, heating, ventilation, plumbing, and air-

conditioning equipment and other service facilities shall be designed and/or otherwise elevated or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

- G. All new and replacement water supply and sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system. New and replacement sewage systems shall also be designed to minimize or eliminate discharge from the systems into flood waters. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.
- H. All proposals shall be consistent with the need to minimize flood damage, shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage and shall have adequate drainage provided to reduce exposure to flood damage. Where base flood elevation data has not been provided or is not available from another authoritative source, it shall be generated by the applicant for proposals and other proposed developments that contain at least 50 lots or 5 acres (whichever is less).
- I. For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this criteria must either be certified by a registered engineer or architect or meet or exceed the following minimum criteria:
 - 1. A minimum of two openings having a total net area of not less than one (1) square inch for every square foot of enclosed area subject to flooding.
 - 2. The bottom of all openings shall be not higher than one (1) foot above grade.
 - 3. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

2.7.700 Investigation Report

As a part of the review prior to approval, a site investigation report shall be required that provides information on the site of the development and adjacent land that is likely to be affected. Site Investigation Reports will require third party review at the expense of the applicant. The site investigation report shall provide topographic information of the area in sufficient detail to assess accurately potential flooding elevations based on the recognized definition of area flood potential; identify existing natural drainage ways and potential drainage ways; and other characteristics of the area and their significance as related to the proposed development flooding potential. A description of whether and the extent to which a watercourse will be altered or relocated as the result of proposed development shall be included in the report. The report also may serve to refine boundaries shown on the Comprehensive Plan and/or Zoning Map that classify land areas within the Flood Plain Overlay. In an effort to site structures as far away from any watercourses and protected areas as possible, the report shall include elevations of the 10-year and 50-year floods and location of any proposed structures in relation to these elevations. The purpose of including and mapping these elevations is to show that risk has been minimized to the greatest extent possible. The report shall comply with the standards for the kind of area being investigated and the kind of development being proposed.

The site investigation report shall be prepared by a person or team of persons qualified by experience and training to assemble and analyze physical conditions in a flood potential area. The person or team shall be employed by the applicant but shall be subject to approval as to qualifications by the City. The site investigation report shall also be reviewed by a qualified third party as retained by the City. The comments and recommendations of the third party reviewer shall be incorporated into the findings prepared by the City.

2.7.710 Alterations and Relocations of Watercourses

- A. Generally, no alterations or relocations of watercourses should be allowed unless the primary function of the action is to restore ecological functioning. Alteration or relocation requires approval of the U.S. Army Corps of Engineers (ACE) and possibly the Department of State Lands (DSL). If a watercourse is to be altered or relocated, notice shall be provided to adjacent properties, Department of Environmental Quality (DEQ), and Oregon Department of Fish and Wildlife (ODFW). Proof of notification and required state and federal permits shall be submitted to the Federal Insurance Administration.
- B. When an alteration or relocation does occur, maintenance within the altered or relocated portion of the watercourse shall be provided so the flood carrying capacity is not diminished.
- C. Alterations or relocations, including stabilization projects, shall not degrade fish and wildlife habitat or the physical processes that create and maintain habitat, or cause increased flood hazard or erosion to other properties and shall be subject to the following provisions:
 - 1. Any culverts that are used on fish-bearing streams must conform with ODFW standards for fish passage and protection.
 - 2. Bridges or other crossing must allow for uninterrupted downstream movement of wood and gravel, must be close to perpendicular to the stream as possible, be designed to minimized fill and to pass 100-year flood flows allowing full channel migration and conveyance of 100-year flood water flows.
 - 3. Alterations must maintain natural meander patterns, channel complexity and flood plain connectivity. Such characteristics must be restored as part of the alteration.
 - 4. The applicant shall identify the channel migration zone for the stream at the project site and for a reasonable reach upstream and downstream of the site, and shall not undertake actions as part of the alteration that would in any way inhabit the channel.
 - 5. Wherever feasible as part of an alteration, existing culverts not in compliance with ODFW fish habitat requirements must be removed or replaced with those meeting the standards.
 - 6. Alteration projects shall not result in blockage of side channels. If at the time of alteration there are known barriers to fish passage into side channels, they shall be removed.
 - 7. If man-made side channels are part of an alteration project for irrigation, industrial, or similar purposes they shall be adequately screened and conform to all state and federal requirements.

2.7.800 General Requirements

A. In a special flood hazard area where base flood elevations have not been established:

1. The applicant shall be notified that the building site is in an Approximate Study Flood Hazard Area and extra precautions may be appropriate to assure that the building site will be reasonably safe from flooding.
2. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure. All manufactured homes must be anchored to prevent flotation, collapse, or lateral movement, shall be installed using methods and practices that minimize flood damage, and shall be installed within 30 days of placement. Anchoring methods may include, but are not limited to, use of over-the-top or frame ties to ground anchors and shall be installed in a manner to comply with State standards.
3. A time extension to the tie-down requirement may be granted for hardship by the Building Official between May and October based on written appeal. A request shall contain a time schedule for achieving compliance and an agreement not to remonstrate against enforcement action for failure to comply.
4. Require that development greater than 50 lots or five acres, whichever is the lesser, include within such proposals base flood elevation data.

B. Where base flood elevation data is provided through the Flood Insurance Study or required as in Section 2.7.200.B, the City shall:

1. Obtain and record the actual elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially improved structures, and whether or not the structure contains a basement.
2. For all new or substantially improved floodproofed structures:
 - a. Verify and record the actual elevation (in relation to mean sea level), and
 - b. Maintain the floodproofing certifications required in Section 2.7.200.A.
3. Maintain for public inspection all record pertaining to the provisions of this Section.
4. Apply the following standards for construction and improvements of residential structures other than manufactured homes (see subsection 6 below).
 - a. Require that all construction and substantial improvements of residential structures have the lowest floor (including the basement and mechanical systems) elevated to one (1) foot above the base flood elevation. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.
 - b. Fully enclosed areas below the lowest floor that are subject to flooding are prohibited, or shall be designed to automatically equalize hydrostatic flood

forces on exterior walls by allowing for the entry and exit of floodwater. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria:

- (1) A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.
- (2) The bottom of all openings shall be no higher than one foot above grade.
- (3) Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwater.

5. Apply the following standards to all construction and improvements of non-residential structures:

- a. Require that all new construction and substantial improvements of nonresidential structures have the lowest floor (including the basement and mechanical systems) elevated to one (1) foot above the base flood elevation; or
- b. Require that, together with attendant utility and sanitary facilities, all new construction and substantial improvements of nonresidential structures shall:
 - (1) Be floodproofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water;
 - (2) Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;
 - (3) Be certified by a registered professional engineer or architect that the design and methods of construction are in accordance with accepted standards of practice for meeting provisions of this subsection based on their development and/or review of the structural design, specifications and plans. Such certifications shall be provided to the official as set forth in this Section.
 - (4) Nonresidential structures that are elevated, not floodproofed, must meet the same standards for space below the lowest floor as described in part 2.7.800.B.4.b. of this Section.
 - (5) Applicants floodproofing nonresidential buildings shall be notified that flood insurance premiums will be based on rates that are one foot below the floodproofed level (e.g., a building constructed to the base flood level will be rated as one foot below that level.)

6. Apply the following standards to all construction and improvements of manufactured homes:

- a. All manufactured homes must be anchored to prevent flotation, collapse or lateral movement, and shall be installed using methods and practices that minimize flood damage. Anchoring methods may include, but are not limited to, use of over the top or frame tie to ground anchors.
- b. All manufactured homes to be placed or substantially improved within Zones A1-A30, AH, and AE on sites:
 - (1) Outside of a manufactured home park or subdivision,
 - (2) In a new manufactured home park or subdivision,
 - (3) In an expansion to an existing manufactured home park or subdivision, or
 - (4) In an existing manufactured home park or subdivision on which a manufactured home has incurred “substantial damage” as the result of a flood;

Shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated one (1) foot about the base flood elevation and be securely anchored to an adequately designed foundation system to resist flotation, collapse, and lateral movement.

- c. Manufactured homes to be placed or substantially improved on sites in an existing manufactured home park or subdivision within Zones A1-A30, AH, and AE that are not subject to the above manufactured home provisions be elevated so that either:
 - (1) The lowest floor of the manufactured home is at least one foot above the base flood elevation, or
 - (2) The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist floatation, collapse, and lateral movement.

7. Require that all recreational vehicles placed on sites within Zones A1-30, AH, or AE either:

- a. Be on the site for fewer than 180 consecutive days,
- b. Be fully licensed and ready for highway use, on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions or
- c. Meet the permit requirements in Section 2.7.400 and the anchoring requirements for manufactured homes.

C. In all designated regulatory floodways the City shall:

1. Require that no partitions or land divisions be permitted, if the development site for the structure is inside the floodway boundary or unless an engineering analysis can demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the base flood levels during the occurrence of a base flood discharge. The analysis shall also be reviewed by a qualified third party as retained by the City. The comments and recommendations of the third party reviewer shall be incorporated into the findings prepared by the City.
 2. Prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.
 3. Mobile homes on single lots or in new or improved mobile home parks or subdivisions are prohibited in designated regulatory floodways.
- D. Replacement in kind shall comply with standards for new construction.
- E. Requirements of this Section shall not apply when specifically waived in accordance with Federal or State laws governing the reconstruction, rehabilitation, or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places.
- F. Development permitted under this subsection shall also be subject to the requirements of Sections 2.7.800.A2 and B.
- G. Adjacent communities and the Department of Land Conservation and Development shall be notified prior to any alteration or relocation of a watercourse, and evidence of such notification shall be furnished to the Federal Insurance Administration.
- H. Maintenance shall be required within the altered or relocated portion of altered or relocated watercourses so that the flood carrying capacity is not diminished.

2.7.900 Grading, Excavating and Filling - General Requirements

All areas identified as special flood hazard are subject to the following:

- A. No development will occur within 50 feet of any primary or secondary stream channel, including but not exclusive to the Coast Fork of the Willamette River, Camas Swale and Hill Creek and no swale or other low area necessary to discharge water downstream during periods of flooding shall be obstructed unless a grading plan is approved in accordance with Article 3.
- B. Channel improvement or bank protection shall be performed only after receiving approval of a site review permit.
- C. The site review permit shall not authorize any work that is not in compliance with local zoning or other local, state or federal regulations pertaining to the operations authorized by

the permit. The permit holder is responsible for obtaining the necessary approvals and permits before proceeding under the site review permit.

- D. Require that in riverine situations, adjacent communities and Division of State Lands State Coordinating Officer be notified prior to any alteration or relocation of a watercourse, and that copies of such notification be submitted to the Federal Administrator.
- E. That the flood carrying capacity within the altered or relocated portion of any watercourse shall be maintained.

2.7.910 Variances

- A. The issuance of the variance described in this Section is for flood plain management purposes only and is generally limited to a lot size less than one-half acre. Insurance premium rates are determined by statute and will not be modified by the granting of a variance.
- B. Variances shall not be issued by the City within any designated regulatory floodway if any increase in base flood discharge would result.
- C. Variances may be issued for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.
- D. Variances shall only be issued by the City upon showing good and sufficient cause based on scientific technical data compiled by a surveyor, engineer or architect submitted by the applicant. There must be a determination that failure to grant the variance would result in exceptional hardship to the applicant. It must be determined that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with local laws or ordinances.
- E. In all cases, the applicant is charged with the responsibility of obtaining all technical or other evidence for review and filing.
- F. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
- G. The applicant shall be notified in writing that:
 - 1. The issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as \$25 for \$100 of insurance coverage and,
 - 2. Such construction below the base flood level increases risks to life and property.
- H. Records will be maintained on all variance actions, including justification for their issuance, and reported in the annual or biennial report submitted to the Administrator.
- I. Variances may be issued for new construction and substantial improvements and for other

development necessary for conduct of a functionally dependent use provided that items C through H of Section 2.7.910 are met and the structure or other development is protected by methods that minimize flood damages during the base flood and create no additional threats to public safety.

2.7.920 Fees

Fees established by the resolution of the City Council for the flood plain permits or variances will be required by this Section to defray the cost of processing the application.

*LCOG: L:\SMALL CITY PLANNING\CRESWELL PLANNING\PLANNING\COMP PLAN UPDATE\NATURAL HAZARDS\NATURAL HAZARDS PLAN\DRAFT HAZARDS STUDY VERSION 2.DOC
Last Saved: January 9, 2008*