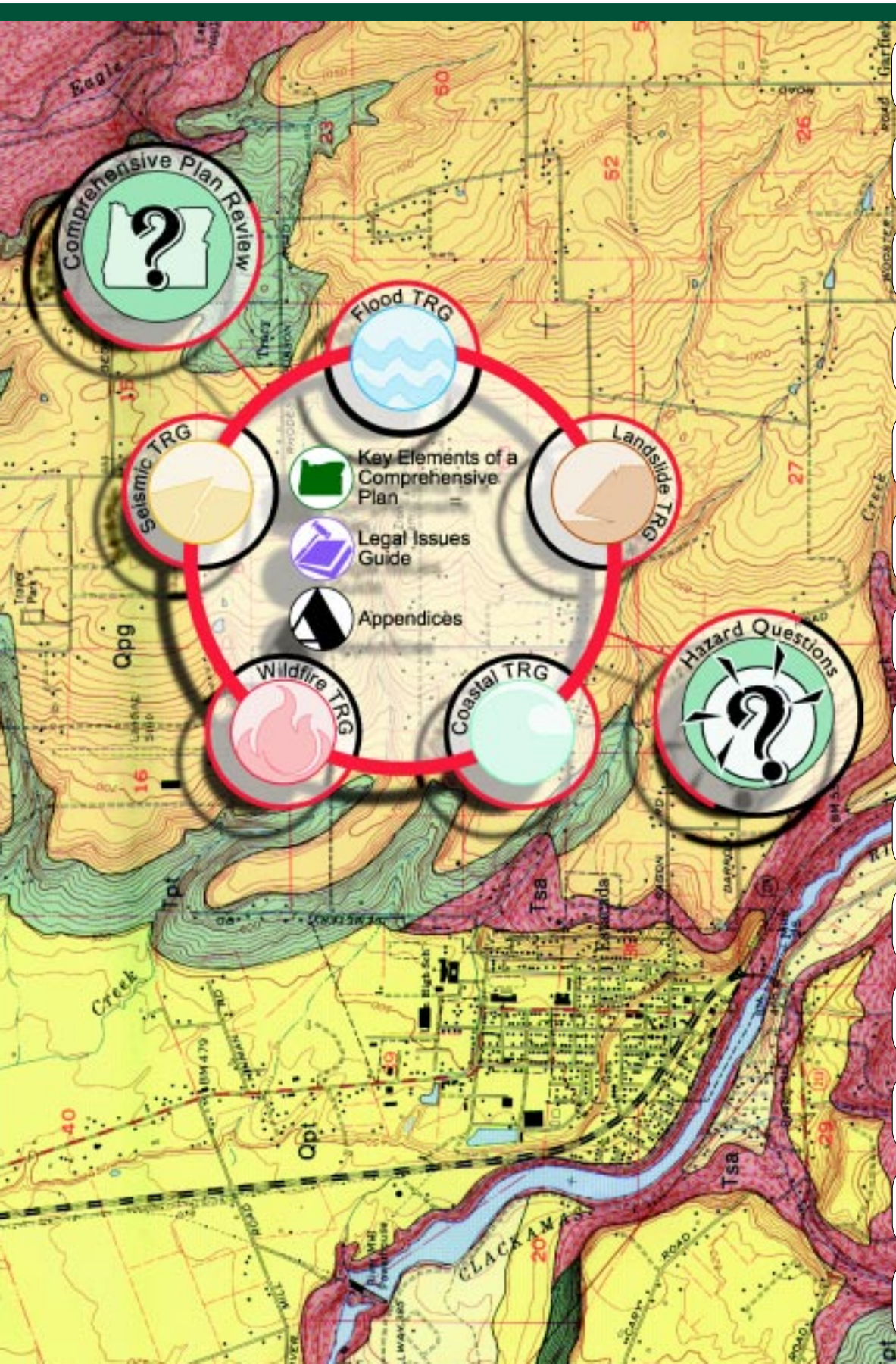
Planning for Natural Hazards:

Oregon Technical Resource Guide



Letter from the Director of the DLCD

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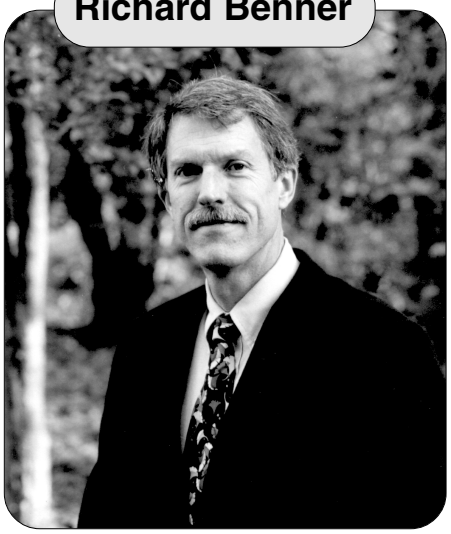
From the Director:

On behalf of the Land Conservation and Development Commission (LCDC), our department is pleased to provide the Planning for Natural Hazards: Oregon Technical Resource Guide.

The Guide is part of the state's response to the damaging flood and landslide events of 1996 and 1997. Following those disasters, Governor Kitzhaber directed our agency to review Statewide Planning Goal 7 (Natural Hazards) to see if more could be done through the state land use program to reduce the risks to life and property.

With the support of a federal hazard mitigation grant, our review of Goal 7 began in 1998 with the assistance of a consultant team from the University of Oregon's Community Planning Workshop. We conducted a statewide survey of local planning officials and met with hazard experts and state agencies. The survey revealed two priorities for many local planners: 1) the need for updated information about natural hazards affecting their communities, and 2) practical examples and technical assistance to help strengthen the hazard provisions of their comprehensive plans and implementing regulations. In June 1999, based on the survey and the recommendations of a state-local advisory committee, LCDC directed the department to prepare a package of technical assistance materials for local governments on natural hazards.

Richard Benner



The department believes that the task of addressing natural hazards adequately in the planning and development of Oregon's communities will become more important as our state's population continues to grow. We hope the Guide will help lead to improved comprehensive plans to relieve the mounting pressures to develop in hazard areas.

The department is grateful for the assistance of many local and state specialists who volunteered their time and expertise to review the drafts of the Guide and offered many useful suggestions. Their contributions were invaluable in making sure that the Guide is technically accurate and presents practical planning assistance in an easy-to-use format.

The Natural Hazard Guide demonstrates our department's continuing commitment to respond to the technical assistance needs of local governments as they carry out their many responsibilities under Oregon's statewide planning program. Those using the Guide are encouraged to share it with others and copy pertinent sections to further expand their awareness of the importance of natural hazards in land use planning.

Please feel free to write or contact the department concerning any questions, corrections or improvements to the Guide. A 'comment card' is included with the document. In the future, if budget funds permit, we hope to prepare and distribute updated supplements to the Guide.

Sincerely,

Richard Benner, Director

To Whom We Owe Thanks:

The Oregon Department of Land Conservation and Development (DLCD) recognizes the many individuals and organizations who provided invaluable assistance in preparing the Natural Hazards Technical Resource Guides.

We would like to offer special thanks to the members of our project steering committee. Steering committee members from local government provided insights about the challenges facing many Oregon communities to successfully address natural hazards in their comprehensive plans at a time of rapid population growth. Their advice and experiences from the perspective of the "local planning shop" also provided a critical reality check. They helped to make sure that the guides offer needed information in an easy-to-use format. Their contributions will benefit professional planners, planning commissioners and local elected officials.

We would also like to thank the state agency representatives who participated on the steering committee. Agency members of the steering committee provided descriptions of current Oregon law on natural hazards as well as background about the missions and programs of their respective agencies. Our state agency colleagues also helped clarify technical issues and identified references and web sites for those readers seeking additional information. The Department expresses special thanks to Dennis Sigrist of Oregon Emergency Management who managed the Federal Emergency Management Agency's hazard mitigation grant which funded this project.

All of the committee members deserve our appreciation for the many hours spent in meetings and reviewing and commenting on draft documents. Listed on the next page are the committee members, along with the organizations they represent and their positions.

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Photo by: André LeDuc

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Natural Hazard Technical Resource Guide: Research Team

None of the guides and the other related documents would have been possible without the dedication, initiative and tireless efforts of our consultant team of graduate planning students from the University of Oregon's Community Planning Workshop (CPW). The students accomplished a great deal of work in a relatively short amount of time, while still carrying their normal academic course loads.

Overall project management was the responsibility of Andre LeDuc, with assistance from Robert Parker. Both serve on the CPW staff and are instructors at the University of Oregon. Their good humor, attention to detail, strong organizational skills and patience in responding to editorial comments were major factors in ensuring the successful completion of this project. Finally, all credit for the project's graphic design and text layout is owed to Skipper McFarlane, also a member of the CPW staff and a University of Oregon instructor.

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Other Specialists Deserving Our Thanks:

Along with those on the steering committee and the reseach team, other specialists were very helpful in editing drafts and suggesting additional technical resources. These individuals include:

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This project was supported, in part, by financial assistance from the Federal Emergency Management Agency's Hazard Mitigation Grant Program which assists states and local communities in implementing long-term hazard mitigation projects following major disaster declarations. Grant funds were managed through the Oregon State Police - Office of Emergency Management.

Background

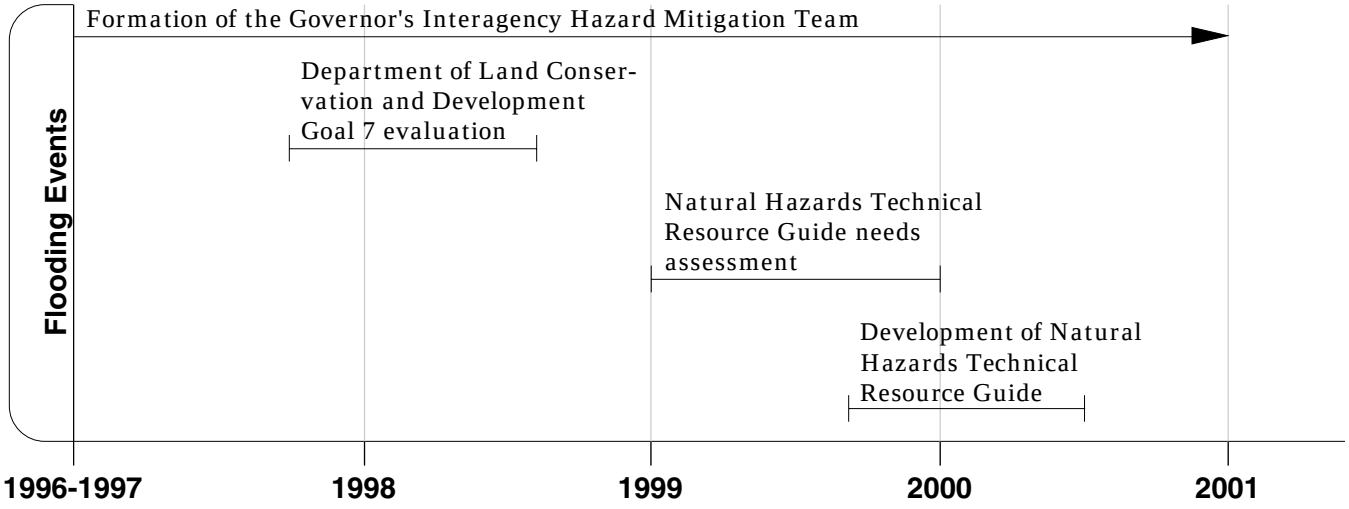
Historians may record the end of the 20th century as a time when the United States awoke to the seriousness of the threat that natural hazards pose to human development. From the Carolinas, across the Midwest, and into California, the combined losses from Hurricane Hugo, the 1993 midwest floods, and the Northridge earthquake totaled more than $74 billion. The devastation caused by natural hazards has also been felt at a smaller scale as communities across America have been overwhelmed by natural events they were unable to control. Experts conclude that most of the estimated $26 billion the United States experiences each year in damage from natural disasters comes from localized events. In Oregon, these events have included the Tillamook County floods. Douglas County landslides, and Deschutes County wildfires. Oregonians know all too well that natural hazards can have devastating impacts.

Across the United States, planning experts have observed that as the pressure to develop increases, so does our vulnerability to catastrophic losses from future disasters. On a national level, one of the identified reasons for this increased vulnerability is that local governments have not done an adequate job of steering development away from hazardous areas or of seeing to it that appropriate hazard mitigation measures are incorporated in new construction. In Oregon, we face a similar challenge of planning development in both urban and rural areas in ways which reduce our vulnerability to natural hazard losses. In addition, communities must ensure that local hazard regulations are legally sound, protect the public interest and provide certainty to landowners and developers in the use of their property.

This guide is written for a wide audience and is designed to be a useful tool for anyone from a city clerk or planner to a planning commissioner or city councilor. This guide provides information on how to identify, plan for, and address natural hazards. It also directs local governments to additional resources and information that may be needed to solve local problems.

The emphasis of this document is on strengthening local comprehensive land use plans. This guide presents a broad range of resources for understanding and implementing effective land use plans and natural hazard ordinances at the local level. It emphasizes that the primary tools each community has for implementing its natural hazard strategy are the hazards elements in its comprehensive plan, and its zoning code and subdivision ordinances. Finally, the guide also highlights a number of various land use tools and techniques presently used in Oregon communities to implement both regulatory and non-regulatory hazard mitigation strategies.

Development Timeline



Why a Technical Resource Guide?

The impetus for the Technical Resource Guide was damage resulting from the severe winter storm events that struck Oregon in February and November of 1996. These storms triggered heavy flooding and numerous landslides throughout the state, resulting in widespread property destruction and the unfortunate loss of human life. Immediately following these events, Governor John Kitzhaber requested that several state agencies take steps to review their programs and identify ways of reducing future risks from natural hazards in Oregon. The Governor specifically directed the Land Conservation and Development Commission to review Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards. The review of Goal 7 began in 1998 with support from a federal hazard mitigation grant and the assistance of a consultant team from the University of Oregon's Community Planning Workshop.

The Community Planning Workshop conducted a statewide survey of local planning officials and met with hazards experts and state agencies to assess the effectiveness of Goal 7 in addressing natural hazards. The survey revealed two priorities for local planners: (1) the need for updated information about natural hazards affecting their communities; and (2) practical examples and technical assistance to help strengthen the hazard provisions of their comprehensive plans and implementing regulations. In June 1999, based on survey responses and the recommendations of a state-local advisory committee, LCDC directed the department to prepare a package of technical assistance materials for local governments on natural hazards.

As the State's population grows, the task of adequately addressing natural hazards in the planning and development of Oregon's communities will become increasingly important. This guide is designed to help communities improve their comprehensive plans and to counter the mounting pressures to develop in hazard areas.

The Context for Natural Hazards Planning in Oregon

Professional planners, hazard mitigation specialists and emergency response officials have long recognized that the cost of coping with the aftermath of natural disasters could be significantly reduced by better planning. Proactive approaches such as avoiding hazard areas where possible or limiting the type and intensity of development in such areas are the best methods to reduce risk to people and structures.

While communities across the country have employed innovative planning strategies to address natural hazards, Oregon is one of a few states that makes planning for natural hazards an integral element of a statewide land use planning program.

Oregon's statewide land use planning program, begun in 1973, is premised on three basic principles:

- Each of Oregon's 277 cities and counties must develop local comprehensive plans and implementing ordinances;
- Local comprehensive plans and implementing ordinances must meet standards set by the Statewide Planning Goals, related statutes, and administrative rules; and
- The state must provide technical and financial assistance to help local governments meet the state requirements.

More than a quarter century after the program's inception, the three principles continue to be reflected in Oregon's land use program. All Oregon cities and counties have comprehensive plans and implementing ordinances that comply with the statewide planning goals.

The continuing challenge faced by local officials and state government is to keep this network of coordinated local plans effective in responding to the changing conditions and needs of Oregon communities. This is particularly true in the case of planning for natural hazards where communities must balance development pressures with more detailed information on the nature and extent of hazards.

Oregon's land use program has given its communities and citizens a unique opportunity to ensure that natural hazards will be included in the development and implementation of local comprehensive plans and thus reducing the risk and damage from future natural disasters.

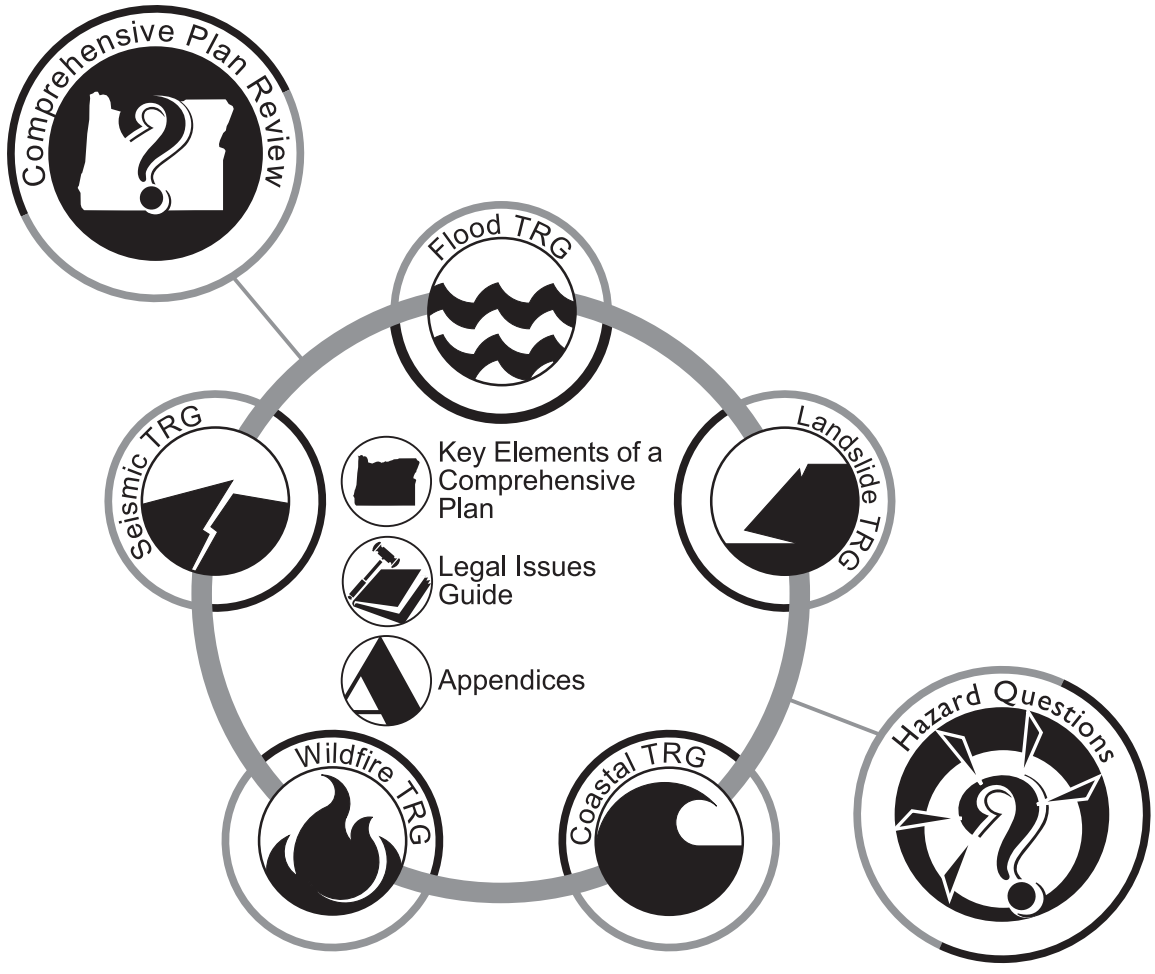
Back Forward

How is this Guide Organized?

The Guide contains eight chapters and three appendices. The eight chapters of the guide are organized into three main components: comprehensive planning in Oregon, legal issues, and chapters on five of Oregon's most common natural hazards. Given the complexity of the information presented, the guide is designed to help the reader move smoothly throughout the document. Visual cues, such as icons representing the specific hazards, are used throughout the guide to highlight important information and to help the reader find related materials in other chapters. There are two primary ways to find information in this guide:

1. The reader may choose to begin with the chapters on Comprehensive Plan Review if their community wishes to evaluate its existing plan and ordinances on natural hazards.
2. The guide may also be used as a resource for answering specific hazard-related questions. In this case, the reader would go directly to the hazard specific chapter.

TRG organization flowchart



Comprehensive Planning: (Chapters 1- 2)

The Comprehensive Planning component is covered in the first two chapters of the guide. Chapter 1 provides local governments with a comprehensive plan evaluation tool. The evaluation is designed to help you identify the strengths and weaknesses of your plan and is not intended to judge whether your plan is good or bad or to rank the quality of an individual plan. This evaluation may serve to assist your community in determining whether amendments may be necessary in order to achieve your community's goals for natural hazards planning. Chapter 2 provides an overview of Oregon's land-use planning system and the required elements of a comprehensive plan and implementing measures.

Legal Issues of Planning: (Chapter 3)

Chapter 3, provides a brief overview of some of the legal requirements and duties which are imposed on local governments by state and federal law. This chapter is designed to identify broad legal issues that must be considered by local governments when developing, amending or implementing comprehensive plans. This chapter also contains a brief discussion on the Oregon Tort Claims Act which governs the legal liability of local governments, and offers a brief summary of constitutional takings issues which may be present when local governments choose a regulatory approach to restricting development in hazardous areas.

Hazard Specific Planning: (Chapters 4-8)

The final chapters address flood, landslide, coastal, wildfire, and seismic hazards. Each of these chapters begins with an introduction that provides an overview of the chapter's contents. The introduction is followed by five sections that pose and answer the following questions:

(1) Is your community threatened by natural hazards?
(2) What are the laws in Oregon for natural hazards?
(3) How can your community reduce risk from natural hazards?
(4) How are Oregon communities addressing natural hazards?
(5) Where can your community find resources to plan for natural hazards?

These hazard specific chapters are designed to assist a local government in rolling up its sleeves and getting to work on developing long-term plans and hazard-specific ordinances to implement their plans.

Further Information and Comments on the Document

For additional information on this guide, please contact the Department of Land Conservation and Development at 503-373-0050. If you have comments please use the “comment card” at the front of the document. We welcome your questions, corrections and suggestions for improving this guide.

PLANNING FOR NATURAL HAZARDS:
Comprehensive Plan Review

July 2000

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Special thanks to the following persons for their guidance in the development of this chapter:

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Michele Steinberg — *Institute for Business and Home Safety*

This questionnaire was modeled from the Institute's Communty Land Use Evaluation for Natural Hazards (CLUE). For more information: **http://www.ibhs.org**

Planning for Natural Hazards: Comprehensive Plan Review

The Oregon Land Use Planning Act (ORS Chapter 197) requires all cities and counties to develop and adopt comprehensive land use plans. Statewide Planning Goal 7 requires communities to (1) inventory known natural hazards, and (2) implement appropriate safeguards for development in hazardous areas. Goal 7, however, does not provide specific direction on how communities should address development in hazardous areas. Thus, a wide range of approaches exists for communities to address Goal 7. The Technical Resource Guide includes a questionnaire to help your community review your comprehensive plan for natural hazards.

The purpose of this review is to help you assess the natural hazard element of your community's comprehensive plan. Although each question is preceded by "yes" and "no" checkboxes, there are no "right" or "wrong" answers. This review is *not* intended to evaluate the degree to which your community is in compliance with Statewide Planning Goal 7. Rather, it is intended to help you appraise and potentially improve the effectiveness of your community's natural hazard planning element.

This review should be used in combination with the rest of the Natural Hazards Technical Resource Guide. The Guide, as a whole, is designed to help local governments ensure that their comprehensive plans continue to meet and go beyond the intent of Goal 7 and other state land-use requirements related to natural hazards. The review will lead you to information presented in the hazard-specific Technical Resource Guides (TRGs) and in the accompanying appendices. These TRGs contain Oregon community case studies, resource listings and additional information on specific hazards. This review focuses on comprehensive plan elements. Implementing ordinances and regulations for reviewing development applications in hazard-prone areas are addressed in each hazard-specific TRG.

The review includes six sections. The questions found in each section address the key components of a comprehensive plan, as they relate to natural hazard planning. Included in the margin of each page is a blank column for you to make notes and jot down questions. A person familiar with his or her community's comprehensive plan should complete the review in about 30 minutes. However, it may take more time to gather or review the local documents needed for this process.

1. Statewide Planning Program Requirements

Oregon's planning laws require every community that has an area, or areas, subject to one or more natural hazards to have a comprehensive plan element addressing natural hazards. The most common natural hazards affecting Oregon communities include: earthquakes, floods, landslides, and wildfire. Depending on your community's location and topography, you may also have to consider the impacts of coastal erosion, wind storms, tsunamis, volcanoes, winter storms, or soil subsidence.

1.1. Does your community have areas of known (i.e., identified) natural hazards?

- ❒ YES
- ❒ NO

1.2. Does your comprehensive plan have a natural hazards element?

- ❒ YES
- ❒ NO

For record keeping purposes, write its name and the date when the hazards element was last revised here:

_____

1.3. Does your comprehensive plan contain background information, policies and implementing measures to address natural hazards? (Check all that apply)

- ❒ Background
- ❒ Policies
- ❒ Implementing Measures

1.4. Does your comprehensive plan reference or contain appendices concerning other plans or studies that address natural hazards?

- ❒ YES
- ❒ NO

For record keeping purposes, write their name(s) and date(s) here:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Notes

TRG Key

Information on Statewide Planning Program requirements for flood, landslide, coastal, wildfire and seismic hazards can be found in Section 3 of each Hazard Specific Technical Resource Guide. Also, the full text of Statewide Planning Goals 2, 7, 17 and 18 can be found in Appendix A.

Notes

2. Quality of Factual Base

Every comprehensive plan must incorporate or reference factual data, including maps, to support the plan's policies, land-use designations (e.g., commercial, residential) and implementing measures. The natural hazards element should explain current conditions, trends and likely future conditions for each hazard in the community.

2.1. For each identified hazard, does the plan describe past natural disasters, their effects and costs, and the response to them?

- ❒ YES. DESCRIBES ALL.
- ❒ YES. BUT DESCRIBES ONLY SOME.
- ❒ NO

2.2. For each identified hazard, does the plan assess the degree of risk facing the community?

- ❒ YES
- ❒ YES. BUT ONLY SOME.
- ❒ NO

2.3. Does the factual base support the comprehensive plan's policies, maps with overlay districts and implementing measures?

- ❒ YES
- ❒ NO

2.4. Does the plan describe the natural hazards in terms of the geographical extent, the severity, and the frequency of occurrence?

- ❒ YES
- ❒ NO

2.5. Does the plan include or reference maps that identify hazardous areas?

- ❒ YES
- ❒ NO

TRG Key

Information on factual base development for natural hazards can be found in Chapter 2: Key Elements of a Comprehensive Plan. For information on factual base development for flood, landslide, coastal, wildfire and seismic hazards, refer to Section 2 of each Hazard Specific Technical Resource Guide.

3. Identification of Issues

Well-written comprehensive plans explain why natural hazards are of significance, both to the community and to individual property owners, in order to support the plan's policies, land-use designations and implementing measures.

3.1. Does the plan discuss the importance, purpose and benefits of regulating development in hazardous areas?

- ❒ YES
- ❒ NO

3.2. Does the plan discuss specific issues related to development in hazardous areas? For example, foundation cracking in areas with unstable soils.

- ❒ YES. DESCRIBES ALL.
- ❒ NO
- ❒ PARTIALLY. IF PARTIALLY, PLEASE EXPLAIN.

3.3. List the major issues related to natural hazards in your community.

Notes

Use table of contents or bookmarks to navigate multiple sections.

TRG Key

For information on the significance of flood, landslide, coastal, wildfire and seismic hazards in Oregon, refer to Section 1 of each Hazard Specific Technical Resource Guide. Refer to Section 4 of each guide for specific risk reduction techniques.

Notes

4. Policies

Statewide Planning Goal 2 requires that policies must be supported by a sound factual base. Depending on the types of hazards present in your community, not all policies listed below will necessarily apply. Indicate "not applicable" by checking the "N/A" box.

4.1. Does the plan have a policy supporting non-structural approaches to hazard mitigation?

- ❒ YES
- ❒ NO

4.2. Does the plan have a policy to consider the environmental issues of hazard mitigation activities?

- ❒ YES
- ❒ NO

4.3. Does the plan include policies to zone for low-intensity development in areas of high vulnerability to natural hazards? Examples of such policies include: cluster zoning to keep structures from being built in floodplains, zoning for recreational or open space, land acquisition priorities on high hazard areas, etc.

- ❒ YES
- ❒ NO
- ❒ N/A

4.4. Does the plan have a policy to locate public buildings, key facilities, or infrastructure (e.g., sewer lines and gas mains) out of the areas most vulnerable to natural hazards?

- ❒ YES
- ❒ NO

4.5. Does the plan have a policy to acquire or dedicate open space in hazard areas?

- ❒ YES
- ❒ NO

4.6. Does the plan have policies to reduce vulnerability to existing development in hazardous areas (such as retrofit or relocation)?

- ❒ YES
- ❒ NO

4.7. Does the plan have policies supporting public disclosure of the vulnerability to natural hazards for specific areas?

- ❒ YES
- ❒ NO

4. Policies (Continued)

4.8. Does the plan have policies regarding the incorporation of new natural hazards information into the comprehensive plan fact base, policies and implementing measures?

- ❒ YES
- ❒ NO

4.9. Does the plan require amendments for new information?

- ❒ YES
- ❒ NO

4.10. Does the plan have a policy calling for ongoing public education about, and awareness of, natural hazard vulnerabilities?

- ❒ YES
- ❒ NO

Notes

Surveying Flood Damage. Myrtle Creek, OR

Photo by: André LeDuc

TRG Key

Statewide Planning Goal 2 requires communities to have comprehensive land use plans. Complete Text of Statewide Planning Goal 2 is included in Appendix A. For information regarding policies for flood, coastal, landslide, wildfire and seismic hazards, refer to Section 3 of each Hazard Specific Technical Resource Guide. Additional policy-related information is contained in Chapter 2: Key Elements of a Comprehensive Plan, Chapter 3: Legal Issues Guide and Appendix C.

Notes

5. Coordination and Consistency

The plan should integrate key actions of other plans and policy instruments that are authored both within and outside the community. Natural hazards do not respect community boundaries.

5.1. Does the plan refer to federal policies and programs for hazard-prone areas?

- ❒ YES
- ❒ NO

5.2. Is the plan consistent with other plans internal to the community, such as the emergency response plan?

- ❒ YES
- ❒ NO

5.3. Does the plan describe the ways in which state, regional and local programs will be coordinated to promote the plan's goals and policies?

- ❒ YES
- ❒ NO

TRG Key

For information related to federal policies and programs and statewide guidelines for flood, coastal, landslide, wildfire and seismic hazards, refer to Section 3 of each Hazard Specific Technical Resource Guide.

6. Implementation Measures

To carry out the policies and objectives of a comprehensive plan, the plan must contain the means by which these policies and objectives can be implemented. This is accomplished through implementing measures, which are the ordinances and programs that carry out the plan's policies and objectives. They include zoning ordinances, land division ordinances, land-use regulations and non-regulatory practices.

6.1. Are the plan's policies supported by and/or carried out through specific implementing measures, rather than through general intentions? Specific implementing measures might be flood-plain development ordinances requiring specific construction practices, and a general intention might be to reduce the risk of flooding.

- ❒ YES
- ❒ NO

6.2. Does the plan explain how its policies are to be implemented?

- ❒ YES
- ❒ NO

6.3. Does the plan identify opportunities for project review and approval by other departments within the community (e.g., approval by emergency manager for siting new development in high-fire hazard area?)

- ❒ YES
- ❒ NO

6.4. Are funding sources identified for implementing the plan?

- ❒ YES
- ❒ NO

6.5. Does the comprehensive plan require that zoning decisions and subdivision approvals be in conformance with the plan?

- ❒ YES
- ❒ NO

6.6. Does the plan include measures for reassessing risks related to natural hazards following a disaster event?

- ❒ YES
- ❒ NO

6.7. Does the plan contain procedures for monitoring and evaluating the implementation of the plan?

- ❒ YES
- ❒ NO

Notes

Use table of contents or bookmarks to navigate multiple sections.

TRG Key

For information on implementation measures for flood, coastal, landslide, wildfire and seismic hazards refer to Section 4 of each Hazard Specific Technical Resource Guide. Example implementation measures from Oregon communities are included in Section 5 of each hazard specific guide, and potential land use management tools are located in Appendix C.

Notes

Conclusion

The Comprehensive Plan Review Questionnaire is a tool your community can use to assess how natural hazards are addressed in your comprehensive land use plan. The purpose of having local comprehensive plan policies and implementing ordinances in your local land use plan is to reduce risk to life and property. Thus, your plan is the tool your community uses to weigh those risks through review of development applications. A good comprehensive plan and implementing policies should: describe a vision of what the community desires over the planning period; identify a set of goals, objectives, and policies to achieve the vision; provide guidance on land use decisions; and provide certainty about what land uses are allowable and the process for reviewing land use applications.

The Comprehensive Plan review focuses specifically on natural hazards. The questions reference a number of innovative approaches that go beyond Goal 7 requirements and are not typically included in most local comprehensive plans. The intent is to identify approaches your community might consider to strengthen development review. Your community may want to consider some of these approaches to strengthen your comprehensive plan policies and implementing ordinances.

PLANNING FOR NATURAL HAZARDS:

Key Elements of a Comprehensive Plan in Oregon's Statewide Land Use Planning Program

July 2000

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This chapter of the Natural Hazards Technical Resource Guide is based upon sections from a document entitled *A Citizen's Guide to the Oregon Coastal Management Program*, Published by the Department of Land Conservation and Development.

Special thanks to the following persons for their guidance in the development of this chapter:

The Natural Hazards Technical Resource Guide Steering Committee

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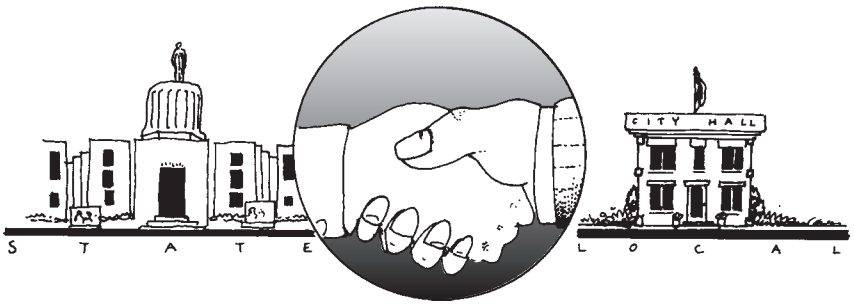
Introduction:
A Partnership

In Oregon, state and local governments share the job of planning. The state, through the Land Conservation and Development Commission (LCDC), sets the overall rules for planning decisions and oversees the statewide planning program. Cities and counties adopt plans to comply with the statewide requirements. Day-to-day land use decisions are made by local governments in conformance with their state-approved plans.

Oregon's Land Use Planning Partnership



LCDC

- Adopts statewide planning goals & administrative rules.
- Approves locally adopted comprehensive plans.
- Periodically reviews and approves revised plans.
- Reviews amendments to plans and implementing ordinances.

(PRINCIPAL STATUTE: ORS 197)

CITIES and COUNTIES

- Adopt comprehensive plans in compliance with statewide goals.
- Make land use decisions in conformance with state-approved plans.
- Amend plans and implementing ordinances to meet changing needs and to comply with new requirements.

(PRINCIPAL STATUTES: ORS 215 & 227)

Section 1: Statewide Planning Requirements

The Statewide Planning Goals are Oregon's mandatory standards for comprehensive planning. Goals set requirements for comprehensive plans and how land use decisions are to be made. For example, the goals require that local governments provide opportunities for citizen involvement. They also set standards on how certain types of land are planned and zoned. The goals also apply to state agencies when they make decisions affecting land use. LCDC is responsible for adopting rules to interpret the goals and land use planning laws. LCDC — the commission — is a seven-person panel appointed by the Governor, and confirmed by the Senate. The commission meets regularly and commissioners serve without compensation. The Department of Land Conservation and Development (DLCD) carries out commission decisions and administers other parts of the state's land use laws.

Oregon Land Use Planning Goals

1 Citizen Involvement
2 Land Use Planning
3 Agricultural Lands
4 Forest Lands
5 Natural Resources, Scenic & Historic Areas, and Open Space
6 Air, Water and Land Resources Quality
7 Areas Subject to Natural Disasters and Hazards
8 Recreational Needs
9 Economic Development
10 Housing
11 Public Facilities and Services
12 Transportation
13 Energy Conservation
14 Urbanization
15 Willamette River Greenway
16 Estuarine Resources
17 Coastal Shorelands
18 Beaches and Dunes
19 Ocean Resources

Related Oregon Administrative Rules (OAR)

660-001 Procedural Rules
660-002 Delegation of Authority to the Director
660-003 Acknowledgment Process
660-004 Exception Process
660-006 Forest Lands
660-007 Metropolitan Housing
660-008 Housing
660-009 Industrial & Commercial Development
660-011 Public Facilities Planning
660-012 Transportation Planning
660-013 Airport Planning
660-014 Incorporation of New Cities
660-015 Statewide Planning Goals & Guidelines
660-016 Goal 5
660-017 Classifying Oregon Estuaries
660-018 Plan Amendment Review Process
660-020 Willamette River Greenway
660-021 Urban Reserve Areas
660-022 Unincorporated Communities
660-023 Goal 5 (new)
660-025 Periodic Review Process
660-030 State Agency Coordination
660-031 State Permit Compliance
660-033 Agricultural Lands
660-034 Park Planning
660-035 Federal Consistency
660-036 Ocean Planning
660-037 Coastal Shorelands
660-040 Public Records
660-045 Enforcement Orders

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1.1 Summary of Goals

The 19 Statewide Planning Goals reflect Oregonians' desire to protect the state's landscape and to provide orderly planning for urban and rural development. The goals reflect five general themes:

- Planning for People
- Protecting Farm and Forest Lands
- Managing Urban and Rural Development
- Protecting Natural Resources
- Managing Coastal and Ocean Resources

Planning for People

Goal 1

Goal 1 calls for "the opportunity for citizens to be involved in all phases of the planning process." It requires each community to have a citizen involvement program that includes an officially recognized committee for citizen involvement and opportunities for citizens to be involved in all phases of the planning process.

Goal 2

Goal 2 outlines the basic procedures for Oregon's statewide planning program. It requires that each city and county in Oregon have a comprehensive plan that includes factual information, policies and implementing measures. Goal 2 contains procedures for reviewing and amending comprehensive plans.

Protecting Farm and Forest Lands

Goal 3

Goal 3 reflects Oregonians' desire to protect agricultural land from development. The goal defines "agricultural land" and requires counties to inventory such lands and to "preserve and maintain" agricultural land through exclusive farm use zoning. The goal recognizes that not all agricultural land has the same value or needs the same level of protection. Details on the uses allowed in farm zones are found in Oregon Revised Statute (ORS) Chapter 215 and in Oregon Administrative Rules (OAR) Chapter 660, Division 033.

Goal 4

Goal 4 defines forest lands and requires counties to inventory them and adopt policies and ordinances that will "conserve forest lands for forest uses." It reflects the importance of forestry to Oregon's economy. Details on the uses allowed in forest zones are found in ORS Chapter 215 and in OAR Chapter 660, Division 006.

Managing Urban and Rural Development

There are several Statewide Planning Goals that help local governments plan and manage the growth of Oregon's cities and unincorporated communities.

Goal 14

Goal 14 requires cities to estimate future growth and to plan and zone enough land to meet those needs. It calls for each city and surrounding county to establish an "urban growth boundary" to identify and separate urbanizable land from rural land. The land inside the boundary is where a city will grow over the next 20 years.

Goal 9

Goal 9 requires communities to inventory commercial and industrial lands, project future needs for such lands and plan and zone enough land to meet those needs. As a result, every city in Oregon will have a supply of land to sustain a healthy local economy.

Goal 10

Goal 10 specifies that each city must plan for and accommodate a variety of housing types, locations and densities. It requires communities to inventory their buildable residential lands, project future needs for such lands, and plan and zone enough buildable land to meet housing needs.

Goal 11

Goal 11 requires that cities of more than 2,500 have a public facility plan to guide development. Efficient planning of public services such as sewer, water, law enforcement and fire protection promotes cost effective and efficient provision of urban and rural services.

Goal 12

Goal 12 requires communities to adopt transportation system plans to provide for "a safe, convenient and economic transportation system." It requires land use decisions and local transportation planning be closely coordinated with the Oregon Department of Transportation.

Protecting Natural Resources

Goal 5

Goal 5 is designed to protect Oregon's natural and cultural resources. Local governments are required to inventory resources such as wetlands, riparian corridors and wildlife habitat. Communities use the inventories to determine which resources are most significant and to protect such resources in a manner that complies with Goal 5 and applicable administrative rules.

Goal 6

Goal 6 requires that all comprehensive plans and implementing measures comply with state and federal environmental laws.

Goal 7

Goal 7 addresses natural hazards. It requires that local governments apply "appropriate safeguards" when planning for development in areas of natural hazards, such as floodplains and areas subject to landslides.

Goal 8

Goal 8 calls for each community to evaluate its recreational areas and facilities and develop plans to deal with the projected demand for new recreational opportunities

Goal 13

Goal 13 requires communities to manage and control their local land uses in ways that promote energy conservation.

Goal 15

Goal 15 establishes procedures to guide urban and rural development along the Willamette River.

Managing Coastal and Ocean Resources

Goal 16

Under Goal 16, LCDC classified Oregon's 22 major estuaries into three broad categories: natural, conservation and development. Coastal communities have adopted estuary plans to comply with Goal 16.

Goal 17

Goal 17 specifies how coastal shorelands and resources are to be managed and protected.

Goal 18

Goal 18 regulates development on beaches and dunes.

Goal 19

Goal 19 is designed to "conserve the long-term values, benefits and natural resources of the near-shore ocean and the continental shelf." It addresses issues such as dumping dredge spoils and discharging waste products into the open sea.

Section 2: Comprehensive Plans

2.1 What is a Comprehensive Plan ?

A comprehensive plan is an official document adopted by a city or county which sets forth the general, long range policies on how the community's future development should occur. Local plans must:

1) Address all the applicable topics in the Statewide Planning Goals, as well as issues of local concern.
2) Anticipate and provide for future land use needs (20 years).
3) Include plan elements corresponding to each statewide goal (e.g., citizen involvement, agricultural lands, natural hazards, transportation, coastal resources, etc.).
4) All implementing measures must comply with the statewide goals and be consistent with and carry out comprehensive plan policies.

2.1.1 The Key Components of a Plan Required by Statewide Goal 2

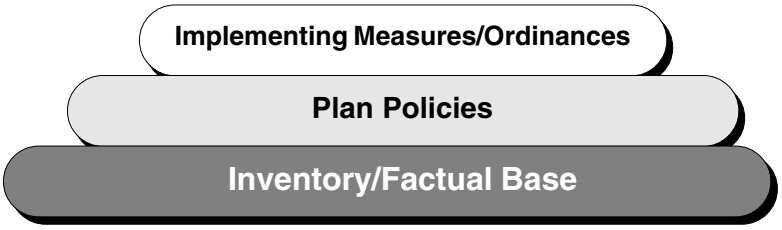
A comprehensive land use plan combines the following:
(1) An inventory of existing conditions (factual base);
(2) General goals and objectives;
(3) Policies; and
(4) Implementing ordinances and regulations.

2.1.2 Components of the Comprehensive Plan

The diagrams on the next two pages illustrate the relationship of the required components of a comprehensive plan.

Inventories provide the basis for plan policies. The term **Inventory** is often used synonymously with **factual base** as a comprehensive plan component.

The figure below shows the relationship between the plan inventory/factual base, plan policies, and implementing measures. The figure is in the shape of a pyramid because each successive component is both dependent on, and more specific then the previous component. The inventory factual base provides the basis and justification for plan policies. The plan policies provide general guidance in review of land use proposal. The implementing measures/ordinances provide the specific standards and criteria against which development proposals are reviewed.



Sidebar

Comprehensive Plan Inventories:

"The findings, data, and technical analysis on which a plan's policies are based. In smaller jurisdictions the inventory material often is included in the same document as the plan's policies and adopted with them. The entire document then is described as 'the Plan'. In larger jurisdictions the inventory is usually presented in one or more volumes separate from the plan policies. The inventory and policies are usually adopted together; however, communities may adopt inventories and policies separately. State law requires communities formally adopt both components into their comprehensive plans.

"The separate volumes of inventory material are variously described as background reports, technical reports, or support documents. Common synonyms for 'inventory' *include* 'factual base,' 'data base,' and 'background material.' "[1]

1. Rohse, M. (1987). Land-Use Planning in Oregon: A No-Nonsense Handbook in Plain English. Corvallis, OR: Oregon State University Press.

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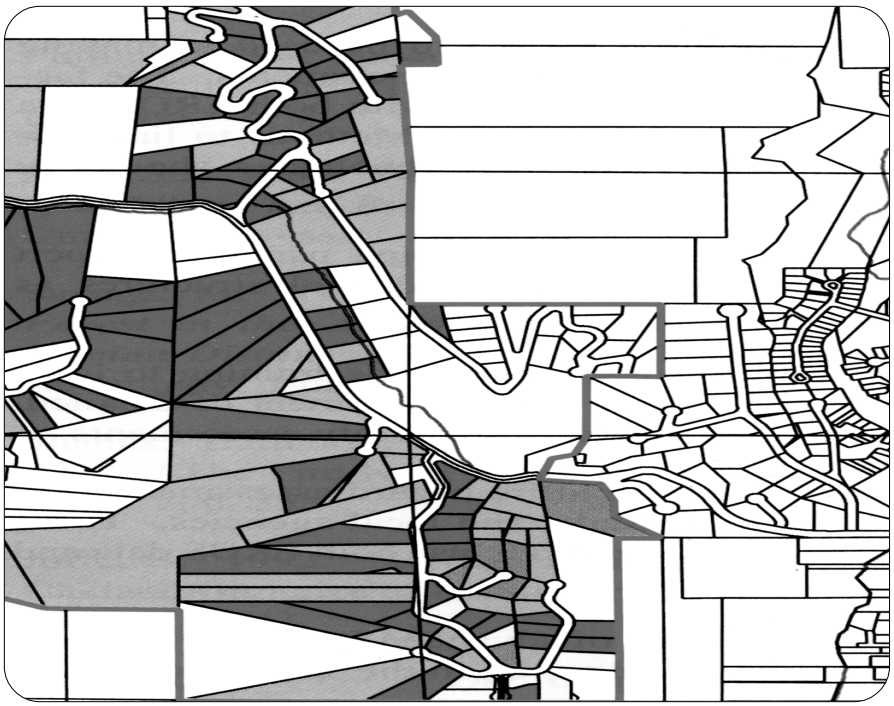
Comprehensive Plan *(Oregon Revised Statute 197.015(5)*

City Comprehensive Plan



Plan Map

Housing
Land Use
Natural Hazards
Transportation
...

Inventories

Policy 1
Policy text ...
Policy 2
Policy text ...
Policy 3
Policy text ...

Policies

Down-town Plan
West-side Plan

Neighborhood Plans

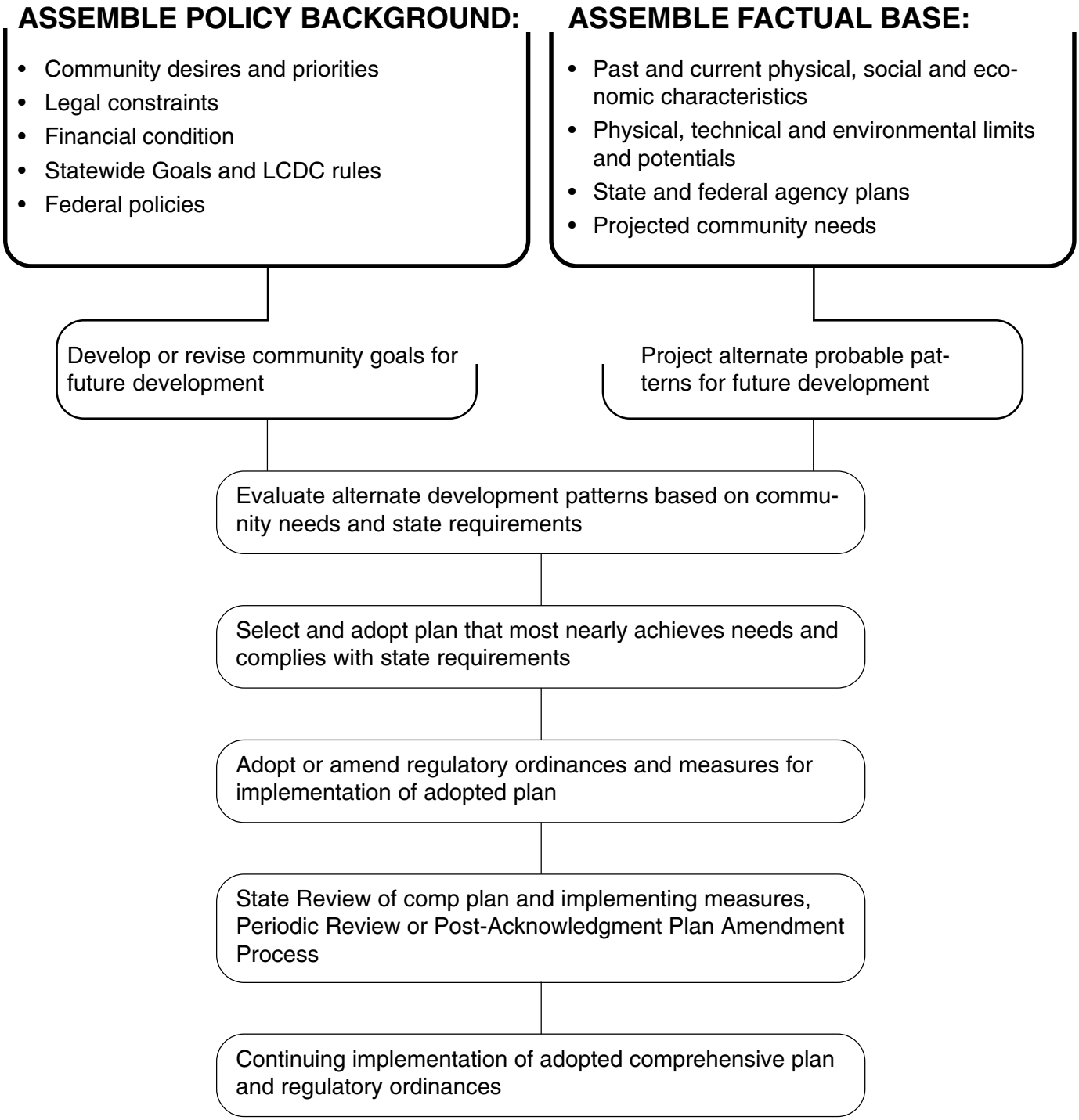
Capital Improve-ments
Transpor-tation Systems
Public Facilities

Functional Plans

Zoning Ords.
Land Division Ords.

Implementing Measures

Major steps in comprehensive planning process



The Three Levels of Hazard Assessment

Community-Wide Hazard Identification ▶ **Community- Wide Vulnerability Assessment** ▶ **Risk Analysis**

2.1.3 Inventories and Fact Base

While much of this chapter provides a broad discussion of Oregon's Statewide Planning Program, this section focuses on approaches to developing a natural hazards inventory. A thorough examination of factual base for natural hazards can found in Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities.[1] The following overview draws on information from that publication.

1) Community-Wide Hazard Identification is the basis for hazard assessment, and is commonly found in comprehensive plans. It is the process of estimating the geographic extent of the hazard, its intensity, and its probability of occurrence.[3] This process usually results in a hazard map. Such maps are effective in providing information about the nature and extent of natural hazards.

Community-wide hazards maps provide a general outline of areas where a more thorough review of development should occur due to potential hazards. Overlay zones are often used to require specific development review standards.

Using hazard maps at a scale of 1 inch to 2,000 feet usually is sufficient for general land use planning and for decisions about locating public facilities.[4] Yet, it is not always possible to discern the precise location of hazardous areas on specific parcels of property at this scale. To review development applications at the specific parcel level, the maps should distinguish individual parcels.

Tip Box

The Factual Base

"For natural hazards to play a significant role in land use management decisions, the factual base detailing the nature and severity of the hazard must be at least as credible as that for the host of other issues that go into determining appropriate land use… Hazard assessment is the mechanism that provides this factual basis."[2]

Tip Box

Natural Hazards Inventory Checklist:

Your communities inventory should contain the following elements:

- ❒ Description of Each Hazard
- ❒ History of Events for Each Hazard
- ❒ Generalized Boundaries of All Known Hazards: flood, landslide, slope, seismic, coastal, and wildfires.
- ❒ Inventory of Critical Facilities, Lifelines and Other Key Facilities
- ❒ A Vulnerability Assessment
- ❒ A Risk Assessment

2) Community Wide Vulnerability Assessment is the second level of hazard assessment. It combines the information from hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and it attempts to predict how different types of property and population groups will be affected by a hazard.[5] The optimum method for doing this at the local level is to use parcel-specific assessment data on land use and structures.[6] Many local comprehensive plans do not contain a vulnerability assessment.

Vulnerability assessment is necessary to understand the consequences of alternative land use configurations. This level of hazard assessment, as with risk analysis, is benefiting from advances in analytic capabilities and digitized land use data. An Oregon example of vulnerability assessment is Portland Metro's Natural Hazards Mitigation Program.

Beginning in 1992, Metro and the Oregon Department of Geology and Mineral Industries (DOGAMI) worked together to produce seismic hazard maps. As part of the project, Metro evaluated buildings for seismic risk, identified vital systems (such as electric power, gas, telecommunications, etc.) and key facilities (such as fire stations, medical services, facilities storing or using hazardous materials, etc.). Metro's geographic information system (GIS) was then used to identify the region's vulnerability to earthquake hazards.

3) Risk Analysis is the final and most advanced level of hazard assessment. It involves estimating the damage, injuries, and costs likely to be experienced in a geographic area over a period of time.[7] This could be community wide or site specific. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through vulnerability assessment; and (2) the likelihood or probability of the harm occurring.[8]

This level of hazard assessment is becoming more common, but relatively few community examples currently exist. Florida completed such an assessment for hurricane risk on Gasparilla Island. Probable damage was calculated using five hurricane intensity categories for a given year based on the value and structural characteristics of 461 existing habitable buildings and the probability of each storm category.[9]

2.1.3 Summary of Three-Level Hazard Assessment:

(1) Community-Wide Hazard Identification
(2) Community-Wide Vulnerability Assessment — Now that we know where the hazard is, what is the risk to new and existing development?
(3) If really serious about hazard reduction, a community can compile a risk analysis.

Finally, in addition to the three levels of community wide hazard assessments, communities need to evaluate potential

Tip Box

Inventory critical facilities — are any of the following in a hazard area?

- ❒ Emergency Operations Center
- ❒ City or Town Offices
- ❒ Water and Wastewater Treatment Plants
- ❒ Sewage Pumping Stations
- ❒ Police or fire Stations
- ❒ Schools
- ❒ Hospitals
- ❒ Day-Care facilities
- ❒ Power Substations
- ❒ Public Works Garages
- ❒ Nursing Homes
- ❒ Elderly Housing
- ❒ Correctional Facilities
- ❒ Shelters
- ❒ Hazardous Materials Facilities
- ❒ Power Plants
- ❒ Access Roads to the above Facilities
- ❒ Evacuation Routes

risks from natural hazards when siting new development. Most inventories conducted at community and/or regional scale lack the detail for site-specific analysis. Therefore communities may need to require site specific evaluation in areas of known hazards prior to allowing new development to proceed.

2.1.4 Site Specific Risk Analysis

Communities can use a regulatory process to assist in evaluating development in hazard-prone areas. If the site is located within the boundary of a known hazard area, the developer can be required by local government regulations to retain a professional to evaluate level of risk at the proposed site and provide recommendations on mitigation measures. During the review of the site development plan, planners must rely on detailed technical information to obtain the most accurate evaluation.

2.2 Why is Hazard Assessment Important?

For natural hazards, hazard assessment provides a factual base; the factual base is the supporting foundation for a comprehensive plan's policies and implementing measures. Ultimately, the more sophisticated the level of hazard assessment, the stronger the local support for policies and ordinances. An important consideration in hazard assessment is the level of precision needed to support decisions about where to locate boundaries that determine allowable land uses or impose different development regulations.[10]

2.3 What are the Challenges that Local Communities Face in Developing a Factual Base?

Unfortunately, increasing the level of detail and the accuracy of hazard identification and vulnerability assessment increases the cost of completing the factual base. Your community will have to decide whether the benefits of better information justify the cost. The level of hazard assessment depends on the severity of the local hazard, availability of community resources, and public support.

Another challenge for local communities may be the availability and use of technology. Many local governments identify staff training among the most serious problems they encounter in implementing GIS and other advanced technologies.[11] The staff expertise available to apply these techniques to natural hazards problems is likely to continue to be a major constraint in many jurisdictions.

In Oregon, educational resources like the Metro Area Disaster Geographic Information System (MAD GIS) CD-ROM[12] and the State Service Center for Geographic Information Systems (**http://www.sscgis.state.or.us**) are helpful tools in addressing this problem. Also, local academic institutions may have faculty or students with technological expertise that could be utilized by local governments in hazard assessment.

2.4 How can the Natural Hazard Technical Resource Guide Help Your Community in Developing a Factual Base?

The most useful information on factual base development is located in Sections 2 and 4 of each hazard specific chapter: **Identifying Hazards in your Community** and **Evaluation and Implementation Strategies**. If your community is affected by a natural hazard, consult the appropriate chapter for hazard assessment information.

Sidebar

Academic Resources

In some cases, academic institutions can be a valuable resource in the development of a hazards factual base. A graduate student in geography, environmental sciences, planning or a related field may want to do thesis work relating to a community's needs. Or, an interested instructor might organize a group of students to work on a community project. GIS researchers have facilitated hazard mapping efforts in places like Portland and Deschutes County. A group of Southern Oregon University geology students helped to develop a damage survey after flooding events in Talent and made recommendations for hazard mitigation. These types of partnerships provide real world educational experience for students and produce affordable planning assistance.

Some considerations for academic/community partnership projects in factual base development are:

- ❒ Do community deadlines match the school's timeline?
- ❒ How well organized is the proposed project?
- ❒ Do the objectives of the project relate well to the educational objectives of the student(s)?

Wind Damage - Portland Metro Area

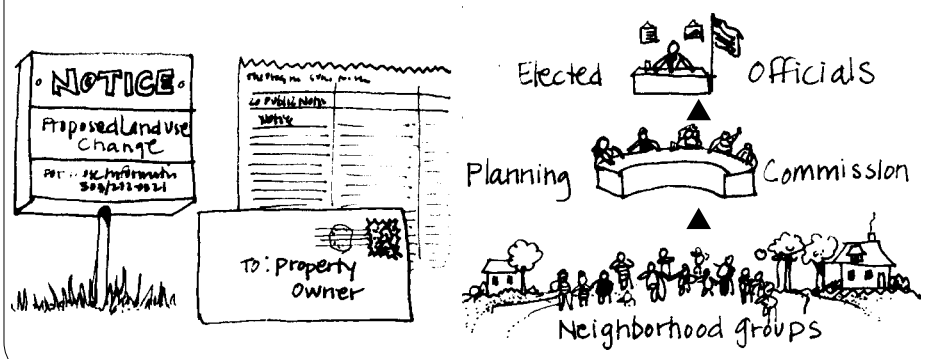
Photo by: FEMA Region X

Section 3:
Key Participants: Citizens and Other Governments

3.1 Citizen Involvement

Citizen participation is a hallmark of Oregon's planning program. Citizens must be kept informed under Goal 1. Each city and county plan includes an adopted citizen involvement program which describes how the public can participate in each phase of the planning process. Local governments must periodically evaluate their efforts to involve citizens, and, if necessary, update their programs.

Techniques for Citizen Involvement



3.2 Coordination

Coordination simply means that government agencies must consult with one another before making land use decisions. The benefits are obvious: by working together, local government, special districts, and state and federal agencies can make decisions that support one another and avoid unnecessary duplication or policy conflicts. For example, coordinated plans help ensure that public spending on roads, sewer, water and other facilities occurs both where and when it is needed. Each local government and state agency has a process for coordinating its decisions with other units of government. This usually involves mailing notices of pending decisions to other agencies and giving them an opportunity to comment. Under Oregon law, state agency actions affecting land use must be compatible with acknowledged city and county comprehensive plans.

For many land use decisions, public notice is printed in the newspaper, and notices are mailed to surrounding property owners. In Oregon, land use decisions are made in meetings that must be open to the public. Some local governments use neighborhood or area advisory committees to review major land use issues and make recommendations to the planning commission or elected officials.

Tip Box

Emergency Management

Coordination with local emergency managers and hazard mitigation plans helps local governments avoid and minimize damage caused by natural hazards. For more information contact Oregon Emergency Management at **http://www.osp.state.or.us/oem/** and the Oregon Emergency Management Association at **http://www.oregonemergency.com**

Section 4:
Changing Times, Changing Plans

Plans are not cast in stone; they can and must be revised to reflect new needs and circumstances. Under Oregon law, the post-acknowledgement plan amendment and periodic review processes keep plans current.

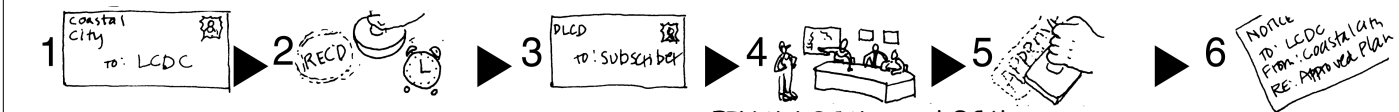
4.1 Post Acknowledgement Plan Amendment Process (PAPA)

Statewide, thousands of individual plan and ordinance amendments are made every year. Cities and counties must provide DLCD notice of proposed plan and ordinance changes. In turn, DLCD notifies interested agencies, groups, and individuals. This ensures that plans will continue to be coordinated. It also gives DLCD an opportunity to make sure the proposal complies with the Statewide Planning Goals. By law, local governments must notify DLCD 45 days before the first evidentiary hearing (usually before the planning commission) on a proposed plan or ordinance amendment. A local government may provide less notice, but that may increase the likelihood of the amendment being appealed to the state Land Use Board of Appeals (LUBA).

4.2 Measure 56

In 1998, Oregon voters approved Ballot Measure 56 amending ORS Chapters 215 and 227 to require "written individual notice of a land use change to be mailed to each owner whose property would have to be rezoned in order to comply with [an] amended or new comprehensive plan ...". Property is considered "rezoned when the governing body ... (a) changes the base zoning classification of the property; or (b) adopts or amends an ordinance in a manner that limits or prohibits land uses previously allowed in the affected zone." Local governments may apply to DLCD for reimbursement of "all actual and reasonable costs of providing notice" where the local government's rezoning effort is either: (1) initiated by a requirement of periodic review; or (2) by a new, or amendment to an existing, administrative rule or statute.

Plan Amendment Review Process: ORS 197.640, OAR 660 Div. 18



1. LOCAL GOV'T SENDS NOTICE
   - City/County notifies DLCD of proposed change of comprehensive plan or ordinance (45 days before 1st evidentiary hearing).
2. DLCD RECEIVES LOCAL NOTICE
   - 45-day period starts.
3. DLCD SENDS NOTICE OF RECEIPT OF AMENDMENTS
   - To persons requesting notice.
4. FINAL LOCAL HEARING
5. LOCAL ADOPTION
   - Time varies.
   - Officials must prepare and sign approved action.
6. NOTICE OF ADOPTION TO DLCD
   - DLCD and others have 21 days to appeal ammendment to LUBA if they participated in the local amendment process.

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4.3 Periodic Review Process

Depending on population, cities and counties must reevaluate their plans and ordinances and submit the revisions to DLCD for approval. This process, called "periodic review," is designed to ensure that plans are updated to reflect new information and changing needs and circumstances. Conditions triggering periodic review are:

1. A substantial change in circumstances so that the comprehensive plan or land use regulations do not comply with the statewide planning goals;
2. Decisions implementing acknowledged comprehensive plan and land use regulations are inconsistent with the goals;
3. Issues of regional or statewide significance, intergovernmental coordination or state agency plans or programs affecting land use which must be addressed in order to bring comprehensive plans and land use regulations into compliance with the goals; or
4. The local government, commission or department determines that the existing comprehensive plans and land use regulations are not achieving the statewide planning goals.

Jurisdictions Required to go through Periodic Review:

Counties (Population)	Intervals
15,000 - 50,000	5 - 15 years
50,000 or more	5 - 10 years

Cities (inside UGB Population)	Intervals
2,500 - 25,000	5 - 15 years
25,000 or more	5 - 10 years

Counties and cities with populations less than those listed above are exempt from periodic review unless specifically scheduled by LCDC or are a city in proximity to cities over 25,000 (see ORS 197.628 et. seq. and OAR 660-025 for details).

The 4 Steps of the Periodic Review Process

DLCD NOTICE	EVALUATE PLAN	PREPARE WORK PROGRAM	CARRY OUT WORK PROGRAM
Notifies local government that process starts based on schedule adopted by LCDC.	Local governments: 1. Review notice and evaluate plans and ordinances for needed changes. 2. Invite citizen and state agency input. 3. Write and distribute evaluation report.	Local governments: 1. Prepare work program based on results of evaluation 2. Local government approves work program. 3. DLCD or LCDC reviews and approves work program.	1. Local governments carry out work tasks and make changes in their plan and ordinances. 2. DLCD reviews results of work tasks. 3. DLCD or LCDC approves work tasks; process complete.
◀.....	TIME VARIES, USUALLY 4 TO 8 MONTHS	▶	UP TO 3 YEARS ... ▶

Section 5:
Plan Implementation

5.1 Local Planning Decisions ... Yes or No to Specific Uses

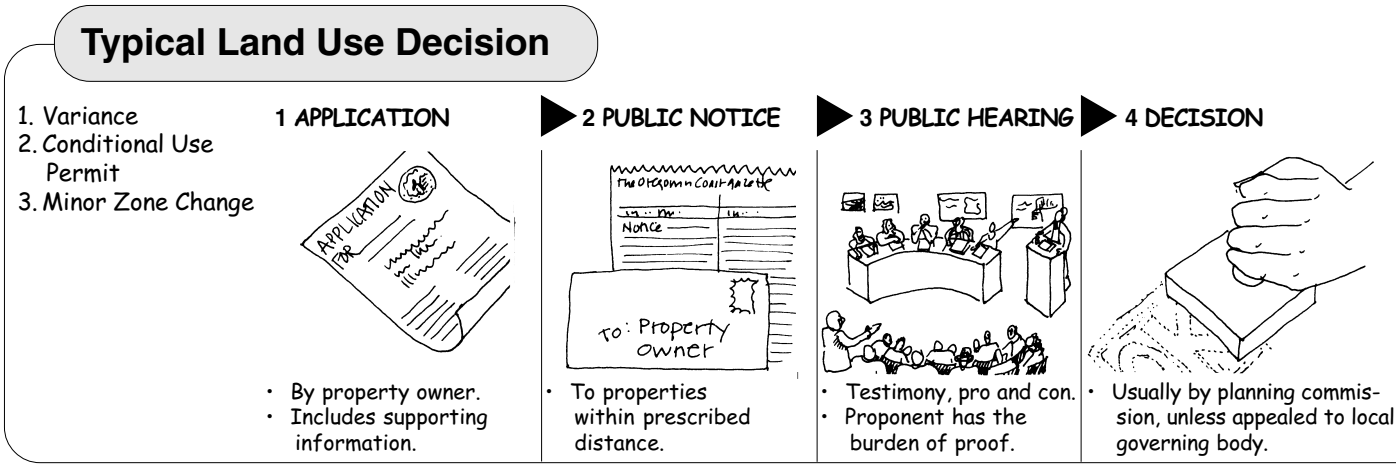
Plan policies contain general decisions about what land uses go where. Policies generally include procedures and standards outlining how subsequent planning decisions will be made. Actual development usually requires a permit or approval from the city or county to make sure the development meets plan policies and ordinance standards.

Most planning decisions are routine — they only involve a building permit for a use allowed outright by the plan. Uses that are not permitted outright are subject to more detailed review. Specific standards for approving proposed land uses are stated in the development ordinance or the local plan. The public usually receives notice in advance of this type of review. Such reviews give a city or county an opportunity to consider the details of a proposed use and how it fits with the site and surrounding uses. They also provide an opportunity for neighbors and the public to review and comment.

Some local land use decisions (e.g., zone changes) require post acknowledgment plan amendments (PAPA) requiring advance notice to DLCD prior to adoption.

The process for making land use decisions is designed to make sure that affected parties have an opportunity to comment and that decisions are made fairly. Check your local zoning ordinance for specific requirements.

Section 6:
The Appeals Process



Because Oregonians have different values and interests, they sometimes disagree over whether a particular development complies with applicable local and state standards. Comprehensive plans have reduced the potential for controversy by making general decisions about what uses go where. But there are still disagreements. Oregon's commitment to open government has led to the creation of appeals processes at both the local and state levels, giving citizens opportunities to challenge land use decisions.

6.1 Who Can Appeal?

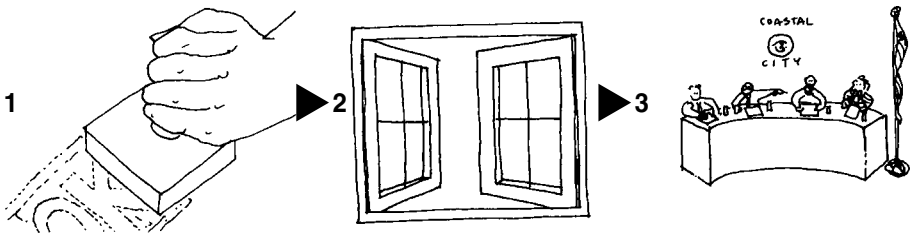
To appeal a land use decision, a person or organization must qualify or have "standing." Generally, to establish standing, a person must be harmed or affected by the proposed development. Standing requirements vary from community to community. Some communities allow appeals by almost anyone. Others limit appeals to nearby property owners or to those who participated in the first local hearing. To have standing to appeal to LUBA a petitioner must: (1) have participated in local hearings (or demonstrate that it was not possible to do so because of an error by the local government); and (2) be affected or harmed by the local decision.

6.2 Local Appeals

Most local land use decisions are made by a planning commission or hearings official. Most of these decisions can be appealed to the governing body — city council or county board of commissioners. Local standards vary, but most cities and counties allow introduction of new evidence showing whether the relevant standards have been met.

Requirements for filing appeals are spelled out in each local zoning ordinance. The ordinance will provide information on deadlines for filing appeals, filing fees, timeline for hearings and a decision, and the legal standards for decisions.

Key Parts of the Plan



LOCAL DECISION
Findings signed by planning official

APPEAL WINDOW
- Standing
- Time limit
- Local filing requirements

APPEAL TO CITY COUNCIL OR COUNTY BOARD

6.3 State-Level Appeals . . . The LUBA Process

City and county land use decisions are final and are deemed to meet state law unless they are appealed to the Land Use Board of Appeals (LUBA). LUBA is a panel of three "referees" appointed by the Governor and confirmed by the state senate. Almost all appeals involving local land use decisions go to LUBA (rather than to circuit or district courts). The person who appeals a local decision to LUBA is the "petitioner." Petitioners must show how the local decision violated local ordinances, the local plan, state law, or, where applicable, the statewide planning goals. LUBA's review is limited to determining whether the city or county has properly applied the relevant standards and has enough evidence to support its decision. Objections or appeals to periodic review work tasks are reviewed by DLCD and LCDC, not LUBA.

LUBA Appeal Process

Local Decision | **LUBA Appeal**

LOCAL HEARING	FINAL DECISION	NOTICE OF INTENT TO APPEAL	RECORD OF LOCAL DECISION	PETITIONER'S BRIEF	RESPONDENT'S (LOCAL GOVERNMENT) BRIEF	LUBA HEARING	LUBA DECISION
Approval by City Council or County Board of Commissioners.	Occurs when orders and findings are signed. Starts 21-day clock for appeal to LUBA.	Petitioner files with LUBA.	Local governement submits records of local hearings and findings.	Must explain how local decision violates plan, ordinances, state law or goals. Show standing.	Responds to petitioner's brief.	Final arguments.	Written decision, affirming or reversing decision or returning decision to local government for further hearings.

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Section 7:
Additional Information on Land Use Planning in Oregon

As mentioned at the beginning of this document, Oregon's land use planning program is a working partnership between the state and cities and counties. The statewide land use program is really a network of 277 state-approved city and county comprehensive plans. Plans reflect the interests of both local communities and the state. As interests change, so too must the plans. The Department of Land Conservation and Development provides both funds and technical assistance to help Oregon's local government maintain their comprehensive plans. The following section describes some of DLCD's other activities and provides information on how to contact the agency.

DLCD provides grants to local governments to help them with planning issues. These funds may be used to conduct inventories, revise plans and ordinances, implement programs and conduct periodic reviews of their comprehensive plans.

Technical assistance to local governments is one of DLCD's most important functions. Assistance is provided by technical specialists based in Salem and by regional representatives in Bend, Central Point and Portland. Assistance includes conducting workshops, publishing technical bulletins and public outreach materials, and providing responses to written and phone requests for land use planning information. DLCD provides information to local governments and the public regarding changes to land use statutes and administrative rules. DLCD's website provides more, up-to-date information in an easily accessible format.

One of DLCD's primary technical-assistance responsibilities is to work with local governments to ensure that local comprehensive plans are up-to-date.

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DLCD participates with four other state agencies (Department of Transportation, Environmental Quality, Economic and Community Development, and Housing and Community Services) as part of the Community Solutions Team (CST). The purpose of the CST is to coordinate state agency programs, investments and actions with state and local growth management objectives. Currently, there are nine (9) regional CSTs made up of field staff from each of the five agencies.

For additional information regarding DLCD and its programs, please contact the department at: 503-373-0050.

Fax: 503-378-6033

DLCD also has several field offices:

Bend	541-388-6424 or 541-388-6157. Fax: 541-388-6480
Central Point	541-858-3152 Fax: 541-858-3142
Portland	503-731-4065 Fax: 503-731-4068

Written requests for information can be sent to:

Oregon Department of Land Conservation and Development, 635 Capitol Street NE Suite 150, Salem, Oregon 97301.

Copies of state land use statutes, statewide planning goals and LCDC administrative rules and information about DLCD's program and publications are available on the department's web site at **www.lcd.state.or.us**.

Key Elements of a Comprehensive Plan Endnotes:

[1] Burby, R. (Ed.). (1998). Cooperating with Nature. Washington, D.C.: Joseph Henry Press.

[2] Deyle, R., French, S., Olshansky, R., & Paterson, R. (1998). Hazard assessment: the factual basis for planning and mitigation. In R. Burby (Ed.), Cooperating with Nature. (pp. 119-166). Washington, D.C.: Joseph Henry Press.

[3] (ibid.)

[4] (ibid.)

[5] (ibid.)

[6] (ibid.)

[7] (ibid.)

[8] (ibid.)

[9] (ibid.)

[10] (ibid.)

[11] French, S., & Wiggins, L. (1989). Computer adoption and use in California planning agencies: implications for education. Journal of Planning Education and Research, 8(2), 97-107.

[12] Metro. (1997). Metro Area Disaster Geographic Information System: GIS Tools for Emergency Management Planning. Portland, OR.

PLANNING FOR NATURAL HAZARDS:
Legal Issues Guide

July 2000

Oregon Department of Land Conservation & Development
635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

Community Planning Workshop
Community Service Center
1209 University of Oregon
Eugene, OR 97403
541-346-3889

CAUTION:

ANY LEGAL QUESTIONS REGARDING SPECIFIC SITUATIONS SHOULD BE REFERRED TO LEGAL COUNSEL.THIS GUIDE MAY NOT BE RELIED UPON, CITED, OR OTHERWISE REFERENCED AS LEGAL ADVICE OR AS A LEGAL OPINION OF THE DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT OR OF THE STATE OF OREGON.

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The Natural Hazards Technical Resource Guide Steering Committee

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Toledo Landslide

Photo: *Department of Land Conservation and Development*

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Section 1: Introduction

The need for responsible planning to direct the orderly growth of our communities is not a new concept. "Local municipal governments since the 1920s have been the front line of public response to private land use initiatives."[1] As a result, local governments have frequently had their power to regulate such growth challenged in, and largely upheld by, the courts. However, as Oregon's population - and the pressure to develop in hazardous areas - continues to grow, planners and local officials will be expected to enact land use programs that are technically and legally sound. This guide describes current state requirements for natural hazards planning in Oregon. This guide also discusses several issues that local governments may face when adopting and enforcing natural hazards regulations.

1.1 How to Use this Guide

The information in this guide is presented primarily in a question and answer format. The questions have been reviewed by local planning officials, land use attorneys, and natural hazards experts from several state agencies. This document is designed to provide general guidance for addressing natural hazards policies, rather than resolving site specific issues.

Tip Box

Legal Authorities on the Web

Oregon Land Use Statutes:
http://www.lcd.state.or.us/goalhtml/laws.html

Statewide Planning Goals:
http://www.lcd.state.or.us/goalsrul.html

DLCD Administrative Rules:
http://www.lcd.state.or.us/goalhtml/rules.html

Land Use Board of Appeals (LUBA) Decisions:
http:// luba.state.or.us

Federal Statutes:
http://memory.loc.gov/glin/us-code.html

Federal Regulations:
http://lcweb2.loc.gov/glin/us-exec.html

U.S. Supreme Court Opinions:
http://memory.loc.gov/glin/us-court.html

Tip Box

Local Government's Power to Zone Land

The authority of local governments to regulate development through zoning was first upheld by the United States Supreme Court and the Oregon Supreme Court, nearly 75 years ago.[1] Prior and subsequent decisions by the Court have affirmed the authority of local governments to declare, regulate, and restrict nuisances,[2] and this authority has been expanded by the Oregon Legislature over time. The foundation of the current statewide land-use planning system in Oregon was established in 1973 with the enactment of Senate Bill 100.

1. Euclid v. Ambler Realty Company, 272 U.S. 365, 385 (1926); Kroner v. City of Portland, 116 Or 141 (1925).

2. Hadacheck v. Sebastian, 239 U.S. 394 (1915); Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470 (1987).

Section 2:
Legal Issues and Requirements for Comprehensive Planning

Tip Box

Oregon Legal Authorities

ORS (Oregon Revised Statutes) refers to state laws enacted by either the legislature or the voters (through ballot measures). These laws are binding on citizens, local governments and state agencies in Oregon.

OAR (Oregon Administrative Rules) refers to regulations adopted by state agencies following a process set forth by the Oregon Administrative Procedures Act. These regulations must be authorized by and consistent with state law, and are binding on citizens, local governments and state agencies in Oregon.

2.1 What are the Basic Legal Requirements in Oregon for Addressing Natural Hazards through Comprehensive Land Use Plans?

Oregon Revised Statutes (ORS) Chapters 197, 215 and 227, and the Statewide Planning Goals require counties and cities to develop, and administer and (most) to periodically update:

(1) Comprehensive Plans and
(2) Land Use Regulations.[2]

Local comprehensive plans must comply with the statewide planning goals.[3] Likewise, land use regulations (e.g., zoning and subdivision ordinances) must comply with the statewide goals and be consistent with and adequate to carryout the local comprehensive plan. Therefore, when adopting comprehensive plans and land use regulations, local governments are required to:

(1) Address each applicable statewide planning goal;
(2) Adopt a comprehensive plan which:
  (a) Operates within the authority delegated to local government by state law;
  (b) Meets specific statutory requirements; and
  (c) Contains plan policies that satisfy the statewide planning goals and act as the basis for implementing local ordinances; and
(3) Adopt land use regulations to implement the comprehensive plan.

A local government may request that the LCDC review and acknowledge that its comprehensive plan and land use regulations comply with the goals.[4] When a local government has its comprehensive plan and land use regulations acknowledged by the LCDC, its land use decisions are generally governed only by that plan and those regulations.[5]

2.1.1 Statewide Planning Goals:

There are 19 statewide planning goals which have been adopted by the LCDC pursuant to ORS Chapters 195, 196 and 197. Each goal is comprised of two sections:

(1) "Goals" which refers to "mandatory statewide planning standards,"[6] and
(2) "Guidelines" which are "suggested approaches designed to aid cities and counties in preparation, adoption and implementation of comprehensive plans in compliance with the goals...."[7]

While the "goals" section is mandatory and must be followed when adopting or amending local comprehensive plans, the "guidelines" section is advisory only.[8]

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In the context of natural hazards, Statewide Planning Goals 2 and 7 impose several broad requirements on local governments. These statewide planning goals establish an obligation for all local governments to:

(1) Develop inventories of hazardous areas for inclusion in the comprehensive plan;
(2) Adopt policies which prohibit development "in known areas of natural disasters and hazards without appropriate safeguards;"[9]
(3) Enact land use regulations based on those inventories and comprehensive plan policies to protect life and property from losses associated with development in hazard areas; and,
(4) Update inventories, policies, and land use regulations on a periodic basis to reflect new information, new laws and goal requirements, and changing circumstances in the community.

In addition, Goals 17 and 18 establish additional authority and requirements for coastal communities.

Statewide Planning Goals with Requirements Relating to Natural Hazards

Goal 2: *For All Cities and Counties*	• City and county land use plans shall include "inventories and other factual information for each applicable statewide planning goal ... " • "All land-use plans and implementation ordinances ... shall be reviewed and, as needed, revised on a periodic cycle to take into account changing public policies and circumstances, in accord with a schedule set forth in the plan."
Goal 7: *For All Cities and Counties*	• "Developments subject to damage or that could result in loss of life shall not be planned nor located in known areas of natural disasters and hazards without appropriate safeguards." • "Plans shall be based on an inventory of known areas of natural disaster and hazards ... " • Areas of natural disasters and hazards are those areas that are subject to natural events known to result in death or endanger the works of man, such as flooding, landslides, earthquakes, and other hazards unique to local or regional areas.
Goal 17: *For Coastal Cities and Counties Only*	• Requires local governments to develop programs to "reduce the hazard to human life and property ... resulting from the use and enjoyment of Oregon's coastal shorelands." • Requires that "[l]and use plans, implementing actions and permit reviews shall include consideration of ... the geologic and hydrologic hazards associated with coastal shorelands." • Requires that "[i]nventories shall be conducted to provide information necessary for ... designating uses and policies. These inventories shall provide information on the nature, location, and extent of geologic and hydrologic hazards ... in sufficient detail to establish a sound basis for land and water use management."
Goal 18: *For Coastal Cities and Counties Only*	• Requires local governments to "reduce the hazard to human life and property from natural or man-induced actions associated with [coastal beach and dune areas]." • Requires inventories to be conducted which "shall describe the stability, movement, [and] hazards ... of the beach and dune areas in sufficient detail to establish a sound basis for planning and management." • "Local governments ... shall base decisions on plans, ordinances and land use actions in beach and dune areas, other than older stabilized dunes, on specific findings that shall include at least: ... Hazards to life, public and private property ... which may be caused by the proposed use."

2.2 What Elements must be Addressed in the Comprehensive Plan?

In Oregon, a local government's comprehensive plan consists of three main elements:

(1) Inventories and Other Factual Information;
(2) Comprehensive Plan Policy and Use Designations; and
(3) Implementing Measures.

The statewide planning goals require local governments to address natural hazards for each of these elements. First, the goals require local governments to inventory hazard areas as a part of the factual base of their comprehensive plans. Second, local governments must develop policies and use designations consistent with the language of Goal 7 (and Goals 17 and 18 for coastal communities). Third, local governments must adopt land use regulations and/or other measures consistent with and adequate to carry out the plan policies and use designations.

For example, a local government may conduct an inventory of steep slope areas within its jurisdiction, where there are potential landslide hazard areas. Next, the local government may develop a policy which states that development on areas identified as posing a high risk for landslides shall be prohibited unless a geologic assessment of the site reveals that no hazardous condition exists or appropriate safeguards are identified to reduce the risk posed by the hazard. Finally, the local government must adopt land use regulations (e.g., zoning or subdivision regulations) or other measures to implement the policy to prohibit development in high hazard areas.

2.2.1 Inventories

Generally, state law does not restrict the sources of information a local government may rely upon when developing their comprehensive plan inventories. State agencies such as the Department of Geology and Mineral Industries (DOGAMI) and the Oregon Department of Forestry (ODF), as well as federal agencies such as the Federal Emergency Management Agency (FEMA), collect and map information on natural hazards. A local government may rely upon this information, locate other sources of information, or develop inventories based upon their own studies. However, when developing the comprehensive plan inventory, it is important that the local government have some rational basis for adopting and relying upon the information. The local government will also need to have a basis for selecting one type of information over another in situations of conflicting information.

It is important that the local government be as thorough as possible when developing a natural hazards inventory. The inventory serves as the supporting basis for the comprehensive plan policies and subsequent land use ordinances designed to evaluate development requests in hazardous areas. Inventories often provide the factual basis to support written findings for land use decisions.

TRG Key

The Three Levels of Hazard Assessment

Refer to the three Levels of Hazard Analysis in Chapter 2: Elements of a Comprehensive Plan. The three levels of hazard assessment are:

(1) Community Wide Hazard Identification
(2) Community Wide Vulnerability Assessment
(3) Risk Analysis

2.2.2 Plan Policies and Plan Designations

Goal 7 requires a plan's policies to declare that development will neither be planned nor located in known areas of natural disasters and hazards without appropriate safeguards. Beyond this minimum requirement, however, local governments should develop specific policies for each type of natural hazard identified in their inventories.

For example, the local government's policies on development in floodplains, landslide hazard zones, wildfire hazard zones, or other hazard areas should be distinguishable from each other, in order to reflect the unique risks associated with development in each area. The policies should also distinguish between the levels of risk associated with certain kinds of development (e.g., nursing home, low density housing, high density commercial, etc.), as well as the degrees of risk associated with each hazard type (e.g., slow moving landslide, rapidly moving landslide, 100-year flood, etc.). Well-drafted policies will avoid ambiguity and confusion, and serve as the basis for consistent application and enforcement of the local government's natural hazards implementing regulations.

The purpose of "use" or "plan" designations is to identify broad areas subject to the natural hazards and express the local government's long-term vision of development within those areas. The level of detail required for plan designations depends largely on whether the local government has a separate zoning map. If the local government uses one map as both its comprehensive plan map and zoning map, refer to the subsection on Implementing Measures. Where the local government has a separate and more detailed zoning map, the comprehensive plan map may broadly define the boundaries of hazardous areas, and need not identify the specific boundaries or parcels to be included in a zone.

Tip Box

Suggestions for Good Plan Policies

(1) Write short, declarative sentences.
(2) Use mandatory language (e.g., "will", "must", or "shall").
(3) Reflect state law and community values.
(4) Provide a clear basis for implementing measures.

2.2.3 Implementing Measures

A local government's natural hazards policies are usually implemented through its zoning ordinance and / or separate hazards ordinances. Either method is acceptable, so long as the ordinance properly identifies the property subject to the ordinance, and sets forth the appropriate standards and criteria for processing and reviewing development requests subject to the ordinance. Implementing measures for natural hazards should:

(1) Identify hazard areas subject to the natural hazard ordinance(s) on the zoning map;
(2) Contain a process for determining the degree of risk created by a specific development request on a specific parcel;
(3) Include a process for identifying the necessary appropriate safeguards (mitigation measures) prior to approving the development request; and
(4) Establish a process for making a final decision on the development request.

2.2.4 Zoning Map

Local governments' zoning maps often identify hazardous areas as overlay zones, subject to specific hazard ordinances. Overlay zones should be developed based on the inventory and comprehensive plan map sections of the local government's comprehensive plan. Identifying hazard areas through overlay zoning helps to:

(1) Eliminate any confusion created by the broadly defined boundaries on the comprehensive plan map;
(2) Ensure consistent administration of all hazards ordinances;
(3) Avoid the time and expense of re-interpreting the comprehensive plan map for each development request; and
(4) Provide clear information, to all current and prospective landowners, of the regulations which affect the use of the zoned parcel.

2.2.5 Site-Specific Risk Analysis

For projects located in identified hazard areas, local governments are encouraged to perform or require a risk analysis to address the Goal 7 prohibition against planning or locating a development in hazardous areas without appropriate safeguards. Risk analysis is used to determine:

(1) The nature and degree of hazard present; and
(2) The degree of risk to life and property posed by the development, if allowed in the hazard area.

In order to fully evaluate risk on a given site, a local ordinance should be designed to require that:

(1) An initial review of site conditions be conducted; and, if necessary,
(2) A comprehensive study of risks posed by development at the site be prepared.

The initial review step should determine if the proposed use for the site presents sufficient risks to warrant further study. To accomplish this, the local government may establish a risk threshold and a rating system based on site conditions, hazard maps, the type of proposed use, or other factors. Any rating system should contain clear and objective standards so that both the applicant(s) and the reviewing body know what information is required and what criteria will be used in reviewing the request. If the proposal exceeds the risk threshold, further review could be required. However, if the threshold is not reached, no further analysis would be necessary. If the threshold is exceeded, then the ordinance should establish the procedure for conducting a more detailed review of the site.

For landslides and other geologic hazards, the best method of determining the actual risks posed by development on a specific site is to conduct a geologic and/or geotechnical study of the conditions present at the site. A local government may require

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the applicant to perform the study and submit findings as a part of the application. The ordinance should set forth the specific information which must be contained in the report. In addition, the ordinance should establish quality-control standards, such as a requirement that the study be conducted and the report prepared by a certified Engineering Geologist or Geotechnical Engineer. The ordinance may also establish a procedure for peer review of the report to ensure that all requirements are met, that procedures used and assumptions made are generally accepted, and that conclusions or recommendations are adequately supported and reasonable.

2.2.5 Identifying Appropriate Safeguards Under Goal 7

Appropriate safeguards are mitigation measures that reduce the level of risk associated with a proposed development in a hazard area. One or more safeguards may — and often should — be combined in order to reduce the level of risk to an acceptable level.

While some safeguards may apply in all situations (e.g., building codes), most safeguards will need to be specifically tailored to meet the unique conditions and hazards posed by each development request. For landslides and other geologic hazards, one of the best methods for determining appropriate safeguards is to base them on the results of a site-specific geologic or geotechnical study of the site. Therefore, a local government should require that any report based upon a study of the site contain a section identifying not only risks, but also recommended safeguards to reduce or eliminate those risks.

2.2.6 Clear and Objective Criteria

A local government's hazard ordinance should set forth the clear and objective criteria that will be used in approving or denying a development request.

Oregon Statutes

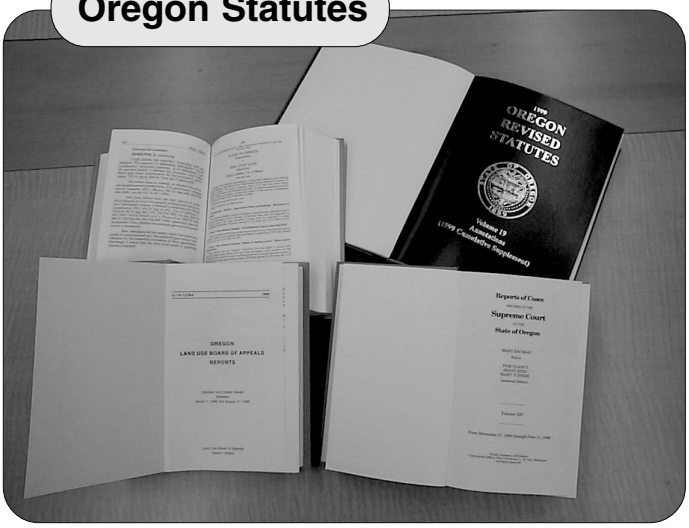

Photo: *André LeDuc*

2.3 When should a Local Government Amend its Comprehensive Plan?

Comprehensive plans must be "regularly reviewed, and, if necessary, amended to keep them consistent with the changing needs and desires of the public they are designed to serve."[10] New information that identifies "areas of natural disasters and hazards" should be incorporated into plans by amendment. If a local government fails to include new inventory data as a part of its acknowledged comprehensive plan, a court may find that this information is not usable during subsequent reviews.[11]

A local government may choose to amend its comprehensive plan for the purposes of incorporating new information in three ways:

(1) **Periodic Review:** A local government subject to periodic review may wait until it receives a Periodic Review notice from DLCD, whereupon the plan will be reviewed to determine its compliance with all of the statewide planning goals.[12]
(2) **Internal Review Timeline:** A local government may establish its own process to determine if the inventory information in its plan is the most current or reliable information available. Amendments would only occur if necessary to update old or unreliable information in the plan.
(3) **As Needed:** Unless precluded by local law, a local government may take the initiative at any time to seek information relating to hazards either by relying on standard sources or conducting its own survey of hazardous areas. This may be the preferred approach if the current comprehensive plan contains little or no inventory information on known hazard areas. Moreover, as state and federal agencies produce new information on hazards, local governments should review this information to determine the appropriateness of including it in the jurisdiction's comprehensive plan.

2.4 When does Ballot Measure 56 Require Notice to Property Owners of Land Use Changes?

In adopting natural hazards regulations, local governments should be aware that 1998's Ballot Measure 56 amended ORS Chapters 215 and 227 to require "written individual notice of land use change to be mailed to each owner whose property would have to be rezoned in order to comply with [an] amended or new comprehensive plan ... "[13] Property is considered "rezoned when the governing body ... : (a) changes the base zoning classification of the property; or (b) adopts or amends an ordinance in a manner that limits or prohibits land uses previously allowed in the affected zone."[14] Under limited circumstances, a local government may apply to DLCD for reimbursement of its costs of providing notice. Reimbursement of reasonable costs may be sought where the local government's rezoning effort is either: (1) initiated by a requirement of periodic review; or (2) by a new, or amendment to an existing, LCDC administrative rule or statute.

Section 3:
Permit Application, Review, and Related Decisions-Making Issues

Procedures for submitting, reviewing and approving permit applications are established by state law and a local government's zoning and planning ordinances.[15]

Oregon law requires that local government's land use decisions be supported by a written statement of findings.[16] These findings must contain:

(1) Criteria and standards used for the decision;
(2) Facts relied upon in reaching the decision; and
(3) Explanation of how the facts relate to the criteria and standards.[17]

Findings are required to:

(1) Ensure that decisions are reached in a fair, impartial, and proper manner;
(2) Provide all parties with notice of the basis for a decision; and
(3) Provide the Land Use Board of Appeals (LUBA) and appellate courts with an adequate basis for review.

By writing clear and complete findings, a local government will reduce the likelihood of having a decision overturned or remanded for additional hearings. Clear findings reduce the number of appeals taken from land use decisions by reducing misunderstandings regarding the reason and meaning of a local government's decision.

3.1 How does a Local Government Identify Standards and Criteria?

The first step in reviewing a permit application is to review the zoning map to determine the allowable uses for the area. If the zoning map contains overlay zones for hazard areas, this review will reveal whether or not special procedures must be followed for processing the permit. If the zoning ordinance is unclear or ambiguous, the comprehensive plan policies should be reviewed to ensure that the ordinance is interpreted in a manner consistent with the local government's comprehensive plan.

The standards and criteria for land use decisions related to natural hazards typically come from zoning or hazard ordinances. The criteria and standards set forth the requirements which must be met prior to permit approval. When writing the findings, each criterion should be stated and addressed individually in the findings.

For example, if a local government has established an overlay zone identifying an area as prone to landslides, the hazard ordinance may set forth a requirement that applicants provide the local government with a geologic or geotechnical report from a certified geologist or geotechnical engineer. The hazard ordinance may further require that this report clearly identify the presence or absence of a hazardous condition on the property and contain recommended methods for mitigating this hazardous condition. In the findings, each of these requirements should be clearly and separately addressed.

Sidebar

What is a LUBA?

The Land Use Board of Appeals (LUBA) was created by legislation in 1979 and has exclusive jurisdiction to review all governmental land use decisions, whether legislative or quasi-judicial in nature.[1] The Legislature stated: " ... it is the policy of the Legislative Assembly that time is of the essence in reaching final decisions in matters involving land use, and that those decisions be made consistently with sound principles governing judicial review."[1] LUBA was created to simplify the appeal process, speed resolution of land use disputes and provide consistent interpretation of state and local land use laws. The tribunal is the first of its kind in the United States. The Governor appoints the three-member board to serve four-year terms. The appointments are confirmed by the Oregon Senate. The members serving on the Board must be members of the Oregon State Bar.

1. ORS 197.810.

3.2 How should a Local Government Present its Findings of Fact?

For each relevant standard and criterion, the findings should contain specific findings of fact which state whether or not the requirements have been met.[18] Written findings of fact require more than a recitation of the evidence or reference to the record of a hearing or documents offered as evidence.[19] Findings of fact require that the decision maker identify the specific evidence used in making the decision. Each finding of fact must be supported by substantial evidence. Findings of fact must weigh the credibility of people giving testimony and any documents or other evidence received. Where there is conflicting evidence between documents, studies, or witnesses (lay or expert), the findings must explain the reason for the decision maker's acceptance of some evidence over other evidence.[20]

For example, a local government may receive testimony from a developer's expert who states that a parcel located in a landslide area will not be at risk from the effects of a landslide. The local government may also receive testimony from another witness which challenges the assertions made by the developer's expert, and offers contradicting evidence. The local government's findings of fact must state which of these witnesses the decision maker will rely upon, and why. In making this decision, the local government may rely upon facts such as the experience of the witnesses, whether the methods used complied with standards set forth by a state licensing board or professional association, or any other relevant facts.

3.3 What Form of Explanation is Required in the Findings?

The findings must clearly state the decision reached by the local government as well as an explanation for how the decision was reached. The explanation must be specific in describing how the facts support the final decision regarding whether or not the standards and criteria are met.[21] General statements of conclusion — such as: "The development plan meets our requirements for appropriate safeguards." — are not sufficient.[22]

Definition Box

What Qualifies as Substantial Evidence?

Substantial evidence is evidence a reasonable person would rely upon in the ordinary course of their serious affairs. In other words, the evidence must be credible. When evaluating the credibility of people testifying in person, a local government should first determine if the witness is an expert. When choosing among the conflicting testimony of more than one expert, a local government should look at the specific training or experience of each expert as well as the facts relied upon or methods used by the experts. When evaluating the credibility of documents, a local government should consider the source, the data relied upon or cited, the date (i.e., Is it current?), and whether the document is in its draft or final form.

Yeunger v. City of Portland, 305 Or 346 (1988); ORS 197.828; 197.835.

3.3.1 Multi-Stage Approval Processes

A local government may find that a multi-stage review process is appropriate for reviewing development permits in potential hazard areas. Such a process generally involves two stages:

(1) Stage One: Initial determination of whether the proposed project can meet all approval standards and criteria.
(2) Stage Two: The identification of precise means of meeting the standards and criteria.

LUBA has observed that this type of multi-stage review process addresses the following public policies:

(1) Avoidance of inordinate expenses at the preliminary plan stage, and
(2) Avoidance of the inordinate expenses "that would result where preliminary approval for a project is granted, but the project is later found to be unfeasible."[23]

During the stage one review, a local government must follow all statutory and local notice and hearing requirements for discretionary permits. If the local government finds that the project can meet all approval criteria (e.g., a requirement that development is feasible given the potential hazard conditions at the site), it may then "impose conditions of approval to assure those criteria are met and defer responsibility for assuring compliance with those conditions to planning and engineering staff as part of a second stage."[24]

If a local government defers its finding of compliance to a later proceeding, or leaves policy discretion regarding how conditions will be satisfied, notice and comment requirements must be followed at the second stage of review.[25] "[T]he issue to be decided to determine whether the compliance with relevant standards has been established or whether compliance with those standards has been deferred to a later stage is whether: '…substantial evidence supports findings that solutions to certain problems (for example landslide potential) posed by a project are possible, likely and reasonably certain to succeed."[26] This is a complex area of the law and persons should consult with counsel regarding any particular factual situation.

CAUTION:

This section on legal liability makes the following assumptions:

(1) All references to local government refer to cities and counties as well as to the officers, employees and agents of cities and counties, unless otherwise stated. This assumption is made because local governmental liability is typically based on the tortious conduct of their employees when acting as governmental agents within the scope of their employment.[27]

(2) Any local government actions are constitutional, and do not otherwise directly violate any state or federal law. The scope of this section is limited to discussing financial liability under the Oregon Tort Claims Act. Any local government actions which are unconstitutional or violate state or federal law may be subject to separate legal action, such as a claim for just compensation for a takings, or an injunction against enforcement of an ordinance.

Definition Box

What is a Tort?

Legal liability in a civil case (as opposed to a criminal or regulatory case) generally arises from two broad areas of law. The first is contract liability which, as the name suggests, deals with the legal liabilities of parties (e.g., individuals, corporations, cities, counties, etc.) created by their own legally binding agreements (contracts). The second is tort liability, defined as "any breach of a legal duty resulting in damages, other than those duties created by contract ... whether that duty is imposed by the common law or by statute."[1] Generally speaking, tort law "imposes duties on persons to act in a manner that will not injure other persons."[2] In general, when we discuss the legal liability of cities and counties in the realm of land use planning, we are discussing tort liability generally, and negligence (unreasonable conduct) in particular.

1. Urban Renewal Agency of the City of Coos Bay v. Lackey, 275 Or. 35, 38 (1976).
2. Prosser, Wade and Schwartz's Torts: Cases and Materials. p.1.

Section 4:
Legal and Financial Liability Issues

4.1 Local Government Actions: Discretionary or Ministerial?

The potential legal liability of a local government for a decision to enact an ordinance, or an action to enforce an ordinance, depends on whether the local government (through its officers, employees, or agents) is performing a discretionary or ministerial act. The words "discretionary" and "ministerial" have legal meanings quite distinct and different from their ordinary, everyday meanings. A government employee almost always exercises some discretion when acting or not taking action, but only those actions viewed as creating policy, rather than enforcing existing policy, are likely to be viewed as discretionary and therefore immune from liability.

The issue of whether a local government is performing a discretionary, and therefore an immune, act can be answered by asking two questions:

(1) Is the local government creating policy (immune) or merely enforcing policy (not immune)?
(2) Is the local government addressing the policy matter based on its own initiative (generally immune) or is it required by law to consider and / or address the policy matter (generally not immune)?

Generally speaking, if a local government is performing a discretionary act, any decision made or action taken is granted immunity from financial liability by the Oregon Tort Claims Act (OTCA).[28] If, instead, the local government is performing a ministerial act, it will not be immune from legal liability and may be held financially liable if it does not act reasonably "so as to avoid creating a foreseeable risk of

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harm to others."[29] Simply because a local government's action is ministerial, and not immune from liability, does not mean that the local government will automatically be held liable. In order to be liable, a tort must be proven against the local government.

The following sub-sections address these issues and further delineate the line between discretionary and ministerial actions.

4.2 Is the Local Government Creating Policy or Enforcing Policy?

If a local government is acting to create a new policy, or amend an existing policy, its actions are presumed to be discretionary and immune from liability. In contrast, where the local government is taking action to enforce a standard or criterion, its actions are presumed to be ministerial, and thus not immune from potential liability.[30]

A hypothetical jurisdiction's flood hazard ordinance provides an example:

(1) If the local government is debating whether or not to require elevation higher than 1 foot above the 100-year flood plain, it has discretion to choose among several different policy options (e.g., 2 feet, 3 feet, 10 feet, etc.) which may include the choice to not take any action at all. This kind of decision-making process involves discretion, and the local government will be granted immunity if it chooses to require elevation to 3 feet.
(2) On the other hand, if the local government is enforcing an existing 3-foot standard, it will be acting pursuant to an already established set of rules, which must be enforced. This kind of action involves no discretion, and is viewed as ministerial. The issuance of a development permit with elevation only up to 2 feet, may be subject to legal liability.
(3) However, sometimes a regulation or ordinance allows for judgement, and, depending on the context, conduct under such a policy could be viewed as either discretionary, and therefore immune, or ministerial and subject to a potential claim for negligence.

Definition Box

What is Immunity?

Traditionally, all state and local governments have been protected from tort claims by the doctrine of sovereign immunity, which generally prevented private parties from raising claims against them in court. With the passage of the Oregon Tort Claims Act (OTCA) in 1967, Oregon law was modified to grant private parties the right to sue the state or a local government for torts, but only if the claim arises under the limited circumstances set forth by the law. If a private party sues the state or a local government on a matter that is not authorized by the OTCA, the governmental body will be immune from the claim, and the courts will dismiss the case.

Definition Box

What are the Requirements for a Negligence Claim?

In order to succeed on a negligence claim, the person suing (plaintiff) the city or county (defendant) must generally prove four things.

(1) DUTY: The plaintiff must prove that the defendant owed them a duty either under common law principles or by statute. When the defendant is a public body, the Oregon Tort Claims Act (ORS §§ 30.260 - 30.300) further requires the duty to be ministerial and not discretionary.
(2) BREACH: The plaintiff must prove that the defendant breached their duty either by unreasonably failing to perform some act, or by unreasonably performing the act in a way that causes a foreseeable injury to the plaintiff.
(3) CAUSATION: The plaintiff must prove that the breach of the defendant's duty caused (was a substanial factor in causing) their injury.
(4) DAMAGES: The plaintiff must prove that they suffered damages (typically to a person or property) from that injury.

It is important to note that there is a wide middle ground between the first two positions. Certainly, policies and rules may be developed in a manner which grants discretion to the local government at the time of enforcement, such as selecting the proper location on a parcel for the siting of a structure where more than one suitable location may exist. Where such discretion exists, immunity may also exist.

If a local government is performing a ministerial action based on rules which it adopted through a discretionary act, it may not be held liable if the rules are properly followed.[31] For example, in our hypothetical situation:

(1) Immunity would attach to a ministerial action which properly imposed a 3-foot elevation requirement pursuant to the local flood ordinance, because any challenge would not be against the application of this requirement, but against the original policy decision establishing the requirement. Since the original policy decision was discretionary, immunity attaches to all future applications of that policy.
(2) On the other hand, since the enforcement of the 3-foot policy is ministerial, no immunity attaches if the local government fails to reasonably enforce the ordinance.

4.3 Is the Local Government Addressing the Policy Matter Based on its Own Initiative or is it Required by Law to Consider and/or Address the Policy Matter?

Where a local government is establishing a policy on its own initiative, its actions are presumptively discretionary; however, when it addresses the matter based on a statutory mandate, its actions are presumed ministerial.[32] Continuing with our hypothetical example from the previous sub-section:

(1) If a local government takes up the matter of whether to impose a 3-foot elevation requirement for structures in the floodplain (beyond the 1-foot requirement established by the National Flood Insurance Program), it is doing so on its own initiative. Since the local government had no previous obligation to consider elevation requirements beyond 1 foot, it could not be held liable if it failed to consider the 3-foot requirement. Likewise, any decision by the local government to set an elevation higher than 1 foot would be immune from liability, as stated in the previous section.
(2) On the other hand, if the local government is required to adopt and enforce a policy by state statute, it does not have discretion to decide not to consider the matter. If a local government fails to consider, adopt, or enforce the statutorily mandated policy, it may be subject to liability for failing to perform its ministerial duty.

Tip Box

Local Government's Liability Limits

Under ORS §30.270, liability for any public body is generally limited to:

(1) $50,000 for each claim of property damage or destruction;
(2) $100,000 for each claim of general or special damages; and
(3) $500,000 for all claims arising from the same incident.

Again, a middle ground exists between these two positions. It may be possible for state statute to require the local government to consider a matter, while at the same time giving the local government discretion to choose the means by which to address the matter.[33] For example, Goal 7 currently requires local governments to develop inventories of known hazard areas and prohibits development in those areas without appropriate safeguards. Local governments must develop inventories and prohibit any development that fails to have appropriate safeguards. Failure to consider these issues could result in legal liability. Local governments, however, are given discretion in selecting the means by which they will conduct inventories, and discretion in selecting when and what safeguards are appropriate and should be required prior to development. Thus, a local government ordinarily may not be held liable for its choice of how to conduct an inventory or its selection of appropriate safeguards.

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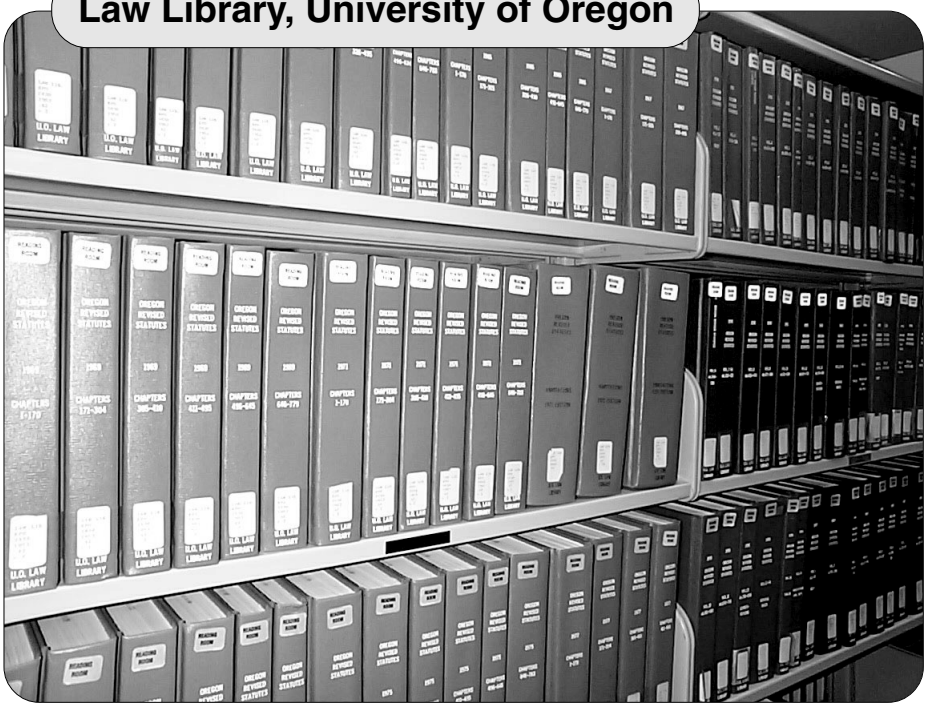

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CAUTION:

This section provides a cursory review of takings law. Any questions regarding this subject should be referred to legal counsel.

Section 5: Constitutional Takings Issues

In drafting ordinances and reviewing development requests, local governments should consider whether such ordinances or decisions may trigger a requirement to pay the landowner compensation under the state and/or federal constitutions. The following section sets out the basic framework for identifying these issues.

5.1 What is a Taking?

The Fifth Amendment to the United States Constitution prohibits the taking of "private property ... for public use, without just compensation."[34] A parallel provision in the Oregon Constitution provides: "Private property shall not be taken for public use nor the particular services of any man be demanded, without just compensation ... "[35] (It is important to note that the action of taking private property for a public use is *not* a violation of the Constitution. Rather, it is the failure of government to provide *compensation* that results in a constitutional violation).

State and federal courts generally recognize three main categories of takings:

1. **Physical Taking**
   Traditionally, takings were thought of as an actual physical invasion of a landowner's property. In other words, a taking occurred if the government physically seized private property and converted it to some form of public use. Thus, a physical taking may occur when a local government initiates eminent domain proceedings to, in effect, seize private property for a public use (e.g., dams, roads, etc.).
2. **Regulatory Taking**
   The term regulatory taking is used to refer to a regulatory action "that goes too far,"[36] by restricting the use of private property. A regulatory taking is sometimes referred to as inverse condemnation. Unlike a physical taking of property through eminent domain and condemnation proceedings, regulatory takings occur as a result of the application of regulations to limit the use of property. A land use action that precludes all economically viable use of property would be considered a regulatory taking.

Definition Box

What is Eminent Domain?

Under the doctrine of eminent domain (a.k.a. condemnation), a local government may take possession of private property, either temporarily or permanently, for any legitimate public purpose. Neither the Oregon nor the U.S. Constitution prohibit the state or a local government from exercising its power of eminent domain over private property. However, both the state and federal constitution generally require that the private property owner be paid "just compensation" which is defined as the fair market value of the property at the time it was condemned.

3. **Exaction Taking**
   An exaction taking is a hybrid of both physical and regulatory takings. Like a physical taking, an exaction taking occurs when the government acquires physical title to the property. However, like a regulatory taking, an exaction taking typically occurs as the result of applying regulations to a specific parcel of property. In the context of land use decisions, an exaction may occur when a local government requires the public dedication of a portion of private property in exchange for permission to develop or re-zone the property (e.g., if parcel is developed, x feet must be dedicated to public right of way for roads, sewers, bicycle path, etc.) and there is not a "rough proportionality" between the effects of the use and the required dedication.

5.2 When does a Regulatory Taking Occur?

There are two tests for determining whether a regulatory taking has occurred:

1. Does the regulation result in a "per se" taking?
2. If not, does the regulation fail a balancing test?

5.2.1 Per Se Regulatory Taking

The United States Supreme Court has held that a "per se" regulatory taking may occur in only a few situations. The most relevant situation for natural hazards planning is where a local government's regulation denies a property owner all economically viable use of their property. In order for a regulation to deny a property owner all economically viable use, a judge or jury must find that "the government has deprived a landowner of all economically beneficial uses [of the property]."[37]

Such was the case in Lucas, where the state trial court found that the South Carolina Beachfront Management Act affected a taking of Lucas' two beachfront lots and awarded him $1.2 million as just compensation. The Beachfront Management Act had been developed in part to manage the beach and dune system of South Carolina's barrier islands as "(a) a barrier and buffer from high tides, storm surge, hurricanes, and normal erosion; (b) a public area which serves as a major source of state and local revenue; (c) habitat for indigenous flora and fauna; (d) a place which harbors natural beauty."[38] The Act sought to achieve these objectives by drawing a line in the sand, seaward of which no permanent structures could be developed. Both of Lucas' lots were located seaward of the line, and as a result the trial court found that Lucas was left with no economically viable uses for these lots. The United States Supreme Court relied on the state trial court's finding, and held that in this situation, where all economically viable use has been prohibited, a taking will be found. The Court also noted that such a finding would be rare, and several of the justices questioned the trial court's conclusion that Lucas had been denied all economically viable use. Finally, even a regulation that denies all economically viable use may not result in a taking if the use was already prohibited at the time the owner acquired the property.

CAUTION:

When in Doubt Seek Legal Counsel

Given the uncertain nature of the law in this area, and the sometimes conflicting positions of state and federal courts, local governments are advised to consult with legal counsel to resolve actual questions involving specific situations.

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5.2.2 Balancing Test

Where some economic use of the property remains after application of the regulation, a court will apply a balancing test to determine whether a taking has occurred. The factors of this test are:

(a) The economic impact of the regulation on the claimant,
(b) The character of the governmental action, and
(c) The reasonable expectations of the property owner.[39]

5.3 When does an Exaction Taking Occur?

The United States Supreme Court has held that, under limited circumstances, a government requirement to dedicate property rights to the public may not result in a taking where the action is linked to the expected effects of the proposed development. Underlying the Court's holding is the philosophy that local governments have the right to limit certain uses of private property, and that certain permit conditions, may be necessary to limit or avoid specific public harms threatened by the proposed use. The Court has set forth the following three part test to determine whether an exaction results in a taking:

(a) Does the exaction substantially advance a legitimate public purpose?
(b) Is there an essential nexus between that purpose and the harm threatened by the proposed use?
(c) Is the exaction roughly proportional to the degree of threatened harm?

Nearly all proposed government purpose will be found legitimate, and the United States Supreme Court has found that "a broad range of governmental purposes and regulations satisfies [the public purpose] requirements."[40] More important under this analysis, is whether the public purpose is legitimate in the context of the local government's authority to limit the proposed land use. In other words, is there a nexus between the government's purpose in requiring the exaction (often by a condition requiring a public dedication) and the public harm threatened by the proposed development? If such a nexus exists, the next inquiry is whether the exaction is roughly proportional to the public harm threatened by the proposed development. This means that the exaction must be "related both in nature and extent to the impact of the proposed development."[41]

Definition Box

What Qualifies as a Legitimate Public Purpose?

The 10th Amendment to the United States Constitution reserves to the states the police power, which allows them to take actions for any legitimate public purpose. In the context of constitutional takings law, the term "legitimate public purpose" refers to any governmental purpose that promotes the health, safety, or welfare of the public. Local governments are given considerable discretion in defining actions as being for a legitimate public purpose. The following list provides just a few examples of local government policies that promote the public's health, safety and welfare:

(1) Restrict development in hazardous areas.
(2) Require elevation above the 100-year flood plain.
(3) Require site-specific geologic or geotechnical surveys in landslide hazard areas.
(4) Prohibit the siting of critical facilities in tsunami or earthquake liquefaction zones.

5.4 What Options does a Local Government have if a Decision will Result in a Regulatory Takings?

The United States Supreme Court has noted two circumstances where a governmental action will not result in a taking, even a "per se" taking. The first is where the proposed use of the property would result in either a private or public nuisance. The second situation is where the proposed use was never allowed on the property to begin with. However, both of these areas of law are still being debated by attorneys and worked out by the courts. Given the uncertain nature of the law, and the sometimes conflicting positions of state and federal courts, local governments are advised to consult with legal counsel to resolve questions regarding regulatory takings.

If a local government discovers that its actions may result in a regulatory taking, it has several different options depending on what stage the development request is at:

(1) If the local government has not yet made a final decision on the proposal, it may choose to grant the property owner a variance or modify the development conditions.
(2) The local government could provide the property owner with a list of suggested economically viable uses which might be pursued as alternatives to the use proposed.
(3) If a final decision has been made, and a takings is found by a court, the local government may modify its decision to allow for some economically viable use, while only providing compensation for a temporary taking based on the length of time that the use was denied.
(4) If the local government chooses to maintain the policy that denied the use, it may condemn the property and pay the property owner the fair market value of the property at the time the taking occurred.

These options are by no means the only options available to a local government in this situation, and local counsel should be consulted if any questions arise before or after a decision is made.

Section 6:
Alternative Dispute Resolution (ADR)

6.1 What is Alternative Dispute Resolution?

Local governments often face opposition from members of the public and developers when they make land use and development decisions, whether at the policy or implementation level. For example, disputes may arise when citizens take an active role in opposing new development proposals in their neighborhood. In addition, disputes may be triggered by a local government's decision to restrict development in hazardous areas. These disputes have the ability to strain local government resources and may place local government decisions under a cloud of threatened litigation. One of the best strategies for resolving disputes, as well as avoiding the costs and uncertainties of litigation, is to develop an Alternative Dispute Resolution (ADR) Program for dealing with disputes.

ADR refers to the use of non-litigation strategies for resolving disputes between parties. The primary goal of ADR is to assist parties in finding mutually acceptable solutions to their disputes through collaborative decision making processes. Local governments may find many useful applications for an ADR Program, several of which may involve natural hazards planning and regulation. Common ADR strategies in the public policy arena include mediation, negotiated rulemaking, facilitation, and consensus building. The common thread between these approaches is the use of an impartial, third party who can facilitate discussions between the disputants, and help them find common ground and craft their own solution.

6.2 What ADR Resources Exist for Local Governments?

An excellent resource for ADR information and assistance is Oregon's Public Policy Dispute Resolution Program. The program can provide the following useful services for local governments:

- Assistance in identifying the most appropriate resolution process for dealing with a specific dispute;
- Critical analysis of a local government's current system for resolving disputes;
- Facilitation of a local government's efforts to retain a mediator;
- Education for local governments, developers, and citizens on ADR processes; and
- Grant assistance for local governments working "to resolve complex pubic policy disputes."

For more information on Oregon's Public Policy Dispute Resolution Program, visit their website at: **(http://www.odrc.state.or.us/ppdrp.htm)**, or contact:

Public Policy Dispute Resolution Coordinator
Department of Land Conservation and Development
635 Capitol Street NE, Suite 200
Salem, OR 97301
(503) 373-0050

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Section 7:
Legal Issues Summary

In order for a local government to develop a legally sound natural hazards strategy, it must comply with Oregon's comprehensive planning requirements and statewide planning goals. Comprehensive plans must rely upon credible inventory data to perform a hazards analysis. Plan policies must be clearly defined, must promote a legitimate public purpose, and must be linked to the inventory fact base of the plan. Ordinances must contain clear and objective standards and must be consistent with the local plan policies. A review process should be in place, which allows for variances to be granted preventing an undue burden where necessary. Finally, a local government should consult its legal counsel whenever potential legal questions arise, whether they are related to planning or implementing a natural hazards strategy.

Legal Issues Endnotes:

[1] Platt, Rutherford H. Land Use and Society: Geography, Law, and Public Policy. p.215.

[2] ORS § 197.629 (1999).

[3] ORS § 197.175 (1999).

[4] ORS § 197.251 (1999).

[5] ORS § 197.251 (1999); Neuberger v. City of Portland, 288 Or 155, 170 (1979).

[6] ORS § 197.015(8) (1999).

[7] ORS § 197.015(9) (1999).

[8] Neuberger, 288 Or at 169.

[9] Statewide Land Use Planning Goal 7.

[10] ORS § 197.010(1)(e) (1999).

[11] Bridges v. City of Salem, 19 Or. LUBA 373, 379 (1990).

[12] ORS § 197.629 (1999). In 1999 the state legislature passed SB 543 which exempts smaller sized cities and counties from the periodic review process. For more information on the new periodic review requirements established by this law, refer to the DLCD document: Understanding the New Periodic Review Process" Senate Bill 543." http:// www.lcd.state.or.us/legis/934300.pdf.

[13] ORS §§ 215.503(3) and 227.185 (1999).

[14] Id.

[15] ORS §§ 197.763, 215.427, and 227.178 (1999).

[16] Fasano v. Washington Co., 264 Or 574, 507 P.2d 23 (1973); O.R.S. §§ 215.416 and 227.173; Statewide Planning Goal 2.

[17] ORS §215.416(9) (1999).

[18] Everets v. Washington Co., 15 Or. LUBA 358 (1987).

[19] DLCD v. Klamath County, 16 Or. LUBA 23 (1987).

[20] Moore v. Clackamas Co., 29 Or. LUBA 372 (1995).

[21] Ball and Associates v. Josephine Co., 25 Or. LUBA 525 (1993).

[22] Kunz v. Clackamas Co., 27 Or. LUBA 130 (1994).

[23] Bartels v. City of Portland, 20 Or LUBA 303, 310 (1990) (citing Margilus v. City of Portland, 4 Or LUBA 89, 98 (1981), Meyer v. City of Portland, 7 Or LUBA 184 (1983), *aff'd* 67 Or App 274 (1984)).

[24] Rhyne v. Multnomah County, 23 Or LUBA 442, 447 (1992).

[25] Burghardt v, City of Molalla, 39 Or LUBA 223, 236 (1995); Eppich v. Clackamas County, 26 Or LUBA 498, 507-08 n8 (1994).

[26] Corbett/Terwilliger/Lair Hill Neighborhood Association v. City of Portland, 25 Or LUBA 601, 611 (1993) (quoting Meyer v. City of Portland, 67 Or App 274, 280, *rev den* 297 Or 82 (1984)).

[27] Smith v. Cooper, 256 Or. 485 (1970).

[28] ORS §§ 30.260 - 30.300 (1999).

[29] Brennen v. City of Eugene, 285 Or. 401, 407 (1979).

[30] Tozer v. City of Eugene, 115 Or. App. 464 (1992); Baker v. Elliott, 125 Or. App. 1 (1993).

[31] Baker v. Elliott, supra.

[32] Miller v. Grants Pass Irrigation District, 297 Or. 312 (1984).

[33] Miller v. Grants Pass, *supra*; State Forester v. Umpqua River Navigation Company, 258 Or. 10 (1970).

[34] U.S. Const. Amend. V.

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[35] Or. Const. Art I, Sect 18.

[36] Pennsylvania Coal Co. v. Mahon, 200 U.S. 393, 415, 43 S.Ct. 158 (1922).

[37] Lucas v. South Carolina Coastal Commission, 505 U.S. 1003, 1017, 112 S.Ct. 2886 (1992).

[38] Lucas v. South Carolina Coastal Commission, 404 S.E.2d 895, 898 (1991).

[39] Penn Cental Transportation Company v. City of New York, 438 US 104, 98 S.Ct 2646 (1978); City of Monterey v. Del Monte Dunes at Monterey, Ltd., ___ U.S. ___, 119 S.Ct. 1624 (1999).

[40] Nollan v. California Coastal Commission, 483 U.S. 825, 834-5, 107 S.Ct. 3141 (1987).

[41] Dolan v. City of Tigard, 512 U.S. 374, 391, 114 S.Ct. 2309 (1994).

PLANNING FOR NATURAL HAZARDS:
Flood TRG

July 2000

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Section 1:
Introduction to the Flood Technical Resource Guide

Many Oregon communities have areas that are subject to flooding. Communities commonly allow development within flood prone areas; however, such development is subject to certain regulations. This guide is intended to serve as a resource and planning tool for local governments in developing land use strategies that reduce the risks posed by flood hazards. This guide provides background information on flood hazards, information on state and federal laws that address flooding in Oregon, and technical information and data sources on reducing the risk of flooding. The guide is designed to help your local government address flood hazard issues through effective comprehensive plan inventories, policies and implementing measures.

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1.1 The Threat of Flood Hazards to Oregon Communities

Floods occur throughout the United States causing loss of life and property, and disrupting families and communities. Communities particularly at risk are those located in low-lying areas, near water.[1] A single flood event can cause millions of dollars in property damage, and pose a significant threat to human life and safety.[2] The economic impacts of flooding on businesses, private citizens, the public sector, and infrastructure (e.g., roads and bridges) can be significant, and Oregon's largest economic loss from natural disasters has resulted from flooding. Businesses are often forced to close or curtail their operations, some are unable to reopen for weeks or months, and many never reopen. Business owners and employees lose money in sales, damaged inventory, and wages. Individual property owners experience both property and structural losses.[3] Understanding flood hazards and how they occur will help reduce the risk these threats pose to Oregon communities.

Flood damage to infrastructure has a devastating effect on local recovery efforts. Damage to federal, state, county and local roads and bridges can leave communities stranded and without access to critical services such as police, fire, and hospitals. Damage to water and sewage treatment plants can result in serious pollution and drinking water contamination when raw sewage or other pollutants are released and carried by floodwaters. Erosion, mudslides, and the carrying of large debris by floodwaters create dangerous or unstable ground conditions, which may pose serious threats to development.[4]

Flash floods represent even greater safety risks than riverine floods because of the rapid onset, the high velocity of water, and the huge debris load carried by floodwaters. Multiple flood crests can occur from a series of fast moving storms. The rapid rise in water level and force may cause motorists to underestimate the depth and velocity of floodwaters, causing stalled and flooded vehicles and loss of life by drowning.

Sidebar

Organization of the Natural Hazards Technical Resource Guide

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goals 2, 7, 17 and 18, a resource directory and land use tools matrix for hazard mitigation.

1.2 How to Use the Flood Technical Resource Guide:

The Flood Technical Resource Guide provides information to help communities in Oregon plan for flood hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about flood hazards.

Section 2:
Is Your Community Threatened by Flood Hazards?

Section 2 presents an overview of the causes and characteristics of floods, and provides information to assist communities in flood hazard identification.

Section 3:
What are the Laws in Oregon for Flood Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for flood hazards.

Section 4:
How can Your Community Reduce Risk from Flood Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from flood hazards.

Section 5:
How are Oregon Communities Addressing Flood Hazards?

Section 5 examines how several communities are implementing programs to reduce risk from flood hazards. These examples illustrate plan policies and implementing measures for floods.

Section 6:
Where can Your Community find Resources to Plan for Flood Hazards?

Section 6 is a resource directory listing contacts, programs, and documents that planners, local governments and citizens can use to access additional information on flood hazards.

Section 2:
Is Your Community Threatened by Flood Hazards?

Flood hazards can cause severe property damage and loss of life. Identifying hazard areas is a key step in developing effective plan policies and implementing measures. This section assists local planners and decision makers in understanding how floods may affect current and future development. An overview of the causes and characteristics of floods is included, along with information on identifying flood hazards in your community.

2.1 A Brief History of Flooding in Oregon

Oregon has a detailed history of flooding. Flood records date back to the 1860s. Oregon's deadliest recorded flood occurred in Heppner in 1903. A June 15th storm dropped 1.5 inches of rain within a 20-minute period. The storm was centered in the headwater area of Willow Creek near Heppner in Northeastern Oregon. Within minutes, a 5-foot wall of water and debris poured through Heppner with enough velocity to rip homes off of their foundations. These floodwaters claimed 247 lives.[5]

The 1948 flood destroyed the entire city of Vanport (now Delta Park). Record flow levels on the Columbia River caused the structural failure of a dike. Vanport was destroyed in minutes and was never rebuilt. Over 19,000 people lost their homes and 18 people lost their lives.[6]

Many of Oregon's flood records were set during the December 1964 and January 1965 "Christmas Flood." Damage from this flood event totaled over $157 million dollars and twenty Oregonians lost their lives. From December 20th through the 24th of 1964, the most severe rainstorm to occur in Central Oregon, and one of the most severe west of the Cascades, left many areas with two-thirds their normal annual rainfall in five days. This was augmented by snowmelt in the mountains and valleys. The ensuing floods destroyed hundreds of homes and businesses, forced the evacuation of thousands of people, destroyed at least 30 bridges and washed out hundreds of miles of roads and highways.[7]

A similar flood event occurred in February 1996. Following an extended period of unseasonably cold weather and heavy snowfall in the Pacific Northwest, warming temperatures and rain began thawing the snowpack and frozen rivers throughout Oregon. On February 6, a strong subtropical jet stream hit Oregon. This warm, humid air mass brought record rainfall amounts, quickly melting the snowpack. At least 25 rivers reached flood stage. Many reached flood levels comparable to those of the 1964 flood. Twenty-seven of Oregon's 36 counties were declared a presidential disaster due to this event. Statewide, damages totaled over $285 million.[8]

Tip Box

Hazard Inventories

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities, and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

Table 1. Historic Flooding in Oregon

DATE	LOCATION (RIVER)	COMMENTS
September 1861	Klamath, Willamette and Umpqua	
March 1876	Columbia	
June 1880	Columbia	
January 1881	Willamette Basin	
December 1882	Umatilla	
June 1884	John Day	
January - February 1890	Willamette Basin	
May - June 1894	Columbia River Basin	Rain on snow pack; highest flood stage ever recorded at Vancouver, WA (33.6 feet)
June 1903	Willow Creek	Flash flood in Heppner; 247 people killed
April 1904	Silvies and Klamath	
March 1906	Umatilla	
February 1907	Western Oregon and John Day	
November 1909	Deschutes, Willamette, Santiam, Umpqua, Coquille and Rogue	
March 1910	Powder and Malheur	
June 1913	Columbia	
January 1923	Clackamas, Santiam, Sandy, Deschutes, Hood and McKenzie	Record flood levels
February 1925	Malheur	
February 1927	Klamath, Willamette, Umpqua, Rogue and Illinois	Major flooding
May 1928	Columbia	
March 1931	Umatilla, Sandy, Clackamas and Santiam	
March 1932	Malheur, Grande Ronde, John Day and Umpqua	
January 1933	Coquille	
November - December 1942	Willamette Basin	10 deaths; $34 million in damages
December 1945	Coquille, Santiam, Rogue and McKenzie	9 deaths; many homes destroyed in Eugene area

Table 1. Historic Flooding in Oregon, continued

DATE	LOCATION (RIVER)	COMMENTS
December 1946	Willamette, Clackamas, Luckiamite, and Santiam	
May June 1948	Columbia River	Rain on snow pack; destroyed city of Vanport
March 1952	Malheur, Grand Ronde, and John Day	Highest flood stages on these rivers in 40 years
December 1955	Rogue, Umpqua, Coquille	11 deaths; major property damage
July 1956	Central Oregon	Flash floods
February 1957	Southeastern Oregon	$3.2 million in flood damages
December 1961	Willamette Basin	$3.8 million in flood damages
March 1964	Oregon Coast	Tsunami claims four lives
December 1964 - January 1965	Pacific Northwest	Rain on snow; record flood on many rivers
December 1967	Central Oregon Coast	Storm surge
January 1972	Western Oregon	Record flows on coastal rivers
January 1974	Western Oregon	$65 million in damages
November - December 1977	Western Oregon	Rain on snow event; $16.5 million in damages
December 1981	Umpqua and Coquille	
January 1982	Tillamook County	
February 1982	Malheur and Owyhee Basins	Cyclical playa floods on Malheur & Harney Lakes
1979 to present	Harney County Lakes	Damages totaling $280 million
February 1996	Nearly statewide	High velocity flows, damage from erosion and undermining of structures
January 1997	Jackson, Josephine and Douglas Counties	
May June 1998	Crook County and Prineville	Heavy rainfall and high tides
December 1998	Tillamook County	
November 1999	Tillamook and Lincoln Counties	

Source: State Hazard Mitigation Plan, Oregon State Police – Office of Emergency Management

2.2 What are the Types of Flood Hazards?

Many types of flooding occur in Oregon. They include riverine flooding, flash flooding, urban flooding, coastal flooding, and playa flooding.

2.2.1 Riverine Floods

Riverine floods - overbank flooding of rivers and streams - are the most common of all natural disasters. Most communities in the United States have the potential to experience this type of flooding after spring rains, heavy thunderstorms, or snowmelt. These floods can be slow or fast-rising, but generally develop over a period of days.[9]

Flooding in large river systems typically results from large-scale weather systems that generate prolonged rainfall over wide geographic areas, causing flooding in hundreds of smaller streams, which then drain into the major rivers.[10] The most severe flooding conditions generally occur when direct rainfall is augmented by snowmelt. If the soil is saturated or frozen, stream flow may increase due to the inability of the soil to absorb additional precipitation.[11]

Almost every county in Oregon experiences riverine flooding. In fact, Oregon has over 250 flood-prone communities. The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with the melting of snow in the Cascade and Coast Ranges. Most of Western Oregon is highly susceptible to riverine flooding, especially Coos, Tillamook and Columbia Counties, as well as the western drainages of the Cascade Range.[12] Examples of riverine flood events occurred in February of 1996, and the “Christmas Floods” that occurred during December of 1964 and January of 1965.[13]

2.2.2 Flash Floods

Flash floods are a major cause of weather-related deaths in the United States. Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods occur with little or no warning and can reach full peak in only a few minutes.[14]

Topography, soil conditions and ground cover are all important factors that contribute to flash flooding.[15] Flash floods are most common in arid and semi-arid areas where there is steep topography, little vegetation and intense but short-duration rainfall. Flash floods occur in both urban and rural settings, principally along smaller rivers and drainage ways. Flash floods occur quickly in smaller waterways, or drainage streams that do not typically carry large amounts of water.[16] Flash floods usually occur in the summer during the thunderstorm season.[17]

In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often contain large amounts of debris. In some situations, a flash flood may arrive as a fast moving wall of debris, mud and water. Occasionally,

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floating debris or ice can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back by the ice jam or debris dam can cause flooding upstream. Subsequent flash flooding can occur downstream if the obstruction suddenly releases. Areas subject to flash floods are often less obvious than those located on a typical riverine floodplain. Flash floods, however, may be associated with recognizable locations such as canyons or arroyos.[18]

Central and Eastern Oregon are the areas of the state most susceptible to flash flooding, particularly due to the arid climate, steep topography and low vegetative cover found there.[19] The most notorious flash flood in Oregon was the June 1903 event in Heppner.[20]

2.2.3 Shallow Area Flooding

Shallow area flooding is a special type of riverine flooding. FEMA defines shallow flood hazards as areas that are inundated by the 100-year flood with flood depths of only 1 to 3 feet. These areas are generally flooded by low velocity sheet flows of water.[21]

2.2.4 Urban Flooding

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. This transition from pervious to impervious surfaces results in more water running off instead of filtering into the ground. Thus, water moves faster to watercourses, with resulting water levels rising above historic, pre-development levels. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with yard waste causing additional, localized flooding.[22]

Another cause of urban flooding is grading associated with development. Grading may cause changes in drainage direction from one property to another. Although this is a small, isolated impact of development, it may be significant to the adjacent property owner.

2.2.5 Coastal Flooding

Coastal flooding occurs in low-lying coastal areas, and is caused by heavy rain, large waves, or even tsunamis triggered by underwater seismic events. The areas susceptible to this intense wave action are termed high velocity zones, or “V-zones”. Special regulations apply for development in these areas. For more details, refer to the discussion on “V-zones” later in this section.

TRG Key

For more comprehensive information on coastal flooding hazards, see the Coastal Technical Resource Guide.

2.2.6 Playa Flooding

Playa flooding results from greater than normal runoff into a closed basin. Closed basin systems are those areas that have one or more rivers emptying into one or more lakes that have no outlet. In these situations, water leaves the system primarily through evaporation. Thus, if annual precipitation in the basin increases significantly, evaporation is not enough to

reduce water levels. Lake levels rise and inundate the surrounding properties.

The best-known example of playa-basin flooding in Oregon occurs at Malheur and Harney Lakes in Harney County. In higher than average precipitation years, the lakes flood adjacent ranches and public roads. Malheur and Harney Lakes flooded during the years 1979 to 1986, and then gradually receded. During the wetter years of 1997 to 1999, these lakes again flooded.[23]

2.3 What are some Terms Related to Flooding?

2.3.1 Floodplain

A floodplain is a land area adjacent to a river, stream, lake, estuary or other water body that is subject to flooding. These areas, if left undisturbed, act to store excess flood water. The floodplain is made up of two sections: the flood fringe and the floodway (See Figure 1).[24]

2.3.2 Floodway

The floodway is one of two main sections that make up the floodplain. Floodways are defined for regulatory purposes. Unlike floodplains, floodways do not reflect a recognizable geologic feature. For National Flood Insurance Program (NFIP) purposes, floodways are defined as the channel of a river or stream, and the overbank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures, so that flood flows are not obstructed or diverted onto other properties.[25] The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot (See Figure 1)."[26] Floodways are not mapped for all rivers and streams but are generally mapped in developed areas.

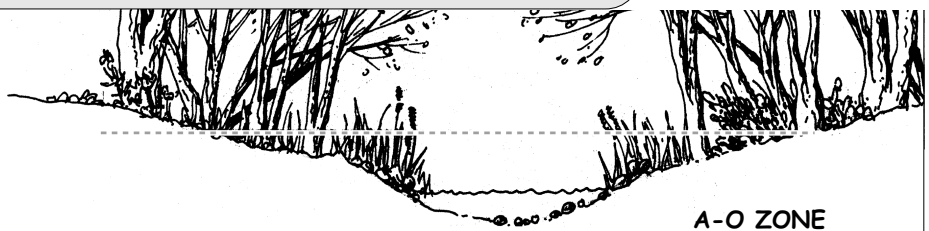
2.3.3 Development

For floodplain ordinance purposes, development is broadly defined to mean "any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials."[27] The definition of development for floodplain purposes is generally broader and includes more activities than the definition of development used in other sections of local land use ordinances.

2.3.4 The Flood Fringe

The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. This is the area where development is most likely to occur, and where precautions to protect life and property need to be taken (See Figure 1).

Figure 1: Cross-section of the Floodplain



AREA	FLOOD FRINGE	FLOODWAY	A-O ZONE FLOOD FRINGE
DESCRIPTION	Shallow flooding usually standing or slow moving water.	Usually fast-moving water. Area reserved to conduct water of a 100-yr. flood out of the area.	
USE LIMITS	Construct residential buildings above base flood elevation. Other buildings may be flood-proofed.	No fill or structure that would cause any rise in base flood elevation.	

Source: *Department of Land Conservation and Development. A Citizen's Guide to the Oregon Coastal Management Program. Salem, Ore.: Oregon Department of Land Conservation and Development (1997) p. 15.*

2.3.5 Base Floods and Base Flood Elevations

Flooding occurs for different reasons and at varying levels. "Base Flood" is defined by the NFIP regulations (44 CFR 59) as "the flood having a 1 percent chance of being equaled or exceeded in any given year." This flood is referred to as the 100-year flood. Determination of the 100-year flood is based on a statistical analysis of record flood flows, some dating back to the 1860's.

The term "Base Flood Elevation" refers to the elevation (normally measured in feet above sea level), which the base flood is expected to reach. Base flood elevations can be set at levels other than the 100-year flood. Some communities choose to use higher frequency flood events as their base flood elevation for certain activities, using lower frequency events for others.[28] For example, for the purpose of stormwater management, a 25-year flood event might serve as the base flood elevation, while the 500-year flood event may serve as base flood elevation for the tie down of mobile homes.[29] The regulations of the National Flood Insurance Program focus on development in the 100-year flood plain.

Flood Key

See Section 4 of this guide for information on stormwater management.

2.4 What is the Effect of Development on Floods?

When development is located in the floodplain, it may cause flood waters to rise higher than before development, particularly if that development is located within the floodway. When structures or fill are placed in the floodway, water is displaced. Development raises the base-flood elevation by forcing the river to compensate for the flow space obstructed by the inserted structures. Over time, when structures or materials are added to the floodway and no fill is removed to compensate, serious problems can arise. Floodway development is currently regulated and local governments must require engineer certification that proposed developments will not cause the base flood (100-year flood) elevation to rise.[30] Displacement of only a few inches of water can mean the difference between no structural damage occurring in a given flood event, and the inundation of many homes, businesses and other facilities. Careful attention must be paid to development that occurs within the floodway to ensure that structures are prepared to withstand base flood events.

In highly urbanized areas increased paving can lead to an increase in volume and velocity of runoff after a rainfall event, exacerbating the potential flood hazards. Care should be taken in the development and implementation of stormwater management systems to ensure that these runoff waters are dealt with effectively.[31]

Sidebar

Mapleton, Oregon and the 1996 Flood Event

Mapleton, a small community in Oregon's Coast Range, was one of the many communities affected by the 1996 Oregon Floods. Like many communities, most of Mapleton's development historically occurred in the floodplain. The Mapleton flood is an example of the intense chain of destruction that can be caused by flooding events when a community is built within the boundaries of the 100-year floodplain: "…(A) number of docks, outbuildings and mobile homes were washed away. Mud slides and floodwaters cut off the community completely. Several feet of floodwaters filled the floors of many homes and businesses. Mapleton's water system was completely knocked out by the flood. This not only raised health concerns, but hampered response and recovery operations until service was restored. Wells were also contaminated. At least one or two homes were completely destroyed by mudslides and over 30 homes and a number of businesses suffered serious water damage…"[32]

2.5 How are Flood-Prone Areas Identified?

Flood insurance studies and Flood Insurance Rate Maps (FIRMs) are often used in characterizing and identifying flood prone areas.

2.5.1 Floodplain Maps and Flood Insurance Studies

Floodplain maps are the basis for implementing floodplain regulations and for delineating flood insurance purchase requirements. A Flood Insurance Rate Map (FIRM) is the official map produced by the Federal Emergency Management Agency (FEMA), which delineates Special Flood Hazard Areas or floodplains where National Flood Insurance Program regulations apply. FIRMs are also used by insurance agents and mortgage lenders to determine if flood insurance is required and what insurance rates should apply.[34]

Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood and floodway areas. In some cases they may include 100-year base flood elevations (BFEs) and areas located within the 500-year floodplain.[35]

Flood Insurance Studies and FIRMs produced for the National Flood Insurance Program (NFIP) provide assessments of the probability of flooding at a given location. FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. *They do not reflect changes within the study area that might affect flooding since*

the studies. For example, many of Oregon's metropolitan areas have had significant population increases resulting in increased development during the past 20 years. Development changes the hydrology of urban streams as an increase in impervious surfaces results in greater runoff volumes and velocities. In order to address changing conditions, some communities have adopted higher regulatory standards such as Metro's balanced cut and fill requirements and Tillamook County's requirement that new homes and substantial improvements to existing homes be elevated at least 3 feet above the base-flood elevation. [36]

Although many communities rely exclusively on FIRMs to characterize the risk of flooding in their area, some jurisdictions develop their own flood hazard maps. They use high-water marks from flood events or aerial photos, in conjunction with the FEMA maps to better reflect the true flood risk for their communities (See case study on Talent in Section 5 of this guide).[37]

Geographic Information Systems (GIS) are increasingly becoming an important tool for flood hazard mapping. FIRMs can be imported directly into GIS, which then allows for GIS analysis of flood hazard areas. Communities find it particularly useful to overlay flood hazard areas on tax assessment parcel maps.[38] This allows a community to evaluate the flood hazard risk for a specific parcel during review of a development request. Coordination between FEMA and local technical experts is the key to making a strong connection with GIS technology for the purpose of flood hazard mapping.

FEMA and the Environmental Systems Research Institute (ESRI) have formed a partnership to provide multi-hazard maps and information to the public via the internet. ESRI produces GIS software, including ArcView© and ArcInfo©. The ESRI web site has information on GIS technology, as well as downloadable maps and other resources. The hazards maps provided on the ESRI site will assist communities in evaluating geographic information about natural hazards. Flood information for most Oregon communities is available on the ESRI web site. Visit **http://www.esri.com** for more information.

Sidebar

The 100-Year Flood Myth

This long-standing myth actually has two parts, and neither is true. The first is that every flood is a 100-year flood. The second is that the 100-year flood occurs only once every 100 years.

Often, floods that crest at a level well below that of the 100-year flood are incorrectly termed "100-year floods." This common misuse in flood designation leads people to the conclusion that an event that is supposed to happen only every 100 years is happening every time flood waters spill over the river bank. The reality is that the majority of floods consist of lesser frequency events such as the one-year, five-year or ten-year floods. The 100-year flood is not a frequent event and has only a one percent chance of being equaled or exceeded during any given year.[33]

Recent decades have seen an increase in 100-year flood events. For example, the Mississippi River Basin and parts of Southern Louisiana have had at least two 100-year events in the last decade. Because flooding depends on variables that cannot be accurately predicted, determination of exactly where the 100-year flood levels are is not an exact science. Factors such as climate change and changes to the built environment can have dramatic effects and communities should periodically review flood plain boundaries.

Tip Box

Evaluating Development in Flood Hazard Areas

When an individual walks into a local planning office with a proposed development, there are several steps that must be taken in order to identify the floodplain designation for that property and evaluate whether or not development can occur. A detailed description of this process can be found in Section 4 of this guide.

2.5.2 How to Read Flood Maps

Flood Insurance Rate Maps (FIRMs) are presented in a variety of formats. Many of the flood maps produced since January 1985 include floodway and floodplain management information that was not shown on older versions of flood maps. Many new Flood Maps also present simplified flood insurance risk zone designations. The most common scales are one inch = 500 feet, one inch = 1,000 feet, and one inch = 2,000 feet. The jurisdictions covered may include partial or entire counties or individual cities.

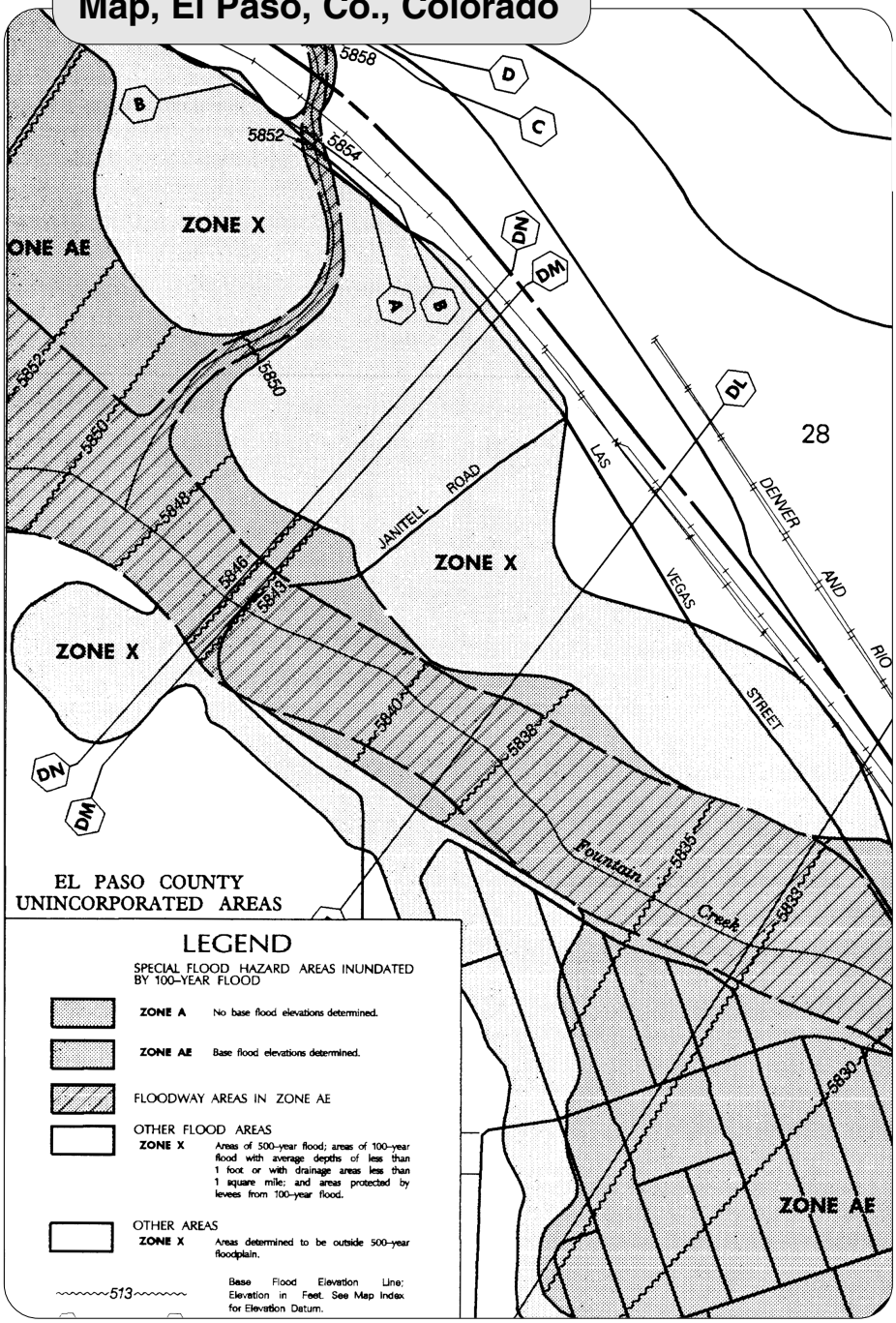
When a flood map cannot be presented on one page, it is produced on several pages. Those pages are known as panels. Panels depict flood hazards in a community. Each panel includes a title box that contains the name of the community, the panel number, and other information. All panels include seven items that also appear on the index. They are:

- Community name
- Community number
- Panel number/community panel number/map number
- Corporate limit or county boundary line
- North arrow
- Effective or revised date
- Map scale

Elevation reference marks are found on flood maps. These marks identify points where a ground elevation is established by survey. Elevations are usually expressed in feet; for some communities, however, the elevations are shown in meters. Descriptions of the marks, including their elevations are provided. These surveyed elevations are used to determine the base flood elevation.

Flood Hazard Area designations appear as dark and light tints. Dark tints indicate areas of increased flood hazards; light tints indicate areas of lesser flood hazards. Floodplain boundaries show the limits of the 100- and 500-year floodplains. Most flood maps cover only one community.[39]

Digital Flood Insurance Rate Map, El Paso, Co., Colorado



Source: *Federal Emergency Management Agency. Multi-Hazard Identification and Risk Assessment. Washington, D.C.: FEMA (1997) p. 141.*

Sidebar

Questions to ask about Floodplain Mapping

- How do I know if my flood map is up to date?
- Where can my community get more flood maps?
- Is the floodway mapped in my community?

FEMA's map distribution center can answer questions and provide additional copies of flood maps. They can be contacted at (800)358-9616.

- How do I get my map updated?

FEMA establishes priorities for remapping. Contact FEMA Region X's mitigation division at (425)487-4678 for information.

Individual property owners who wish to demonstrate that their property or structures are not located in a special flood hazard areas should submit a Letter of Map Amendment or a Letter of Map Revision for land that is out of the floodplain because of the placement of fill. Forms for Letters of Map Amendment and Map Revision are available on FEMA's website (**www.fema.gov/nfip/forms.htm**) or from the Oregon Floodplain Program coordinator (503)373-0050.

2.6 Summary of Flood Hazards in Oregon

Many different types of flood hazards exist in Oregon, and their effects can be devastating. By understanding flood hazards, communities will be better prepared and equipped to plan for floods in the future.

Once flood hazards are identified, communities can review functional plans such as those for natural resources, open space, and master plans to integrate flood hazard information. To identify flood hazards in your community and to develop an inventory of flood hazards, use the following resources:

- ❒ *Existing flood maps* and information, including FIRMs, Flood Boundary-Floodway Maps, and FEMA Flood Insurance Studies (digital flood maps on FEMA or ESRI web sites)
- ❒ *FEMA Region 10* for information about recent map revisions or amendments. Contact information can be found in Section 6 of this guide.
- ❒ *Historical documents* such as "official" high water marks, aerial photos taken during flood events, newspaper articles or interview with local officials and residents on storm events and hazards over the past decade.
- ❒ *Soil maps* can show whether there are wet or "hydric" soils in your community. Wet soils may be indicative of historic flooding.
- ❒ *Other organizations* such as USGS or local watershed councils may have relevant flood data for your community.

TRG Key

Chapter 2: Elements of a Comprehensive Plan provides information on three phases of hazard assessment: hazard identification, vulnerability assessment and risk analysis.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment will examine identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following in determining whether or not its comprehensive plan has adequately inventoried flood hazards.

- ❒ Are there flood hazards in your community?
- ❒ Does your comprehensive plan hazard inventory describe floods in terms of the geographical extent, the severity and the frequency of occurrence?
- ❒ Has your community conducted a community wide vulnerablity assessment?

Section 3:
What are the Laws in Oregon for Flood Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Flood Technical Resource Guide presents current laws that Oregon communities are required to address.

3.1 Oregon Laws Related to Flood Hazards

3.1.1 Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning goal that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states that "Developments subject to damage or that could result in loss of life shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards..."

In addition to the requirement "To protect life and property from natural disasters and hazards," Statewide Planning Goal 7 includes specific guidelines for local governments to address in responding to flood hazards. For example, Goal 7 guidelines include a specific preference for the use of non-structural techniques to minimize flood hazards. The guidelines state, "In planning for floodplain areas, uses that will not require protection through dams, dikes and levies should be preferred over uses that will require such protection." The guidelines also suggest that land uses that are least subject to loss of life and property damage, such as parks and open spaces should be encouraged in the floodplain. Finally, to avoid obstructing floodwater flow, no development should occur in the floodway portion of the floodplain.[40]

TRG Key

Information on Goal 7 and additional floodplain development guidelines can be found in Appendix A of the Natural Hazard Technical Resource Guide.

3.1.2 Goal 17: Coastal Shorelands

Goal 17 is concerned with conservation and protection, as well as appropriate development of Oregon's coastal shorelands. It aims to reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat resulting from the use and enjoyment of Oregon's coastal shorelands.

3.1.3 Goal 18: Beaches and Dunes

The purpose of Goal 18 is to conserve, protect, and where appropriate, to either develop on or restore the resources and benefits of coastal beach and dune areas. It is also concerned with reducing the hazard to human life and property from natural or man-induced actions associated with these areas. [41]

TRG Key

Additional development standards related to flooding apply in coastal areas where velocity zones, or V-zones, have been mapped. Refer to Section 3 of the Coastal Hazards Technical Resource Guide for additional information on V-zone requirements, coastal shorelands and beaches and dunes.

Tip Box

Division of StateLand Permits

When reviewing applications for development in floodplains, local governments should determine whether or not Oregon Division of State Lands (DSL) permits are required. These permits generally go through a joint review by DSL and the Army Corps of Engineers. In the case of an application for a floodway development permit, the DSL should always be contacted. Also, local governments will be asked to sign-off on DSL permits to ensure that the proposed activity is consistent with the local comprehensive plan and implementing ordinances.[43] Division of State Lands contact information is included in Section 6.

3.1.4 Division of State Lands (DSL) Fill and Removal Permit Program

Oregon's Removal-Fill Law (ORS 196.800-990) requires individuals who remove or fill 50 cubic yards or more in "waters of the state" to obtain a permit from the DSL. "Waters of the state" are defined as "natural waterways including all tidal and non-tidal bays, intermittent streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable, including that portion of the Pacific Ocean which is in the boundaries of this state." In State Scenic Waterways or areas designated by DSL as essential indigenous anadromous salmonid habitat, most removal-fill activities require a permit, regardless of the number of cubic yards affected.[42] In addition, the Oregon Department of Environmental Quality is responsible for water quality certification under section 401(a) of the Clear Water Act. This certification is required as part of the DSL permitting process.

3.1.5 Oregon State Building Codes

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The One- and Two- Family Dwelling Code and the Structural Specialty Code contain requirements to elevate a building at least one foot above the base flood elevation. These codes also contain provisions for flood proofing, underfloor drainage, and directing stormwater away from buildings. The building department that has jurisdiction generally coordinates with others to ensure that permit applications for new construction meet these requirements. Verification of the floor elevation is obtained during the permitting and inspection process. ORS 455.447 and the State Structural Code establish restrictions on the location of essential facilities in tsunami inundation zones along the coast subject to flooding following an earthquake. Essential facilities include hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools. State building codes do not cover facilities constructed in public right-of-ways or waterways used to control flooding.[44]

Back Forward

Sidebar

The Oregon Plan for Salmon and Watersheds

"The Oregon Plan" is the state's program to restore native salmon and trout populations and to improve water quality. The overall goal of the Oregon Plan is to restore fish populations to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits. The plan consists of four essential elements:

- Coordinated federal and state agency programs,
- Community based actions,
- Monitoring of program accomplishments, and
- Application of appropriate corrective changes based on monitoring results.

Many efforts under the Oregon Plan will benefit local floodplain management efforts. Protection of wetlands for clean water and improved habitat will also result in more flood storage. Riparian area protection and setbacks from shorelines provide a greater floodplain area and reduce streambank erosion. Designation of floodplain areas as open space will help improve water quality and habitat conditions but will also keep structures out of hazardous areas. For more information on the Oregon Plan, contact (503)378-3589 or see **http://www.oregon-plan.org.**

3.2 Federal Policies and Programs Related to Flooding

3.2.1 The National Flood Insurance Program (NFIP)

The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost, and to encourage the location of new development away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains.

Congress created the NFIP in 1968 to minimize response and recovery costs and to reduce the loss of life and damage to property caused by flooding. The NFIP is administered by the Federal Emergency Management Agency (FEMA). The two fundamental objectives of the NFIP are to:

1. Ensure that new buildings will be free from flood damage; and
2. Prevent new developments from increasing flood damage to existing properties.[45]

Tip Box

Benefits of the National Flood Insurance Program

The primary benefits of the NFIP are to:

1. Provide flood insurance coverage not generally available in the private market;
2. Stimulate local floodplain management to guide future development;
3. Emphasize less costly nonstructural flood control regulatory measures over structural measures; and
4. Reduce costs to the federal government by shifting the burden from the general taxpayer to floodplain occupants.

Tip Box

Good Record Keeping

FEMA and the Oregon NFIP Coordinator periodically review community enforcement of their floodplain ordinance to ensure compliance with federal NFIP regulations. Keeping good records is essential to this process. Some record keeping tips for communities are:

1. Keep two copies of all floodplain development permits. One in the tax assessor's property file (by parcel number or street address) and one in a chronological file with all other floodplain development permits.
2. Set up a tracking system to ensure that a copy of the final, as-built elevation certificate is returned for your files. Establish a system that works for you and your building inspector.
3. Consider requiring a specific floodplain development permit.

Community Participation in the NFIP

Community participation in the NFIP requires the adoption and enforcement of a floodplain management ordinance that controls development in the floodplain. This type of ordinance has been accepted by Land Conservation and Development Commission (LCDC) as sufficient to comply with Statewide Planning Goal 7 for flood hazards. To ensure that a community is in compliance with the NFIP and Oregon state law, a jurisdiction is required to do the following:

1. Require development permits for all proposed construction and other development within the community's designated 100-year floodplain;
2. Review permits to be sure that sites are reasonably safe from flooding;
3. Review subdivision proposals to determine whether the project is safe from flooding and provides adequate drainage;
4. Require residential structures to have the lowest floor (including basement) elevated to at least one foot above Base Flood Elevation (BFE);
5. Require non-residential structures to have the first floor elevated or flood proofed to one foot above BFE;
6. Require manufactured homes to be elevated and anchored;
7. Require water supply systems to be designed to eliminate infiltration of flood waters;
8. Require new replacement sanitary sewage systems be designed to minimize or eliminate infiltration of flood waters;
9. Ensure flood carrying capacity of altered or relocated watercourses is maintained;
10. Maintain records of all development permits;
11. Verify and document elevations of new or substantially improved structures; and
12. Properly address development in coastal "Velocity Zones."[46]

General NFIP Flood Insurance Information

Important points for cities and counties to understand about the flood insurance provided through the NFIP are:

1. Federal flood insurance is only available in those communities that participate in the NFIP. In Oregon, all communities with federally mapped flood hazards are eligible to participate.
2. Flood insurance is required for federally backed mortgages to purchase or build structures located in any Special Flood Hazard Area.
3. Communities must participate in, and be in good standing with the NFIP, to receive federal disaster assistance in identified floodplains.
4. Flood insurance can be purchased from any insurance agency.
5. Flood insurance can be purchased for any building, regardless of where the structure is located, if the community participates in the NFIP.

TRG Key

Refer to Section 3 of the Coastal Technical Resource Guide for more information on Velocity Zones.

6. The NFIP does not cover basement contents or finished portions of a basement.
7. Rates are subsidized for pre-FIRM buildings; actuarial rates apply to post-FIRM structures.
8. There is a waiting period of 30 days before insurance coverage takes effect.
9. There is no waiting period when transferring titles of properties to new owners.[47]

NFIP Community Assistance Visit (CAV)

Once a jurisdiction is successfully participating in the NFIP, FEMA or the Oregon Floodplain Coordinator will, every two to four years, conduct a Community Assistance Visit (CAV) to assess how well the community is administering its local floodplain ordinance. The visit ensures compliance with NFIP requirements. In addition, by meeting with local officials, checking building permits and elevation documentation, and touring the flood hazard areas, a CAV evaluates the community's floodplain management program relative to the provisions, stipulations and recommendations of the NFIP. Following the CAV, a follow-up letter is sent to the chief elected official, and a report is filed with FEMA regarding the findings of the visit and any necessary follow-up activities.[48]

Flood Key

Refer to the sidebar on elevation certificates in this section.

3.2.2 FEMA Region X's Policy on Fish Enhancement Structures in the Floodway

The Federal Emergency Management Agency (FEMA) regulates development in the floodway. The regulations require that a community prohibit encroachments (including fill, new construction, and other development) within the floodway unless it is demonstrated by engineering analysis that the proposed encroachment will not result in any increase in flood levels during the occurrence of a 100 year flood event.

The recent designation of several northwest salmon and steelhead runs as threatened or endangered has resulted in an increased effort to restore fish habitat. Restoring habitat often involves placing structures in stream. These structures, including fish weirs, log drops, root wads and small rock deflectors are "encroachments" when placed in mapped floodways. A literal interpretation of the FEMA floodway standard may require a relatively expensive "no-rise" analysis that might exceed the cost of the habitat enhancement project.

In order to encourage habitat enhancement projects while still providing communities with information needed to make appropriate floodplain management decisions, FEMA Region X will allow communities to rely on the judgment of a qualified professional regarding the impact of fish enhancement structures on flood elevations. Qualified professionals include hydrologists and hydraulics professionals and staff of fisheries, natural resource or water resource agencies. This will minimize the cost of getting a "no-rise" analysis. However, the community, while making use of the professionals' advice, must still

Tip Box

Community Rating System

The Community Rating System (CRS) is a program operated by the NFIP that recognizes communities who go beyond the minimum requirements of the National Flood Insurance Program (NFIP). CRS offers reduced flood insurance premiums for communities who adopt higher standards and encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. Detailed information on the CRS program can be found in Section 4 of this guide.

Sidebar

Elevation Certificates

The Elevation Certificate is a form published by the Federal Emergency Management Agency required to be maintained by communities participating in the National Flood Insurance Program (NFIP). The NFIP requires local governments to obtain certificates for all new construction in floodplains and to keep the certificates on file.

Elevation certificates are used to:

1. Record the elevation of the lowest floor of all newly constructed buildings located in the floodplain.
2. Determine the proper flood insurance rate for floodplain structures.

Local governments must insure that elevation certificates are filled out correctly for structures built in floodplains. Certificates must include:

1. The location of the structure (tax parcel number, legal description) and use of the building.
2. The Flood Insurance Rate Map panel number and date, community name and source of base flood elevation date.
3. Information on the building's elevation.
4. Signature of a licensed surveyor or engineer.

make the ultimate decision on whether to allow the habitat enhancement structure.

For more information on the policy on fish enhancement structures in the floodway, contact FEMA Region X at (425)487-4682.

3.2.3 Army Corps of Engineers Permit Program

The U.S. Army Corps of Engineers is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. The Corps administers a permit program to ensure that the nation's waters are used in the public interest, and requires any person, firm, or agency planning work in the waters of the United States to first obtain a permit from the Corps. Permits are required even when land next to or under the water is privately owned. It is a violation of federal law to begin work before a permit is obtained and penalties of fines and/or imprisonment may apply. Examples of activities in waters that may require a permit include: construction of a pier, placement of intake and outfall pipes, dredging, excavation and depositing of fill. Permits are generally issued only if the activity is found to be in the public interest. In Oregon, permits for development of these activities are issued jointly by the Oregon Division of State Lands (DSL) and the U.S. Army Corps of Engineers**.** As mentioned in the discussion of DSL permits, local planning agencies are required to sign off on any permits issued by DSL and the U.S. Army Corps of Engineers and water quality certification is required by the Department of Environmental Quality.[50] Contact information for the U.S. Army Corps of Engineers is provided in Section 6.

3.3 Summary of State and Federal Flood Laws and Programs

State Laws

- ❒ Oregon Statewide Planning Goal 7
- ❒ Oregon Statewide Planning Goal 17
- ❒ Oregon Statewide Planning Goal 18
- ❒ Division of State Lands Fill and Removal Permit Program
- ❒ Oregon State Building Codes

Federal Policies

- ❒ National Flood Insurance Program
- ❒ FEMA Region X's Policy on Fish Enhancement Structures in the Floodway
- ❒ Army Corps of Engineers Permit Program

A number of state and federal agencies are involved in regulating land use in and near floodplains. Local planning departments are the main point of contact for development permits issued by cities and counties. Communities also need to coordinate their review of floodplain development permits with other agencies. For example:

1. Permits for new structures in the floodplain should be coordinated with the building inspection program having authority;
2. Floodway development permits should by coordinated with Division of State Lands and the Army Corps of Engineers;
3. Development on the coast needs to comply with local land use requirements to implement State Planning Goals 17 and 18.[51]

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. Section 3 of the Flood Technical Resource Guide describes laws that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying flood hazards in your area:

- ❒ Does your community's comprehensive plan contain an inventory of flood hazards, a vulnerability assessment and policies addressing flood hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on flood hazards in your community and the current laws for flood hazards?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in flood hazard areas?

Flood Key

Section 2 of this Guide provides information that can assist your community in identifying flood hazards.

Section 4:
How can Your Community Reduce Risk from Flood Hazards?

Avoiding development in hazard areas is the most effective way to reduce risk. There are, however, many areas in Oregon where some degree of hazard is unavoidable. Communities in vulnerable areas should manage and reduce their risk from flood hazards if the risk cannot be completely eliminated. Section 4 describes methods to evaluate site-specific development and other implementing measures to reduce risk from flood hazards. Implementing measures are the ordinances and programs used to carry out decisions made in the comprehensive plan. They include zoning ordinances, and other land use regulations, which directly regulate land use activities.

4.1 How can Your Community Plan for Flood Hazards?

It is possible to plan, at least to some degree, for flood hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in flood areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

To successfully plan for a flood hazard, consider the following steps:

- ✓ **Identify the hazard**
  Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.
- ✓ **Avoid the hazard**
  Restrict development in flood prone areas. For areas with high density and potential for severe property damage or loss of life, this option should be followed.
- ✓ **Evaluate site-specific development**
  Communities can require evaluation of site-specific development in flood hazard areas. Section 4 describes techniques for evaluating development.
- ✓ **Implement risk reduction measures through land use planning**
  Minimizing development in flood hazard areas through low density and regulated development can reduce risk of property damage and loss of life. Section 4.3 provides information on specific land use planning and zoning measures.
- ✓ **Implement additional non-regulatory measures**
  Additional mitigation strategies and non-regulatory measures can further reduce risk from flood hazards. Section 4.5 provides information on additional mitigation activities.

TRG Key

Chapter 2: Elements of a Comprehensive Plan provides information on hazard identification, vulnerability assessment and risk analysis that can be used for site-specific development.

Back Forward

4.2 What is the Process for Evaluating Development in Flood Hazard Areas?

After a proposed development is submitted to the local planning office, the first step is to identify the floodplain designation for the property. This review includes the following steps:

1. The planner examines the FIRM or other flood area maps to determine where the property is in relation to the flood hazard areas. If the property is in the floodplain or floodway, the planner will give instructions on the permitting procedure and requirements for these areas. Most development in the floodway is usually prohibited.
2. Permits are required for any development in the floodplain. Development, as defined by the NFIP regulations, includes residential, non-residential, fill/grading/excavation, and other non-structural development. Permits must be issued before any development occurs.
3. The local government must determine whether an elevation certificate is required. Elevation certificates are required for new residential construction.
4. Local governments must review floodplain development permits for compliance with their comprehensive plan and other land use requirements.
5. The local government can issue a floodplain development permit like a zoning permit without opportunity for public comment. Alternatively, a local government could process such a permit review as a conditional use with opportunity for public comment.
6. Local governments must offer opportunity for other interested local agencies to comment (e.g., emergency managers and natural resource program managers).

Tip Box

NFIP Development Standards

The National Flood Insurance Program (NFIP) does not prohibit floodplain development, but rather guides development in floodplain areas to lessen the economic loss and social disruption caused by flood events. The NFIP establishes minimum standards for floodplain development that are implemented and enforced through local floodplain development ordinances.

4.3 What Land Use Tools are used for Floodplain Management?

Land use planning and zoning are powerful tools that communities can use to further reduce flood risks. The following are land use tools communities can use to reduce risk from flood hazards.

4.3.1 Overlay Zones

Most Oregon communities use floodplain overlay zones to implement their flood ordinances.[52] Overlay zones are independent zones that co-exist with the base-zoning district. Development is usually in accordance with the uses allowed by the base-zoning district. Parcels that fall within the overlay zone are subject to the regulations of the base zone and the additional regulations of the overlay zone. For example, a community could create an overlay zone for high flood hazard districts and establish additional requirements for those districts. Such requirements might include rules for new development, or limit reconstruction in the hazard area.[53] The city of Talent in southern Oregon is using a floodplain, parks and greenway overlay to achieve its floodplain management goals.

Sidebar

Transfer of Development Credits

Deschutes County had significant population growth in the late 1980s and 1990s. Much new development occurred in southern Deschutes County including new housing in areas like the SunRiver resort community. The area is characterized by numerous small (less than two acre) lots that were created prior to adoption of Oregon's Statewide Land Use laws. These rural areas are not served by community water or sewer systems. Pollution of the area's groundwater with nitrates from septic systems is a major issue and a constraint on new development. Approximately 1800 of the undeveloped residential lots have water tables at 2 feet or less so installing additional septic tanks is unlikely.

In order to promote development in other areas (areas not constrained by polluted groundwater), Deschutes County is exploring the possibility of a "Transfer of Development Credits" program. Owners of each of the 1800 lots would be granted a development credit that they could then sell for development at another location. The original lot would be left undeveloped although the owner could use it for recreational or other purposes. For more information on the Deschutes County project, see: **http://newberry.deschutes.org/CDDW** and look for information on the Regional Problem Solving Program or contact the Deschutes County Planning Department at (541)388-6575.

4.3.2 Incentive Zoning

Incentive zoning allows developers to exceed limitations imposed upon them by regulations, in exchange for specific concessions. For example, if developers avoid developing in the floodplain, the local government might allow them to build on other portions of their land at a higher density than is allowed by the current zoning designation.[54] Transfer of Development Rights (TDRs) and Transfer of Development Credits are examples of powerful incentives to curb development in floodplains. TDRs are enabled by Oregon State Law, but have not yet been used for floodplain management in Oregon.

4.3.3 Performance Zoning

Performance zoning sets standards for the allowable impact of development. The standards usually specify limits to certain environmental conditions, like the amount of traffic or pollution generated. Usually this technique is used in conjunction with standard zoning. For example, a performance standard may limit the number of times a structure can be rebuilt after multiple flood events.[55]

4.3.4 Incorporating Flood Mitigation Requirements into Subdivision Regulations

These types of regulations govern the division of land for sale or development. Sometimes certain fees may be incorporated into these types of regulations. For example, developers who wanted to subdivide a property located in a high flood-risk area could be required to pay developer exactions, impact fees or other system development charges.[56] Subdivision regulations combined with a fee extraction can serve to discourage development in the floodplain. In Polk County, Oregon no subdivisions are allowed in the floodplain. If a developer proposes to subdivide to a high density, as is characteristic of a subdivision, that developer must generate maps to prove that his property does not lie within the boundaries of the floodplain.[57] Three mitigation approaches that can be included in subdivision regulations include:

1. *Cluster Development* is the concentration of structures on one part of a lot to preserve the remainder of the property for open space. Cluster development usually is permitted only under planned unit development procedures. Clustering offers the potential for savings in some areas: the sewer and water lines and streets needed to serve a cluster may be much shorter than those necessary for a traditional subdivision of comparable density.[58] Cluster development provides the opportunity to avoid developing in hazard areas by maximizing development in non-hazard areas.
2. *Performance Bonds* are bonds required of a subdivider or developer to ensure that specified improvements be carried out after approval for the development is given by the local government. Performance bonds are widely used for a broad range of improvements sidewalks, streets, curbs,

storm sewers, street lighting, etc. They are one type in a broader category known as surety bonds.[59] Performance bonds could be used to improve drainage practices or implement other mitigation techniques.

3. A *Site Plan* is a detailed map of a proposed development site. Many subdivision and zoning ordinances require that a site plan accompany any application for a partition, variance, conditional use, zone change, or other quasi-judicial action. The standards for the drafting of such maps are usually defined in the community's zoning and subdivision ordinances. At a minimum, site plans should have a consistent scale (described on the plan), a north arrow, and a title or legend, and should show property lines, the locations of buildings, and the presence of roads, streams, and other major features of the landscape.[60] If a flood hazard is present, you can use the site plan to determine the location of the permitted development in relation to the hazard area.

4.4 What can Your Community do to Strengthen its Flood Ordinance?

Flood Key

Refer to Section 6 of this guide for contact information for FEMA and the NFIP.

All Oregon communities participating in the National Flood Insurance Program (NFIP) have adopted floodplain development ordinances. Many communities have adopted the Oregon Model Floodplain Development Ordinance prepared by the Federal Emergency Management Agency (FEMA). This model ordinance meets the minimum requirements for local jurisdictions to participate in NFIP. The model ordinance is available from FEMA Region X, the Oregon Floodplain Coordinator, or online at: **www.lcd.state.or.us/issues/rural.htm.**

Communities are encouraged by FEMA and DLCD to adopt floodplain management standards in addition to those required by the NFIP to address local concerns and flood conditions. Communities may benefit from these higher standards through participation in the Community Rating System. Residents in these communities may enjoy reduced insurance premiums due to their community's enactment of ordinances that go beyond the minimum NFIP requirements.

The following are examples of some of the regulations that Oregon communities are adopting, as well as some examples of language being used by communities as they try to strengthen their flood management ordinances.

4.4.1 Adopt Stricter Elevation Requirements

The NFIP requires that new structures in the floodplain be elevated to or above base flood elevation. Oregon State Building Codes require such structures to be elevated to one foot above base flood elevation. Based on historic flood levels or other information, some communities have chosen to adopt a more protective standard, to safeguard the lives and property of their citizens.

For example, Tillamook County, along Oregon's north coast, requires residential structures to be elevated three feet above the base flood elevation. Marion County, Oregon requires elevation to two feet above the base flood elevation. This extra "margin of safety" provides added protection to new development, particularly in situations where maps may be incomplete or outdated.

4.4.2 Prohibit Development in Floodways

Floodways include the normal stream channel and those areas closest to the stream channel. A floodway's function is to move water out of a community as quickly as possible. Therefore, the NFIP regulations require that development will not encroach on the mapped floodway areas. Current federal regulations require engineer certification that development in the floodway area will cause no rise in the base flood elevation. Some Oregon communities have gone beyond this general requirement to prohibit any development or "encroachment" in the floodway area. For example, a local government could adopt ordinance language stating:

> "Above ground structures are not allowed in the (jurisdiction) floodway as delineated by the Federal Emergency Management Agency on (date of floodway map)."

In some cases, local governments allow no new development in floodways with the exception of local public works activities (e.g., utilities, bridges, etc.). For example:

> "Floodways are established in Special Flood Hazard Areas to transport the waters of a 100-year flood out of the community as quickly as possible with minimal flood damage. Floodways are most often mapped in urban areas, including in small cities. Encroachments on the floodway generally produce a rise in base flood elevation and contribute to other hydraulic problems. Accordingly _____ (city/county) prohibits encroachment on designated floodways except for public works projects pursuant to section xx (below)."
>
> "_____ (city/county) recognizes that utilities, flood prevention structures and improvement projects that are in the public's best interest must sometimes encroach on designated floodways. In compliance with Federal Emergency Management Agency requirements, (44 CFR s. 65.12), _____ (city/county) will permit floodway encroachments under the following conditions:
> The city/county finds that the proposed public works project is in the public interest; and FEMA has approved the proposed project."

In some cases, certain types of activities or uses are prohibited in floodways. For example:

> *"No filling operations of any kind shall be allowed in the floodway."*

Washington State prohibits any and all new construction or substantial improvements in floodways. County and city flood management ordinances must be approved by the state. Any ordinance that does not restrict land uses within designated floodways, including the prohibition of construction or reconstruction, repair, or replacement of residential structures, may be disapproved by the state.[61]

4.4.3 Adopt Hazardous Material Provisions

Hazardous materials when inundated by a flood event can be released into the environment and harm community members as well as wildlife. Local governments may want to include a provision banning storage of hazardous materials in the 100-year floodplain. Hazardous material can be defined as a combustible, flammable, corrosive, explosive, toxic or radioactive substance that is potentially harmful to humans and the environment.

4.4.4 Adopt Water Quality Provisions

Floodplain development ordinances can be used to address community concerns such as protection of water quality and the preservation of open space. When addressing these concerns in their floodplain ordinance, communities need be sure that the concern is identified up front, in the discussion of the intent and purpose section of the ordinance.

It may be appropriate for local governments to address water quality issues through their floodplain development ordinance since floodplain development impacts water quality in several ways. The filling of floodplains and increased impervious surface results in the loss of infiltration capacity and increased velocity of stormwater runoff. Use of fill may also disturb riparian areas. Although floodplain development ordinances are primarily designed to reduce flood insurance claims through site development standards, local floodplain management can be done in a manner that protects and enhances water quality.

There are a number of options available to help local governments address water quality concerns through their floodplain development ordinances. Adding language to the purpose section of a floodplain ordinance specific to the water quality is one option:

> "To protect and enhance water quality by restricting or prohibiting uses which cause increased flood heights or velocity or lead to increased erosion on site or downstream."

Water quality issues associated with floodplain management can also be addressed through performance standards required for floodplain development (e.g., balanced cut and fill requirements). Information relating to watershed management and water quality issues can be found through local

Tip Box

Water Quality Model Code

Oregon's Departments of Land Conservation and Development and Environmental Quality will issue a Water Quality Model Code and Guidebook in fall 2000. For more information, contact DLCD at (503)373-0050.

watershed councils or through the Oregon Watershed Enhancement Board (OWEB). See Section 4.5.1 for more information on how OWEB and watershed councils can provide assistance in flood mitigation.

4.4.5 Improve Maps of the Flood Hazard Area

In order to participate in the National Flood Insurance Program, local governments must include a reference to the Flood Insurance Administration's (FIA's) Flood Insurance Study and the Flood Insurance Rate Maps in their flood development ordinance. However, many of these maps are almost twenty years old and do not reflect flood hazards associated with new development. A community might include a broader area for floodplain management based on historic flood records, including aerial photos to better protect its residents from flooding. Oregon's Marion County has done this, and it has improved their maps significantly. An example of the possible ordinance language that can be used is:

"The Ordinance shall apply to all areas of special flood hazard areas within the jurisdiction of _____. The areas of special flood hazard identified by the Federal Insurance Administration in a scientific and engineering report entitled "The Flood Insurance Study for the _____" dated _____, 19__, and as amended, with accompanying Flood Insurance Maps, as amended are hereby adopted by reference and declared to be a part of this ordinance. The flood hazard areas also include areas identified and mapped by (jurisdiction) that were not studied by the Flood Insurance Administration. The report and maps are incorporated in the overlay zone by this reference and are on file _____."

4.4.6 Strengthen Setback Requirements

The National Flood Insurance program does not require a specific setback requirement for new development along waterbodies. Statewide Planning Goal 17 requires a setback from coastal shorelands. Local governments may apply Statewide Planning Goal 5 provisions for "safe harbor" riparian area protection in their ordinances as a means to enhance floodplain management and reduce flood damages. See Section 6 for information on Goals 17 and 5 and how to contact the Department of Land Conservation and Development.

Under a typical setback ordinance, new development is required to be set back from the top of the bank of a stream or river or from a mapped floodway line. Setback distances will vary depending upon the site conditions (again, see the safe harbor for Goal 5). The following are some of the benefits of maintaining a riparian buffer area:

- Setbacks provide an added margin of safety by keeping structures away from the higher velocity flood forces that are closest to the main stream channel;
- Setbacks reduce flood losses caused by stream bank failure (erosion damage) when stream channels migrate; and

- Setbacks provide the benefits of a riparian buffer along stream channels to protect fish and wildlife habitats and improve water quality.

4.4.7 Consider the Effect of Proposed Development on Existing Development

The NFIP program regulations do not specifically require local governments to consider the impact of proposed floodplain development on existing development (although this is required for development in a floodway). Some jurisdictions evaluate the effects of floodplain development on existing development and stream velocity. For example, "Any proposal for development within the Flood Plain Special Purpose District shall be accompanied by documentation prepared by a registered civil engineer demonstrating to the satisfaction of the manager that the development:

- Will not result in an increase in floodplain area on other properties; and
- Will not result in an increase in erosive velocity of the stream that may cause channel scouring or reduced slope stability downstream of the development."

Communities may want to consider this type of ordinance if they expect a large amount of new development in their flood hazard areas.

4.4.8 Regulation of Fill in the Floodplain

The current NFIP regulations allow local governments to permit the placement of fill material in the mapped floodplain. Placement of fill results in a net loss of floodplain storage. Water can no longer infiltrate and instead runs off at a higher velocity while carrying pollutants. One option for local governments to reduce the loss of floodplain storage and slow down the movement of pollutants to waterways is to limit fill in the floodplain. Ordinance language could:

- Prohibit all new fill in floodplain areas. (This could be limited to those areas with water quality limits or areas with prime habitat);
- Limit new fill in floodplain areas by requiring "compensatory storage." One option is to require balanced "cut and fill." That is, for every, *x* cubic yards of material you put in the floodplain, *x* cubic yards must be removed. METRO, the Portland metropolitan-area planning agency, has required this.

For example, a local code could require developers to compensate for the loss of conveyance storage caused by filling in the floodplain by removing an equal amount of material in the floodplain near the development. Some jurisdictions require balanced cut and fill on the property seeking the development permit. Others require that balanced cut and fill be accomplished on a watershed level.

Sidebar

Stormwater Management Program

In 1987, the U.S Environmental Protection Agency's (EPA) Clean Water Act was amended to require implementation of a comprehensive national program to address non-agricultural sources of stormwater discharges. Stormwater discharges are the runoff of water from industrial sites, construction activities and through municipal storm sewer systems that drain directly into lakes, streams and coastal waters. Measures used to address water quality problems associated with stormwater should also minimize the impact of uncontrolled stormwater runoff on flood levels and landslides.

Implementation of EPA's stormwater regulations is through the existing NPDES (National Pollutant Discharge Elimination System) water quality permitting program. EPA has adopted the program in two phases. The first phase required permits for industrial stormwater discharges, runoff from construction sites disturbing five acres or more of land and large municipal systems.

TRG Key

Additional information on critical facilities planning can be found in Chapter 2 of this guide: Elements of a Comprehensive Plan.

4.4.9 Improve Stormwater Management

Most communities are already engaging in some type of stormwater management. Communities can conveniently incorporate their flood mitigation goals into the stormwater management design process. They can do this through the design of water retention and detention facilities and by setting performance standards.

4.4.10 Protection of Natural and Beneficial Floodplain Functions

One of the goals of the National Flood Insurance Program is to protect the natural and beneficial functions of floodplains. Natural and beneficial floodplain functions include both the natural infiltration capacities of floodplains, as well as minimizing the pollutants that can enter waters from floodplain development activities. Though nothing in the model ordinance specifically addresses this issue, a variety of options are available to local governments;

- Prohibit all activities in the floodplain that may be hazardous to public health or water quality (e.g., septic systems, storage of hazardous materials, location of landfills, etc.).
- Require new floodplain developments to avoid or minimize disruption to shorelines, stream channels and stream banks (e.g., setback requirements).
- Adopt regulations pursuant to a Habitat Conservation Plan approved by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.[62]

4.4.11 Discourage Placement of Critical Facilities in Floodplains

Jurisdictions can prohibit certain types of critical uses in floodplains (e.g.,hospitals, fire stations, etc). This is important to ensure that these vital services are not lost in the event of a flood. Careful planning should occur to ensure that these facilities are not sited in floodplains. If your critical facilities are already located in a floodplain, pre-disaster planning before a flood event is crucial to ensuring that these services are not incapacitated. It is also important to consider and evaluate factors such as:

- Are police or ambulance vehicles going to be cut off from sections of the community?
- Will critical services be able to access the entire population in the event of a disaster?
- What possible routes of travel might be incapacitated?

Communities might need to determine if alternate routes are available and how that will effect service delivery.

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4.5 What are Some Additional Flood Mitigation Activities?

4.5.1 Build Partnerships with Watershed Councils

Watershed councils are locally organized, voluntary groups established to improve the condition of watersheds. Watershed councils are a source of data and technical assistance for communities as they develop their inventories and flood mitigation plans. Council members can serve as technical advisors to local planners attempting to deal with watershed and flood processes. Watershed councils can also help communities seek funding for mitigation projects.

Councils offer local residents the opportunity to independently evaluate watershed conditions and identify opportunities to restore or enhance conditions in their riparian areas. They bring varied interests together in a non-regulatory setting to form a common vision for the ecological and economic sustainability, and livability of their watershed. The councils provide a voice for local people in natural resource management decisions, including floodplain management.[63]

Watershed councils offer a view of the watershed as a natural system. They are resources for communities as they develop their flood mitigation plans. Making connections between the natural environment, floodplain processes, and floodplain mitigation can lead to dramatic improvements in floodplain management. For a list of all the watershed councils in Oregon visit: **http://www.4sos.org/group/gweb_wscs.htm** on the Internet.

4.5.2 Develop Flood Mitigation Plans

A flood mitigation plan addresses the hazard risk to communities located partially or entirely in a floodplain. These plans help communities to address the flood hazard by developing goals and strategies for flood hazard mitigation within the community.[64] Talent, Oregon has developed such a plan. It includes an assessment of the flood hazard in their community, goals for how to better manage flood hazards, a discussion of existing mitigation activities and a list of recommended activities for the future. One of their mitigation activities includes a long-term effort to acquire flood prone properties through purchase, donation, or other mechanisms.[65]

In developing these plans it is important to remember that floodplains are natural phenomena. As such, they are best addressed in ways that preserve their natural function in the ecosystem. For example, as floodplain boundaries rarely fall within a single jurisdiction, these types of plans are likely to be addressed most effectively through regional government bodies.

4.5.3 Participate in NFIP's Community Rating System

The Community Rating System (CRS) is operated under the National Flood Insurance Program (NFIP). The NFIP provides flood insurance to homes and businesses located in floodplains at a reasonable cost, and encourages the movement of develop-

ment away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains. For more detailed information on the NFIP, turn to Section 2 of this guide.

CRS recognizes community efforts that go beyond the minimum standards of the NFIP. This recognition is in the form of reduced flood insurance premiums for communities that adopt such standards. CRS encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood insurance awareness. There are over 900 communities participating in CRS nationwide. Some of the benefits of CRS are listed below.

CRS Benefits

- Flood insurance premium reductions, ranging from 5% to 45%. The higher the CRS rating a community achieves, the greater the premium discount.
- Floodplain management activities enhance public safety and reduce damages to private property and public infrastructure.
- Communities can evaluate the effectiveness of their floodplain management program against a national benchmark.
- Implementation of some CRS activities makes communities eligible for other funding sources (See the end of this section for information on funding sources).

Participation in the CRS is voluntary. There are minimum requirements in order to participate.

- Your community must be in compliance with the rules and regulations of the NFIP.
- The community's chief executive (mayor, County Board of Commissioners) must appoint a CRS coordinator.
- Communities must require and keep all NFIP elevation certificates on file.
- Communities with repetitive losses must develop and implement a floodplain mitigation plan.

The CRS rating system is based on the ranking of community activities within four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Communities engaging in these types of activities receive points according to a schedule developed for the CRS. CRS ratings are assigned based upon the number of points earned. The majority of CRS communities are in Class 8 or Class 9. A Class 8 rating earns about a $40 savings in flood insurance premiums per insurance policy, per year. Only three communities out of 900 have achieved Class 5 status. The system is summarized in Table 2, below. CRS handbooks are available from your local FEMA representative or by calling (800)427-4661. See Section 6 for information on how to obtain this document.

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Table 2. Summary of Points and Insurance Rate Discounts under CRS

Credit Points	Class	Premium Reductions
0-499	10	0
500-999	9	5%
1000-1499	8	10%
1500-1999	7	15%
2000-2499	6	20%
2500-2999	5	25%
3000-3499	4	30%
3500-3999	3	35%
4000-4599	2	40%
4500+	1	45%

Tip Box

Benefits of the Community Rating System's Methodology

Even if a jurisdiction is not ready to officially apply to be a part of CRS, the CRS flood mitigation planning standards are very useful for assessing local needs with regard to floodplain management and hazards planning in general. In addition, if a community begins to use CRS methodologies now, it will only expedite the process later when a CRS application is filed.[67] For more information on CRS, refer to Section 6 of this guide for contact information for the Oregon Floodplain Coordinator at DLCD.

Sidebar

Oregon CRS Communities

As of January 2000, 16 Oregon jurisdictions are participating in the CRS program.[66] The requirements of Statewide Planning Goal 7 and the State Building Codes make it relatively easy to achieve a Class 9 CRS rating. Communities are required to create and implement policies that address flood hazards. Achieving a higher CRS rating, however, requires a greater effort from communities. Local communities, particularly smaller communities with limited resources, must weigh the costs and benefits of putting forth this effort. It is important to consider the realities of available resources, the number of structures at risk, and number of insurance policies in the community, when deciding whether or not to participate in voluntary flood mitigation programs such as the CRS.

Oregon Communities	CRS Rating
Albany	8
Ashland	8
Cannon Beach	7
Central Point	8
Corvallis	8
Douglas County	8
Eugene	8
Grants Pass	9
Jackson County	8
Medford	9
Polk County	9
Rogue River	8
Roseburg	8
Scappoose	8
Stanfield	9
Talent	8

4.5.4 Fee Simple Acquisition of Land and Buyouts

Though this is usually the most expensive method of mitigation, it is also the most effective in terms of a flood mitigation strategy. Once the land in the floodplain is purchased outright by a local government entity, all development can be prohibited, and the land can be officially designated as open space. There are four types of buyouts:

1. Basic buyouts, which have no relocation element;
2. Buyout and infill programs which encourage the relocation of structures outside of the floodplain;
3. Buyout and reorganization plans which create new subdivisions where the moved structures are relocated; and
4. Buyout and complete relocation, which involves the construction of an entire new town, using new or relocated old buildings.[68]

FEMA's Hazard Mitigation Grant Program, administered in Oregon by the Oregon State Police (OSP) - Office of Emergency Management (OEM), is one funding source for such buyouts. In Oregon the HMGP has funded the acquisition of two homes in Talent, a hotel in Tillamook, and two homes in Keizer. A number of homes along Johnson Creek in Portland have been bought out with funds provided by the city and FEMA. These areas are now free from development and are being held as open space in perpetuity.[69]

4.5.5 Use of Easements

Easements restrict certain activities on properties. When an easement is granted, certain activities or land uses are no longer available to the property owner. They are usually given up in exchange for some type of compensation. Easements foregoing the right to develop a property can be either sold or granted to local jurisdictions or other organizations by property owners. This is described as "acquiring a negative easement against development." This can be extremely useful to local communities by providing a mechanism for de facto acquisition of undeveloped floodplain lands, and at a lower price than fee-simple acquisition.

When granting an easement, landowners sign a legal document giving up the right to some use of their property (for example, the ability to subdivide), and they are potentially eligible for certain financial benefits. Easements can be purchased by a community or donated by the property owner. A decrease in property value with a corresponding decrease in property taxes usually follows, as the property no longer has the legal ability to be used to its full development potential. So, the property owner gets some financial gain from his land, while the entire community benefits by having that land as protected open space.[70]

4.5.6 Use of Tax Incentives

Differential tax assessment can be used to provide an incentive for landowners who own undeveloped land in the floodplain to keep it undeveloped. If taxes for floodplain lands are differentially low, the owner has a financial incentive to keep it as open space. Tax abatements can also be used in this fashion, as well as to encourage developers to integrate mitigation into their developments. For example, abatements, subsidies or other economic incentives have been used for floodproofing programs.[71]

Flood Key

Refer to Section 6 of this guide for information on how to contact OEM.

4.6 What Funding Programs are Available to Communities?

4.6.1 Hazard Mitigation Grant Program (HMGP)

The HMGP administered by the Federal Emergency Management Agency (FEMA) provides grants to states and local governments to implement long-term hazard mitigation measures after a federal major disaster declaration. It is important to stress that the HMGP is available only after a federal disaster declaration has been made. When such an event occurs, and these monies become available, they can be used to implement important and innovative flood mitigation projects. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented immediately, during disaster recovery. FEMA can fund up to 75 percent of the eligible costs of each project. Eligible applicants are state and local governments, special districts, Native American nations and organizations, and certain private non-profit organizations. Individual homeowners and businesses may not apply directly to the program, but a community may apply on behalf of homeowners and businesses. An example of an HMGP project would be the purchasing of property located in the floodplain to prevent future damage.[72]

The OSP - Office of Emergency Management (OEM) is the state agency responsible for administering the HMGP.

4.6.2 Flood Mitigation Assistance Program (FMA)

Flood Mitigation Assistance (FMA) program funds are made available by FEMA to states on an annual basis. The Oregon FMA program provides grants to communities for projects that reduce the risk of flood damage to structures that have flood insurance coverage. This funding is available for flood mitigation planning and implementation of mitigation measures only. The Oregon State Police - Office of Emergency Management (OEM) is the administrator of the FMA program and is responsible for selecting projects for funding. The State then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf. [73] Use the resource directory at the end of this guide to contact OEM for more information.

Sidebar

Flood Mitigation Assistance Program

To be eligible for a Flood Mitigation Assistance Program project grant, a community must have a FEMA-approved mitigation plan. FEMA recommends a basic flood mitigation process consisting of the following activities:

1. Public Involvement
2. Coordination with other agencies or organizations
3. Flood hazard area inventory
4. Problem identification
5. Review of possible mitigation actions
6. State or local adoption following a public hearing

An example of a community engaging in such activities is Lincoln County. As a result of destructive flooding in November of 1999, Lincoln County applied for and was awarded, a Hazard Mitigation Grant from the OSP-OEM for elevating or relocating damaged structures and developing a flood mitigation plan.

4.6.3 Emergency Watershed Protection Program (EWP)

EWP is a Natural Resource Conservation Service (NRCS) program designed to relieve imminent hazards to life and property caused by floods, fires, windstorms and other natural occurrences. EWP provides funds for projects such as: removing debris from stream channels, reshaping and protecting eroded banks, correcting damaged drainage facilities, repairing levees and structures, and purchasing floodplain easements. If your community suffers severe damage from a natural disaster it may qualify for assistance under the EWP program. Public and private landowners are eligible for assistance but must be represented by a project sponsor. City and county governments, general improvement districts and conservation districts are the most common sponsors of EWP projects. Sponsors are responsible for providing land rights to do the repair work and securing permits, as well as furnishing the local cost share and accomplishing the installation of work.[74] See Section 6 of this guide for information on how to contact the NRCS to obtain more information on this program.

4.6.4 Oregon Watershed Enhancement Board (OWEB)

The Oregon Watershed Enhancement Board (OWEB) administers two grant programs that provide funds for mitigation and improvement projects that approach natural resources management from a whole-watershed perspective. Floodplain management fits that profile. OWEB encourages projects that foster interagency cooperation, include other sources of funding, provide for local stakeholder involvement, include youth and volunteers and promote learning about watershed concepts. OWEB's goal is to help Oregonians improve the state's watersheds. The primary functions of OWEB are to provide technical assistance, administer a grant program, promote education and public awareness about watershed enhancement benefits, concepts and techniques, and to support the work of local watershed councils.[75] For more information refer to Section 6 for contact information.

4.7 Summary: Reducing Your Community's Risk from Flood Hazards

Section 4 describes a range of methods and programs communities can use to reduce risk to life and property from flood hazards.

- *Land use tools for floodplain management* include performance zoning, overlay zones, incentive zoning and subdivision regulations. These tools can be used by communities to improve floodplain management and flood mitigation.
- *Flood Development Ordinances* can be constructed and several different standards can be adopted to improve floodplain management. Some of the examples are: 1) the adoption of stricter elevation requirements, 2) the prohibition of development within the floodway, and 3) the adoption of water quality provisions.
- *Additional methods for flood mitigation* include developing a flood mitigation plan, building partnerships with local watershed councils, participating in NFIP's Community Rating System (CRS), use of fee-simple land acquisition, easements and tax incentives.
- *Potential Funding Programs* include the Hazard Mitigation Grant Program (FEMA-Oregon OEM), Flood Mitigation Assistance Program (FEMA-Oregon OEM), Emergency Watershed Protection Program (NRCS) and Oregon Watershed Enhancement Board Grant Program (OWEB).

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your community should ask the following questions in assessing the adequacy of your comprehensive plan in addressing flood hazards.

- Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to flood hazards?
- Has your community implemented a process for evaluating site-specific development in flood hazard areas?

Section 5:
How are Oregon Communities Addressing Flood Hazards?

This section provides information on the flood programs of two Oregon jurisdictions and describes implementation processes that were used for flood mitigation and addressing development in flood prone areas.

5.1 Innovative Approaches to Flood Mitigation in Umatilla County, Oregon

Umatilla County has taken an innovative approach in developing their flood mitigation plan. The county's mitigation plan addresses the variety of flood hazards in their community. Their efforts provide an example of how effective a community can be in developing flood mitigation strategies, and offers lessons for other jurisdictions to consider in developing their own flood hazard mitigation plans.

Background

Flooding in 1996 and 1997 caused widespread erosion of agricultural lands, road damage, and structural damage in Umatilla County. The severity of those events underscored a need for county-wide flood response planning and flood mitigation measures. The county has moved from the use of levees, dikes and reservoirs, which were the primary methods for flood control during the 1970's. In recent years, non-structural methods such as the use of floodplain development regulations have provided a viable alternative to costly structural flood controls.

Umatilla County is an interesting case study because of its susceptibility to a variety of flood types; riverine, flash, and, to some extent, urban. The county has observed that all of these types can occur as part of the same flood event. For example, the foothills of the Blue Mountains experience flash flooding that can contribute to typical riverine flooding of the Umatilla River, and in some instances cause urban flooding. Umatilla County has developed flood preparedness and mitigation strategies to address these types of flood events.

Umatilla County's Flood Mitigation Plan

The County's Flood Mitigation Plan was developed through the combined efforts of the Umatilla County Emergency Management staff, several local and state agencies, and the Umatilla County Planning Commission before adoption by the Umatilla County Board of Commissioners.

Some of the policies in the plan include:

- Review uses of floodplain/floodway as part of periodic review.
- Seek updated and improved floodplain mapping.
- Explore options for acquiring land or establishing easements.
- Provide additional information on elevation and floodproofing options.

Back Forward

- Promote streambank stabilization and bioengineering efforts countywide.
- Evaluate the county's river gauge network.
- Provide ground information to the National Weather Service to better predict risk.
- Adopt a county emergency flood response plan.

Some of the mitigation policies were initiated as the result of immediate need, such as the flooding along Mill Creek, some by regulatory requirements, as in the revised floodplain standards in the county's development code, and some by local initiative, such as new floodplain mapping for the city of Athena.

Implementation

Since the development of the Flood Mitigation Plan, Umatilla County has revised the county's floodplain zoning to conform to FEMA guidelines. The county purchased a former home site in the floodway of Mill Creek and facilitated the elevation of other homes along Mill Creek as well as funded the design and construction of a more flood resistant bridge. The county has been a supporter of the multi-agency bioengineering/streambank stabilization project along McKay Creek and the enhancement of the river gauge system. The county also worked with the National Weather Service Pendleton Office to promote the volunteer "Weather Watchers Network." FEMA and the Army Corps of Engineers have provided new or revised floodplain maps for Mill Creek and for the City of Athena's Urban Growth Area. In 1998, the county adopted an Emergency Flood Response Plan as an annex of the Emergency Operations Plan.

Umatilla County has not had any recent flood events to "test" these new policies. However, they are confident that when flooding occurs in the future, the county's efforts will prove worthwhile, particularly along Mill Creek where physical structures in the floodway have been removed, elevated, or redesigned and rebuilt. Despite their confidence, Umatilla County continues to work on other aspects of their Flood Mitigation Plan.

Through this process Umatilla County has come to realize the importance of fostering a close working relationship between local emergency managers and their local planning department counterparts. Mitigation has to be based upon these two agencies' cooperative efforts, which was easy in Umatilla County as the two are part of the same department. This is not true in many other cities and counties. It is imperative that close coordination occur in order to provide the links necessary between preparedness and response [emergency management] and mitigation [planning and land use regulation].[76]

5.2 Going Beyond Minimum Requirements in Talent, Oregon

Talent offers an example of how a small town with minimal resources can be extremely effective in planning for flood hazards. Talent's flood ordinance exemplifies how a community can exceed regulatory standards to better protect itself from a flood disaster.

Background

After the 1997 New Year's Day flood struck Southern Oregon, the City of Talent went to work. They did a survey of the problem areas in the floodplain, based almost entirely upon field observation volunteers, to document areas damaged by floodwaters and record high water marks. Using FEMA Hazard Mitigation Grant Program (HMGP) funds, the city developed a Stormwater Master Plan and Stormwater Design Standards. As a condition of their HMGP grant, the city also adopted a Flood Hazard Mitigation Plan. Subsequently, they applied to participate in the Community Rating System and will be a Class 8 community when the approval process is complete.

The city also had GIS maps prepared by the county GIS office that overlaid FIRM areas on the tax lot map. This allows staff to make more accurate determinations of flood hazard areas, and makes it possible for citizens to see for themselves how the regulatory floodplain relates to their property. After the 1997 flood event, it became clear to the city that Wagner Creek, the creek that runs through the city, did not perform as the FEMA Flood Insurance Rate Map said it would. This prompted the city planner and engineer to increase their efforts to get FEMA to do a detailed study of Wagner Creek for new FIRM maps. A better model was needed of the hydrologic characteristics of the basin, as well as consideration of changes in the basin and determinations of base flood elevations for unmapped areas inside the city and three miles up Wagner Creek. Geology students from the nearby university did a preliminary survey of high water marks. The FEMA study is currently underway and will provide the City of Talent with the most current and accurate information possible regarding its flood area inventory, so that the city can continue to improve its floodplain management efforts.

City of Talent Flood Damage Prevention Ordinance

The city used the State of Oregon's model ordinance as a base for its Flood Damage Prevention Ordinance. It enhanced the model by increasing the elevation standards for development in the floodplain to two feet above base flood elevation. This allows the city to receive extra points in the NFIP Community Rating System program, which maintains lower insurance rates for their community.

Their ordinance goes beyond current standards by requiring tie downs for mobile homes inside the 500-year floodplain. The standard in the model ordinance applies only inside the 100-year floodplain. The city also continues to look for opportunities to achieve permanent open space designation along the creeks in their area, especially the opportunity to purchase land outright.

The Talent Zoning Ordinance includes special setbacks from streams. New construction must be set back 50 feet from inventoried "locally significant" wetlands and riparian areas. New construction must also be set back 35 feet from the floodway. The stricter standard is controlling. Structures that lie within those setback areas are nonconforming, and are subject to the same regulation of expansion and replacement of other nonconforming uses.

Some of Talent's Flood Damage Prevention Ordinance includes:

Section 5.2.1 Residential Construction

a) New construction and substantial improvement or any residential structure shall have the lowest floor, including basement, elevated *two feet above the base flood elevation.*

Section 5.2.2 Nonresidential Construction

New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor, including a basement floor, *elevated two feet above the base flood elevation*; or, together with requirements for utility and sanitary facilities set out below, shall: a) Be floodproofed so that below the flood protection level (*two feet above base flood level*), the structure is watertight with walls substantially impermeable to the passage of water.

Section 5.2.3 Manufactured Homes

b) Manufactured homes to be placed or substantially improved on sites in an existing manufactured home park located in and A or B Zone on the community's FIRM that are not subject to the above manufactured home provisions shall be elevated so that:

i) The lowest floor of the manufactured home is elevated *two feet above the base flood elevation*, and the chassis is securely anchored to an adequately designed foundation system to resist flotation, collapse, and lateral movement.

Section 5.0 Provisions for Flood Hazard Reduction

5.1 General Standards: In areas of special flood hazards, the following standards are required:

5.1.1 Anchoring is required for all substantial improvements, and new and replacement dwellings in the regulatory floodplain or in the *500-year floodplain*, as follows:

a) All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

b) All manufactured homes must likewise 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 ties to ground anchors (Reference FEMA's "Manufactured Home Installation in Flood Hazard Areas" guidebook for additional techniques).

Section 5.3 Floodways

5.3.1 No new or replacement structures or substantial improvements are allowed within thirty-five feet of the floodway, as established in Article 12 of the Talent Zoning Ordinance.

Implementation of Talent's Flood Damage Prevention Ordinance

Currently, the moratorium on new construction in Talent due to water supply constraints has prevented implementation of new standards, except in the case of replacement manufactured homes in parks. The basic "on-the-ground" implementation procedure is simple. Developers must apply for a floodplain development permit. If the permit request is for development that meets or exceeds the city's standards as set forth in this ordinance, and complies with any other relevant regulation, the development will be approved. Talent also has made use of the Hazard Mitigation Grant Program to obtain the funding that allows them to implement their stormwater master plan and design standards. This small community has been able to utilize many resources in order to achieve great results in floodplain management.

5.3 Summary: Lessons from Oregon Communities Addressing Flood Hazards

- ❒ *Umatilla County's* flood mitigation plan reflects lessons the community learned that can benefit other jurisdictions including the following:
  - A shift from the community's reliance on structural flood controls to non-structural mitigation measures (updated local ordinances, elevations of existing structures).
  - A partnership between local emergency managers and planning department staff. Close coordination is the key to ensuring successful flood risk reduction.
- ❒ *Talent* offers an example of how a small town with minimal resources can be extremely effective in planning for flood hazards. Talent's flood ordinance exemplifies how a community can exceed regulatory standards to better protect itself from a flood disaster.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Your comprehensive plan should be coordinated with and reflect comprehensive plans and implementing measures of other communities within your region. Natural hazards do not respect community boundaries making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plan, your community should ask the following questions in developing plan policies for flood hazards:

- ❒ What plan policies should be added or amended to assist your community in addressing flood hazards?
- ❒ Are there communities that face similar flood threats that have developed ordinances or non-regulatory programs that could be adopted by your community?
- ❒ Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park and transportation districts)?

Section 6:
Where can Your Community Find Resources to Plan for Flood Hazards?

This section is a resource directory including contacts, programs, documents and Internet resources available to communities as they plan for flood hazards.

6.1 State Agency Resources

Department of Land Conservation and Development (DLCD)

DLCD administers the State's Land Use Planning Program. The program is based on 19 Statewide Planning Goals, including Goal 7, related to natural hazards. DLCD also serves as Oregon's federally designated agency to coordinate floodplain management in Oregon. DLCD maintains contact with flood prone communities throughout the state in order to help them meet the requirements of the NFIP and to ensure that they are prepared in case of flood. DLCD offers information on the NFIP, CRS and other FEMA - related programs. They also offer training courses on various flood mitigation programs.

Contact: Department of Land Conservation and Development
Address: 635 Capitol St. NE, Suite 200, Salem, OR 97301-2540
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us

Oregon Floodplain Coordinator: (503) 373-0050 ext. 255

Sidebar

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Oregon State Police (OSP)-Office of Emergency Management (OEM)

OEM administers FEMA's Hazard Mitigation Grant Program, which provides monies for acquisition, elevation, relocation, and demolition of structures located in the floodplain. OEM also administers FEMA's Flood Mitigation Assistance Program. This program provides assistance for NFIP insured structures only. OEM also helps local jurisdictions to develop local hazard mitigation plans. OEM is heavily involved in flood damage assessment and works mainly with disaster recovery and hazard mitigation programs. OEM provides training for local governments through workshops on recovery and mitigation. OEM also helps implement and manage federal disaster recovery programs.

Contact: Office of Emergency Management
Address: 595 Cottage Street NE,
Salem, OR 97310
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://www.osp.state.or.us/oem/

OEM Hazard Mitigation Officer: (503) 378-2911 ext. 247

Recovery and Mitigation Specialist: (503) 378-2911 ext. 240

Division of State Lands (DSL)

DSL is a regulatory agency, responsible for administration of Oregon's Removal-Fill Law. This law is intended to protect, conserve and allow the best use of the state's water resources. It generally requires a permit from DSL to remove, fill or alter more than 50 cubic yards of material within the bed or banks of waters of the state. Exceptions are in State Scenic Waterways and areas designated essential salmon habitat, where a permit is required for all instream activity, regardless of size. These permits may be issued jointly by DSL and the U.S. Army Corps of Engineers. Contact the DSL with specific questions regarding this permit process.

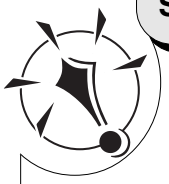
Contact: Division of State Lands
Address: 775 Summer Street NE, Suite 100,
Salem, OR 97301-1279
Phone: (503) 378-3805
Fax: (503) 378-4844
Website: http://statelands.dsl.state.or.us/

Assistant Director: (503) 378-3805, ext. 279

Eastern Region Manager: (541) 388-6033

Western Region Manager: (503) 378-3805, ext. 244

Sidebar



Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[77]

Benton, Deschutes, and Tillamook Counties, and Multnomah County with the City of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the Oregon State Police - Office of Emergency Management in Salem.[78] For more information about Project Impact visit **http://www.fema.gov**

Oregon Watershed Enhancement Board (OWEB)

OWEB is a potential funding source for communities wanting to do flood mitigation projects and other watershed activities/improvements. The mission of the Oregon Watershed Enhancement Board is to promote and implement programs to restore, maintain and enhance watersheds in the State of Oregon in order to protect the economic and social well being of the state and its citizens. Contact OWEB directly for more information on its grant programs.

Contact: Oregon Watershed Enhancement Board
Address: 255 Capitol St. NE, Salem, Oregon 97310
Phone: (503) 378-3589
Fax: (503) 378-3225
Website: http://www.4sos.org/group/gweb.html

Program Manager: ext. 831

Program Representative: ext. 825

Program Representative: ext. 826

State Division of Building Codes, Department of Consumer and Business Services

The Oregon Building Codes Division (BCD) adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. To find out more information about codes that affect development in floodplains contact BCD or your local building department.

Contact: Building Codes Division
Address: 1535 Edgewater Street NW, P.O. Box 14470, Salem, OR 97309-0404
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/bcd/

Oregon Department of Environmental Quality

The Department of Environmental Quality (DEQ) is responsible for protecting and maintaining Oregon's environmental quality, predominately through programs delegated by the U.S. Environmental Protection Agency (USEPA) to the state. Of particular interest to local government for floodplain management purposes are regulations recently issued by USEPA and administered by DEQ for urban stormwater management. In addition to meeting water quality goals, proper stormwater management can help local governments address flood hazards. DEQ also may assist communities in watershed restoration efforts and other activities beneficial to floodplain management. Information on regional office location can be obtained through DEQ's Portland Office.

Contact: Water Quality Division
Address: 811 SW 6th Ave., Portland, OR 97204-1390
Phone: (503) 229-5279
Fax: (503) 229-6993
Website: http://www.deq.state.or.us

State of Oregon Water Resources Department (WRD)

WRD manages the state's Dam Safety Program. Dam failures, though uncommon, can result in catastrophic flooding. WRD can provide technical assistance to local governments on issues of dam safety.

Address: 1158 12th St. NE, Salem, OR 97301-4172
Phone: (503) 378-8455
Fax: (503) 378-2496
Website: http://www.wrd.state.or.us

Oregon Department of Fish and Wildlife (ODFW)

ODFW can provide assistance to local governments in evaluating the effects of floodplain and floodway development on fish and wildlife species and habitat. In particular, your community should contact area Fish and Wildlife staff to help review floodway development permits. To obtain information on area office location, use the following contact information.

Address: 2501 SW First Ave., Portland, OR 97207
Phone: (503) 872-5268
Website: http://www.dfw.state.or.us

6.2 Federal Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA provides maps of flood hazard areas, various publications related to flood mitigation, funding for flood mitigation projects, technical assistance, and also operates the National Flood Insurance Program. FEMA's mission is "to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery". FEMA Region X serves the northwestern states of Alaska, Idaho, Oregon and Washington.

Contact: FEMA, Federal Regional Center, Region 10
Address: 130-228th St. SW, Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: http://www.fema.gov

To obtain FEMA publications, Phone: (800) 480-2520

To obtain FEMA maps,
Contact: Map Service Center
Address: P.O. Box 1038, Jessup, Maryland 20794-1038
Phone: (800) 358-9616
Fax: (800) 358-9620

Army Corps of Engineers

The Army Corps of Engineers administers a permit program to ensure that the nation's waters are used in the public interest. Any person, firm, or agency planning to work in waters of the United States must first obtain a permit from the Army Corps of Engineers. In Oregon, joint permits may be issued with the Division of State Lands. The Corps is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. For more specific information on this permitting program and how it affects your community contact the Portland district office.

Contact: U.S. Army Corps of Engineers-Portland District, Floodplain Information Branch
Address: P.O. Box 2946, Portland, OR 97208-2946
Phone: (503) 808-4874
Fax: (503) 808-4875
Website: http://www.nwp.usace.army.mil/

National Weather Service

National Oceanic and Atmospheric Administration, U.S. Department of Commerce

The National Weather Service mission is to provide weather and flood watches and warnings, and public forecasts and advisories primarily for the protection of life and property. The Weather Service collects, interprets and disseminates up-to-date hydrologic data including information of the magnitude and frequency of past and expected water flows. The Weather Service website provides current forecasts and warnings as well as a link to the Emergency Managers Weather Information Network. Oregon has three weather service stations: Portland, Pendleton, and Medford. The Boise station serves southeastern Oregon.

Contact: National Weather Service - Portland
5241 NE 122nd Avenue
Portland, OR 97230
(503)326-2340
Website: http://www.nws.noaa.gov

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Natural Resource Conservation Service (NRCS)

NRCS operates many programs dealing with the protection of floodplain resources. The two most closely related to flooding are the Watershed Surveys and Planning Program and the Flood Risk Reduction Program, administered through the Farm Service Agency. NRCS also provides technical assistance to property owners, including methods to reduce streambank erosion. NRCS is a federal agency whose mission is to "provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment."

Contact: Natural Resource Conservation Service, Oregon State Branch
Address: 101 S.W. Main Street, Suite 1300, Portland, OR 97204-3221
Phone: (503) 414-3200
Fax: (503) 414-3103
Website: http://www.or.nrcs.usda.gov/Welcome.html

United States Geological Survey (USGS)

The USGS provides hydrologic forecasts including flood warnings, watches, forecasts, and related information for regions of the Pacific Northwest. They provide flood risk maps showing flood potential, watches, and warnings in Oregon and nationwide. On their website they provide current streamflow conditions at USGS gauging stations in Oregon and throughout the Pacific Northwest, for up-to-the-minute information on water levels. The Oregon USGS office is responsible for water-resources investigations for Oregon and part of southern Washington. Their office cooperates with more than forty local, state, and federal agencies in Oregon. Cooperative activities include water-resources data collection and interpretive water-availability and water-quality studies.

Contact: USGS Oregon District Office
Address: 10615 S.E. Cherry Blossom Dr., Portland, OR 97216
Phone: (503) 251-3200
Fax: (503) 251-3470
Website: http://www.usgs.gov

6.3 Recommended Flood Publications

The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should have in its resource library. Secondary documents are those that provide useful information to communities, but that may not be as easy to access. Technical documents are those that focus on a specialized aspect of flood hazard mitigation, and may require interpretation by a scientist or engineer.

Primary Resources

These documents represent the principal resources communities can use to better plan for flood hazards. They are key tools for reducing the risks associated with flood prone areas.

NFIP Community Rating System Coordinator's Manual. FEMA/NFIP. Indianapolis, IN: FEMA

This informative brochure explains how the Community Rating System works and what the benefits are to communities. It explains in detail the CRS point system, and what activities communities can do in order to earn points. These points then add up to the "rating" for the community, and flood insurance premium discounts are calculated based upon that "rating". The brochure also provides a table on the percent discount realized for each rating (1-10). Instructions on how to apply to be a CRS community are also included.

To obtain this resource: visit **http://www.fema.gov**, call 1-(800)480-2520, or call the CRS office in Indianapolis at (317) 848-2898.

Floodplain Management: A Local Floodplain Administrator's Guide to the NFIP. FEMA-Region 10. Bothell, WA: FEMA

This document discusses floodplain processes and terminology. It contains floodplain management and mitigation strategies, as well as information on the NFIP, CRS, CAVs and floodplain development standards.

To obtain this resource: call FEMA at (800)480-2520.

Flood Hazard Mitigation Planning: A Community Guide. Massachusetts Department of Environmental Management. (June 1997)

This informative guide offers a ten-step process for successful flood hazard mitigation. Steps include: map hazards, determine potential damage areas, take an inventory of facilities in the flood zone, determine what is or is not being done about flooding, identify gaps in protection, brainstorm alternatives and actions, determine feasible actions, coordinate with others who are doing this, prioritize actions, develop strategies for implementation, and adopt and monitor the plan.

To obtain this resource: You may download an electronic version at **http://www.magnet.state.ma.us/dem/programs/mitigate/guide.htm**. For a hard copy of this guidebook contact the Massachusetts Flood Hazard Management Program (FHMP) at (617) 626-1250.

Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials. FEMA-116. (Feb 1987)

This guidebook offers a table on actions that communities can take to reduce flood losses. It also offers a table with sources for floodplain mapping assistance for the various types of flooding hazards. There is information on various types of flood hazards with regard to existing mitigation efforts and options for action (policy and programs, mapping, regulatory, non-regulatory). Types of flooding which are covered include alluvial fan, areas behind levees, areas below unsafe dams, coastal flooding, flash floods, fluctuating lake level floods, ground failure-triggered by earthquakes areas, ice jam flooding and mudslides.

To obtain this document: call FEMA at 1-800-480-2520.

Oregon Model Flood Damage Prevention Ordinance. FEMA/DLCD. (Jan 1999)

This is an example of how to write an ordinance that complies with NFIP/ FEMA standards. Communities can simply adopt this ordinance, word for word, filling in the blanks specific to their community or jurisdiction.

To obtain this resource: A copy of this ordinance is on the DLCD's website: **www.lcd.state.or.us** or contact the Oregon DLCD for more information, (503) 373-0050.

Secondary Resources

These documents provide additional information and tools for reducing the risks associated with flood prone areas.

Answers to Questions About Substantially Damaged Buildings. FEMA-213. (May 1991)

Answers to Questions About the National Flood Insurance Program. FIA-2. (March 1992)

Community Flood Mitigation Planning Guidebook. Wisconsin Department of Natural Resources. (Nov 1995)

Tip Box

The Oregon Floodplain Coordinator has:

- FEMA elevation certificates and other forms
- Technical assistance and public outreach materials
- Data on the number of insurance policies in your community
- Oregon's model floodplain development ordinance and examples of other regulatory language

Cities Under Water. Raymond J. Burby. (1988) University of Colorado Institute of Behavioral Science.

Floodplain Management in Northern Illinois. Illinois Department of Natural Resources. (December 1996)

Homeowners Guide to Retrofitting. FEMA-312. (1998)

How to Use a Flood Map to Protect Your Property. FEMA-258. (May 1995)

Manufactured Home Installation in Flood Hazard Areas. FEMA-85 (September 1985).

Technical Resources

The documents listed here focus on the technical aspects of flood hazard mitigation. They may require interpretation by a technical specialist.

Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings. (1995)

Managing Floodplain Development in Approximate Zone A Areas- A Guide for Obtaining and Developing Base (100-year) Flood Elevations. FEMA-265. (July 1995)

6.4 Internet Resources

The National Flood Insurance Program

http://www.fema.gov/nfip

The National Flood Insurance Program (NFIP) Web site is a subsection of the Federal Emergency Management Agency (FEMA) site (**http://www.fema.gov**). The NFIP information is intended for both the general public and the many organizations and agencies participating in the program. It includes much information about the NFIP and other flood disaster assistance available from the federal government. It also provides access to the newly revised NFIP booklet: Answers to Questions about the National Flood Insurance Program.

The Association of State Floodplain Managers

http://www.floods.org

The Association of State Floodplain Managers (ASFPM) is an organization of professionals involved in floodplain management, flood hazard mitigation, the National Flood Insurance Program, and flood preparedness, warning, and recovery. ASFPM fosters communication among those responsible for flood hazard activities, provides technical advice to governments and other entities about proposed actions or policies that will affect flood hazards, and encourages flood hazard research, education, and training. The ASFPM web site includes information on how to become a member, the organization's constitution and bylaws, directories of officers and committees, a publications list, information on upcoming conferences, a history of the association, and other useful information and Internet links.

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USGS Water Resources

http://water.usgs.gov

http://water.usgs.gov/public/realtime.html

This page offers current U.S. water news; extensive current (including real-time) and historical water data; numerous fact sheets and other publications; various technical resources; descriptions of ongoing survey water programs; local water information; and connections to other sources of water information.

Office of Hydrology, National Weather Service

http://www.nws.noaa.gov/oh

http://www.nws.noaa.gov/oh/hic/

The National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer information on floods and other aquatic disasters. This site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, and an Automated Local Flood Warning Systems Handbook, Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding.

The Floodplain Management Association

http://www.floodplain.org

The Floodplain Management Web site was established by the Floodplain Management Association (FMA) to serve the entire floodplain management community. It includes full-text articles, a calendar of upcoming events, a list of positions available, an index of publications available free or at nominal cost, a list of associations, a list of firms and consultants in floodplain management, an index of newsletters dealing with flood issues (with hypertext links if available), a section on the basics of floodplain management, a list of frequently asked questions (FAQs) about the Web site, and, of course, a copious catalog of Web links.

Northwest Regional Floodplain Managers Association (NORFMA)

http://www.norfma.org/

This site is a resource for floodplains, fisheries and river engineering information for the Northwest. This site provides technical information, articles and Internet links in the field of floodplain and fisheries management.

FEMA's List of Flood Related Web Sites

http://www.fema.gov/nfip/related.htm

This site contains a long list of flood related Internet sites from "American Heritage Rivers" to "The Weather Channel," and is a good starting point for flood information on the Internet.

HazLit Database (Univeristy of Colorado, Boulder)

http://www.colorado.edu/hazards/litbase/hazlit.htm

The Natural Hazards Research and Applications Information Center at the University of Colorado, Boulder provides this library, which houses one of the most extensive collections of social science hazards literature in the world. This non-lending library is an important resource for practitioners who need information on different aspects of hazards and disasters. The collection includes approximately 22,000 catalogued items, including books, serials, reports, journal articles, videotapes, and compact discs. The database is comprehensive and is an excellent resource for communities looking for information on hazards.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce flood risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical information and assistance provided by agencies to assist your community in planning for flood hazards?
- ❒ What documents or technical assistance does your community need to find to further understanding of flood hazards and begin the process of assessing community risk from flood hazards?

Flood Endnotes:

[1] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[2] Oregon Cascades West Council of Governments. (Nov 1996) Cascade West Region of Oregon and the February Flood of 1996.

[3] (ibid.)

[4] (ibid.)

[5] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[6] (ibid.)

[7] (ibid.)

[8] (ibid.)

[9] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[10] Multi Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy. Federal Emergency Management Agency. (1997)

[11] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[12] Murray, Joseph. Personal Interview. Feb 9,2000.

[13] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[14] Federal Emergency Management Agency Virtual Library, Backgrounder: Floods and Flash Floods, http://www.fema.gov/library/flood.htm (March 2000)

[15] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[16] (1987) Federal Emergency Management Agency. Reducing Losses in High Risk Flood Hazard Areas- A Guidebook for Local Officials.

[17] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[18] (ibid.)

[19] Murray, Joseph. Personal Interview. Feb 9,2000

[20] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[21] (ibid.)

[22] (ibid.)

[23] (ibid.)

[24] (ibid.)

[25] Federal Emergency Management Agency, Region 10. Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program. (no date on document)

[26] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[27] Code of Federal Regulations. 44CFR59.1

[28] Federal Emergency Management Agency, Region 10. Floodplain Management: a Local Administrator's Guide to the National Flood Insurance Program. (no date on document)

[29] Kincaid, Nancy. Personal Interview. 27 April 2000

[30] Beier, Ann. Personal Interview. 27 April 2000.

[31] (ibid.)

[32] Oregon Cascades West Council of Governments. (Nov 1996) Cascade West Region of Oregon and the February Flood of 1996.

[33] The 100 Year Flood Myth. FEMA , Region 10. Date Unknown.

[34] Last Update: 24 April 2000. <http://www.fema.gov/nfip/readmap.htm> (10 May 2000)

[35] Multi Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy. Federal Emergency Management Agency. (1997)

[36] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[37] (ibid.)

[38] Beier, Ann. Personal Interview. 23 May 2000

[39] Last update 24 April 2000. <http://www.fema.gov/nfip/readmap.htm> (10 May 2000)

[40] Oregon's Statewide Land-Use Planning Goals and Guidelines. (1995) Oregon Department of Land Conservation and Development.

[41] (ibid.)

[42] Oregon Removal-Fill Permit Program Brochure. Division of State Lands.

[43] Beier, Ann. Personal Interview. 23 May 2000

[44] Collins, Peggy, Personal Interview. 10 May 2000

[45] Federal Emergency Management Agency National Flood Insurance Program (NFIP), http://www.fema.gov/nfip (March 2000)

[46] (ibid.)

[47] (ibid.)

[48] (ibid.)

[49] Beier, Ann. Personal Interview. 15 May 2000.

[50] Army Corps of Engineers Regulatory Permit Program Brochure. (1989) United States Army Corps of Engineers.

[51] Beier, Ann. Personal Interview. 23 May 2000

[52] Fancey Mark. Personal Interview. 27 April 2000

[53] Tools and Techniques for Land-use Planning- DRAFT. (1998) Brower, David. State of North Carolina.

[54] (ibid.)

[55] (ibid.)

[56] (ibid.)

[57] Fancey Mark. Personal Interview. 27 April 2000

[58] Land-Use Planning in Oregon. Rohse, Mitch, (1987) Oregon State University Press.

[59] (ibid.)

[60] (ibid.)

[61] Washington State Statutes, Chapter 86.16, “Floodplain Management”, section 86.16.041.

[62] Beier, Ann. Personal Interview. 23 May 2000

[63] Governor’s Watershed Enhancement Board. <www.4sos.org/group/gweb.html>

[64] Tools and Techniques for Land-use Planning-DRAFT. (1998) Brower, David State of North Carolina.

[65] Kincaid, Nancy. Personal Interview.

[66] Beier, Ann. Personal Interview. 4 Feb 2000.

[67] Kincaid, Nancy. Personal Interview. 27 April 2000.

[68] Tools and Techniques for Land-use Planning. Brower, David State of North Carolina.

[69] Kincaid, Nancy; Beier, Ann; & Fancey, Mark. Personal Interview. 27 April 00

[70] Tools and Techniques for Land-use Planning. Brower, David State of North Carolina.

[71] (ibid.)

[72] Federal Emergency Management Agency Hazard Mitigation Grant Program, http://www.fema.gov/mit/grant.htm> (March 2000)

[73] Federal Emergency Management Agency Flood Mitigation Assistance Program, http://www.fema.gov/mit/fldmitast.htm#fludmit (March 2000)

[74] National Resources Conservation Service (NRCS) http://www.or.nrcs.usda.gov (May 2000)

[75] Governor’s Watershed Enhancement Board. http://www.4sos.org/group/gweb.html (March 2000)

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[78] Murray, Joseph. Personal Interview. 9 Feb 2000.

PLANNING FOR NATURAL HAZARDS:
Landslide TRG

July 2000

Oregon Department of Land Conservation & Development
635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

Community Planning Workshop
Community Service Center
1209 University of Oregon
Eugene, OR 97403
541-346-3889

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Section 1:
Introduction to the Landslide Technical Resource Guide

Landslides pose a significant threat to many communities in Oregon and create challenges to development in steep terrain, coastal regions and other landslide-prone areas. The purpose of this guide is to help planners, local decision-makers, and community leaders reduce risk to life and property from landslides. The guide is designed to help your local government address landslide hazard issues through effective comprehensive plan inventories, policies and implementing measures.

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1.1 The Threat of Landslide Hazards to Oregon Communities

Landslides are a serious geologic hazard in almost every state in America. Nationally, landslides cause in excess of $1 billion in damages and 25 to 50 deaths each year.[1] Landslides threaten transportation corridors, fuel and energy conduits, and communication facilities.[2] In Oregon, a significant number of locations are at risk to dangerous landslides. While not all landslides result in property damage, many landslides impact roads and other infrastructure, and can pose a serious life-safety hazard. A rapidly moving landslide in Douglas County, for example, killed five people during the storms of 1996.

Growing population and the resultant increased demand for home ownership has caused development to occur more frequently in hazard areas. Landslide-prone areas are easily identified; they often exist in highly desirable locations, such as beachfront or hillside property. In planning for development, landowners and developers alike should be aware of the implications of siting and building homes and other structures and uses in landslide areas. The number of potential injuries and deaths is directly related to exposure — the more people in areas of known risk, the greater the risk of injury or death. Policies that regulate development in areas of identified risk are essential to reduce risk from landslide hazards. By regulating development in areas of known risk, communities can better protect life and property.

Sidebar

Organization of the Natural Hazards Technical Resource Guide

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goals 2, 7, 17 and 18, a resource directory and land use tools matrix for hazard mitigation.

1.2 How to Use the Landslide Technical Resource Guide:

The Landslide Technical Resource Guide provides information to help communities in Oregon plan for landslide hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about landslide hazards.

Section 2:
Is Your Community Threatened by Landslide Hazards?

Section 2 presents an overview of the causes and characteristics of landslides, and provides information to assist communities in landslide hazard identification.

Section 3:
What are the Laws in Oregon for Landslide Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for landslide hazards.

Section 4:
How can Your Community Reduce Risk from Landslide Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from landslide hazards.

Section 5:
How are Oregon Communities Addressing Landslide Hazards?

Section 5 examines how several communities are implementing programs to reduce risk from landslide hazards. These examples illustrate plan policies and implementing measures for landslides.

Section 6:
Where can Your Community find Resources to Plan for Landslide Hazards?

Section 6 is a resource directory listing contacts, programs, and documents that planners, local governments and citizens can use to get more information on landslide hazards.

Section 2:
Is Your Community Threatened by Landslide Hazards?

Landslide hazards can cause severe property damage and loss of life. Identifying hazard areas is a key step in developing effective plan policies and implementing measures. This section assists local planners and decision-makers in understanding how landslides may affect future and current development. An overview of the causes and characteristics of landslides is included, along with information on identifying landslide hazards in your community.

2.1 What is a Landslide Hazard?

Landslides are relatively common, naturally occurring events in some parts of Oregon. Landslides include any detached mass of soil, rock, or debris that moves down a slope or a stream channel.[3] Landslides are classified according to the type and rate of movement and the type of materials that are transported.[4] Landslides occur when earth materials fall, slide, or flow down a slope. Two types of forces are at work: (1) driving forces combine to cause a slope to move, and (2) friction forces and strength of materials act to stabilize the slope. When driving forces exceed resisting forces, landslides occur.[5]

2.2 Where do Landslides Occur?

Landslides occur as "on-site" hazards and "off-site" hazards, and should be distinguished to effectively plan for future hazard situations. Decision-makers who are familiar with "on-site" landslides often may not be aware of the effects that "off-site" hazards can have on homes and communities.

- "On-site" hazards occur on or near the development site and are typically the slower moving landslides that cause most of the property damage in urban areas. Most existing landslide hazard maps deal with "on-site" hazards. On-site landslide hazards include features called slumps, earthflows and block slides.[6]

- "Off-site" landslide hazards typically begin on steep slopes at a distance from homes or developments, and are often rapidly moving. Recent events highlight the importance of "off-site" landslide hazards. In 1996, "off-site" landslides in Douglas County began a long distance away from homes and roads, traveled at high velocity, killed five Oregonians and injured many others.[7]

Tip Box

Hazard Inventories

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

Tip Box

Steep Slope Ordinances

Many communities in Oregon address landslide hazards through ordinances regulating development on steep slopes and in steep ravines. Section 5 of this guide presents examples of several communities addressing steep slopes in their ordinances, including techniques to help calculate the percentage slope and degree of the hazard.

2.3 What are the Different Types of Landslides?

Landslides are classified by causal factors and conditions, and include falls, slides and flows, which are described below. A combination of characteristics can also contribute to an increased risk of landslide hazards.

2.3.1 Falls

Falls move through the air and land at the base of a slope. In falls, material is detached from a steep slope or cliff and descends through the air by free fall or by bouncing or rolling downslope. Rockfall, the most common type, is a fall of detached rock from an area of intact bedrock. Rockfalls are common along Oregon highways where the roads are cut through bedrock.

2.3.2 Slides

Slides move in contact with the underlying surface. Slides include rockslides – the downslope movement of a rock mass along a plane surface; and slumps – the sliding of material along a curved (rotational slide) or flat (translational slide) surface. Slow-moving landslides can occur on relatively gentle slopes, and can cause significant property damage, but are far less likely to result in serious injuries. Two examples of slow moving landslides are the subdivision landslide in Kelso, Washington and the slide occurrence in 1998 at The Capes development in Tillamook County.[8]

2.3.3 Flows

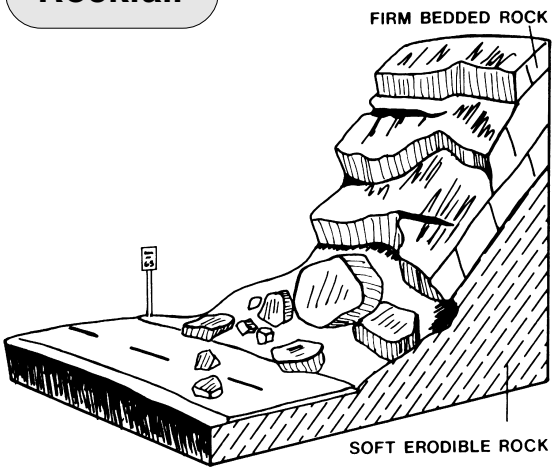
Flows are plastic or liquid movements in which mass (e.g., soil and rock) breaks up and flows during movement. Debris flows normally occur when a landslide moves downslope as a semi-fluid mass scouring, or partially scouring soils from the slope along its path. Flows are typically rapidly moving and also tend to increase in volume as they scour out the channel.[9]

Landslide Key

Section 6 of this guide provides references to documents that provide more detailed information on the nature and types of landslide hazards.

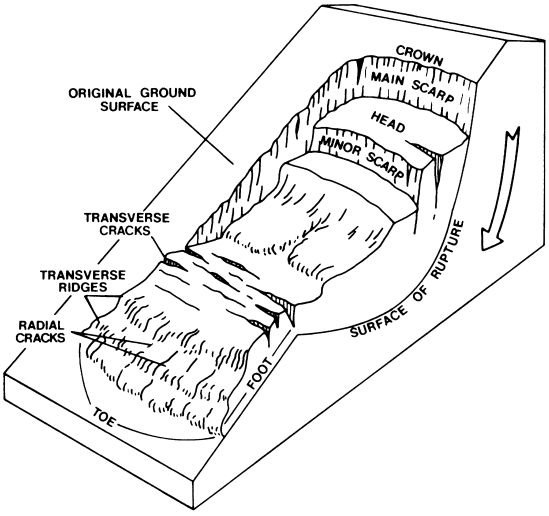
Types of Landslides: Earthflow, Rockfall, Rotational Landslide

Rockfall



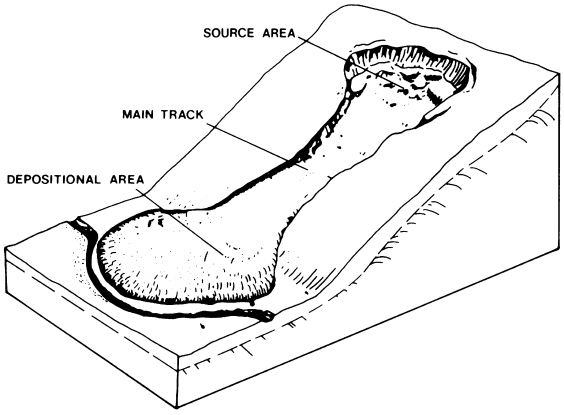
Source: *Federal Emergency Management Agency. FEMA 182, Landslide Loss Reduction. FEMA (1989) p. 11.*

Rotational Landslide



Source: *Federal Emergency Management Agency. FEMA 182, Landslide Loss Reduction. FEMA (1989) p. 12.*

Earthflow



Source: *Federal Emergency Management Agency. FEMA 182, Landslide Loss Reduction. FEMA (1989) p. 15.*

Debris Flows in Oregon

Debris flows (also referred to as mudslides, mudflows, or debris avalanches) are a common type of rapidly moving landslide that generally occur during intense rainfall on previously saturated soil. *"Rapidly moving landslide" is the term used in Senate Bill 12 (1999 ORS section 195.250), Oregon's statewide policy applied to rapidly moving landslides.*

Debris flows commonly start on steep hillslopes as soil slumps or slides that liquefy, accelerate to speeds as great as 35 mph or more, and flow down hillslopes and channels onto gently sloping ground. Their consistency ranges from watery mud to thick, rocky, mud-like, wet cement — dense enough to carry boulders, trees and cars. Debris flows from different sources can combine in canyons and channels, where their destructive power can be greatly increased.[10]

The debris flows occurring during the 1996 Oregon storm events included mud, water, logs, and boulders up to 20 feet in diameter that traveled significant distances. Debris flows are difficult for persons to outrun or escape, and they present the greatest risk to human life. Debris flows have caused most of the landslide-related property damage in rural areas, and have caused most of the recent landslide-related injuries and deaths in Oregon.[11]

Based on Oregon Department of Forestry's (ODF) Storm Impacts Study,[12] the highest debris flow hazard occurs in steeply sloped areas in the Tyee geologic formation (or similar sedimentary rocks) in western Douglas County, Coos County, and western Lane County. The debris flow hazard is also high in much of eastern Tillamook County and the Columbia Gorge.

Most slopes steeper than 70 percent are at risk from debris flows.[13] While these types of debris flow hazards are usually not in located in developed areas, homes that lie in the path of the debris flow are at risk, even those on gentle slopes or those located a significant distance from the initiation point. Landslides can move long distances, sometimes as much as several miles. The Dodson debris flows in 1996 started high on Columbia Gorge cliffs, and traveled far down steep canyons to form debris fans at Dodson.[14] Slope alterations can also greatly affect the number of times channelized debris flows occur, and cause landslides in areas otherwise not susceptible to landslides.

Slide in the Portland Metro Area from the 1996-1997 Landslide Events

Photo: *Federal Emergency Management Agency*

Very large, high-velocity landslides are rare, though there is evidence that the Bonneville landslide was a rapidly moving landslide about 300 years ago. This landslide covered an area of several square miles, apparently damming the Columbia River and creating the "Bridge of the Gods" near Cascade Locks, Oregon.[15]

2.4 What are the Conditions that Affect Landslides?

Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are most susceptible to landslides. The landslides occurring on steep slopes tend to move rapidly and are therefore more dangerous than other landslides. Although landslides are a natural geologic process, the incidence of landslides and their impacts on people and property can be accelerated by human activities.[16] Developers who are uninformed about geological materials and processes may create conditions that trigger landslide activity or increase susceptibility to landslide hazards.[17] This subsection will describe four conditions affecting landslides: natural conditions, slope alterations, grading and drainage.

2.4.1 Natural Conditions

Natural processes can cause landslides or re-activate historical landslide sites. Rainfall-initiated landslides tend to be smaller, while earthquake-induced landslides may be very large, but less frequent. The removal of supporting material along waterbodies by currents and waves, or undercutting during construction at the base of a slope produces countless small slides each year. Seismic tremors can trigger landslides on slopes historically known to have landslide movement. Earthquakes can also cause additional failure (lateral spreading) that can occur on gentle slopes above steep stream and river banks. Landslides are particularly common along stream banks, reservoir shorelines, large lakes and seacoasts. Concave-shaped slopes with larger drainage areas appear to be more susceptible to landslides than other landforms. Landslides associated with volcanic eruptions can include volumes approaching one cubic mile of material. All soil types can be affected by natural landslide triggering conditions.

2.4.2 Excavation and Grading

Slope excavation is generally needed in order to develop home sites or build roads on sloping terrain. Grading these slopes results in some slopes that are steeper than the pre-existing natural slopes. Since slope steepness is a major factor in landslides, these steeper slopes can be at increased risk for landslides. The added weight of fill placed on slopes can also result in an increased landslide hazard. Small landslides can be fairly common along roads, in either the road cut or the road fill. Road associated landslides are good indicators of the potential impacts of excavation on new construction.

2.4.3 Drainage and Groundwater Alterations

Water flowing through the ground is often the factor that finally triggers many landslides. Any activity that increases the amount of water flowing into landslide-prone slopes can increase landslide hazards. Broken or leaking water or sewer lines can be especially problematic, as can water retention facilities that direct water onto slopes. However, even lawn

Tip Box

Landslides and debris flows are triggered or accelerated by:

- Intense or prolonged rainfall, or rapid snow-melt;
- Undercutting of a slope or cliff by erosion or excavation;
- Seismic activity or shocks and vibrations from construction;
- Concentration of runoff onto slopes;
- Alternate freezing and thawing;
- Improper management of surface and ground water;
- Vegetation removal by fires, timber harvesting, or land clearing;
- Placing fill (weight) on steep slopes; and
- Any combination of these factors.

Tip Box

How is Landslide Severity Determined?[19]

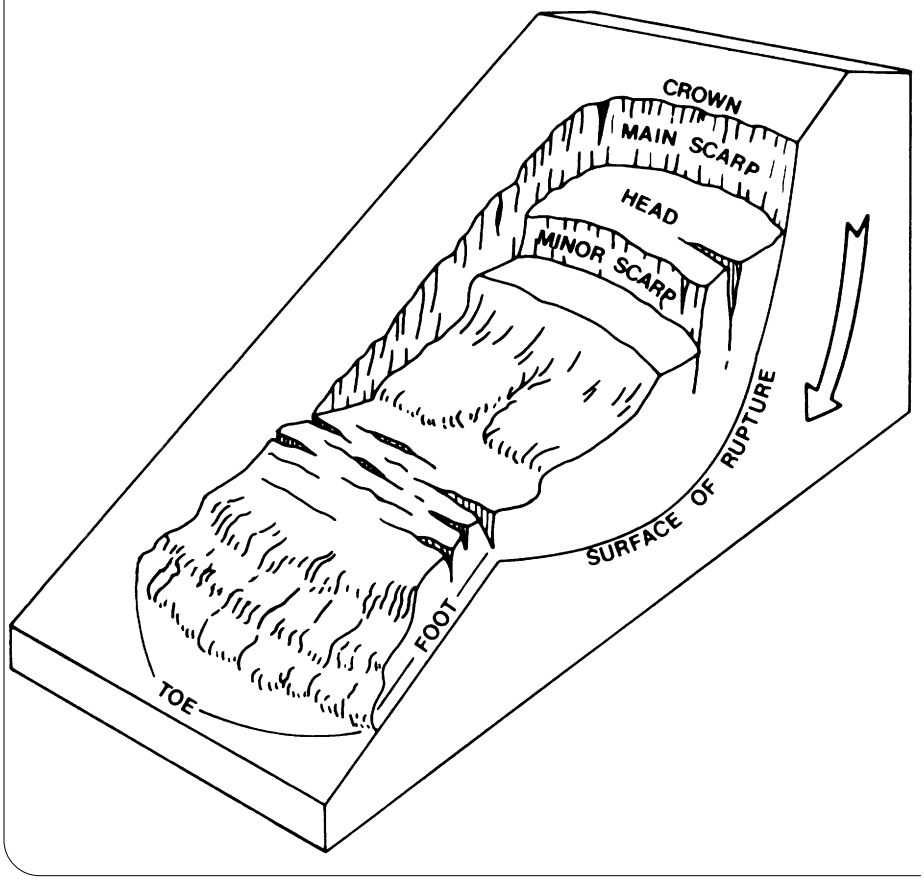
Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

irrigation and minor alterations to small streams in landslide prone locations can result in damaging landslides. Ineffective stormwater management and excess runoff can also cause erosion and increase the risk of landslide hazards. Drainage can be affected naturally by the geology of an area, but development that results in an increase in impervious surface will impair the ability of the land to absorb water.[18]

2.4.4 Changes in Vegetation

Removing vegetation from very steep slopes can increase landslide hazards. A recent study by the Oregon Department of Forestry found that landslide hazards in three out of four steeply sloped areas were highest for a period of 10 years after timber harvesting. Areas that have experienced wildfire and land clearing for development can be expected to have longer periods of increased landslide hazards than after timber harvesting because forest recovery may take a very long time, or may never occur. In addition, woody debris (both natural and logging slash) in stream channels may cause the impacts from debris flows to be more severe.

Rotational Landslide Showing Scarps and Lobe-Shaped Deposits



Source: *Federal Emergency Management Agency. FEMA 182, Landslide Loss Reduction. FEMA (1989) p. 12.*

Landslide Key

Refer to the discussion on evaluating site-specific development in Section 4 for further information on geotechnical reports.

2.5 How do Landslides Affect New and Existing Development?[20]

Landslides are a naturally occurring event and their effect on new and existing development in our communities can be devastating. Three conditions may put people and property at risk of landslide damage:

2.5.1 Creating Steeper Slopes

Excavation practices, sometimes aggravated by drainage, can reduce the stability of otherwise stable slopes. These failures commonly affect one or a few homes. Without these excavation practices, there is little risk of landslides in areas not prone to landslide movement.

2.5.2 Development on or Adjacent to Existing Landslides

Development on or adjacent to existing landslides is generally at risk of future movement regardless of excavation practices. Excavation and drainage practices can further increase risk of landslides, which can be very large. In many cases there are no development practices that can completely assure stability. Homeowners and communities in these situations accept some risk of future landslide movement. Slopes can be very gentle (under 10 percent) on some portions of existing landslides.

2.5.3 Development on Fairly Gentle Slopes

Development on fairly gentle slopes can be subject to landslides that begin a long distance from the development. The sites at greatest risk are against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at grave risk of landslide impacts. The simplest mitigation measure for this situation is to locate the home out of the impact area, or construct debris flow diversions for homes that are at risk.

Landslide Alert and Hillside Drainage Problems

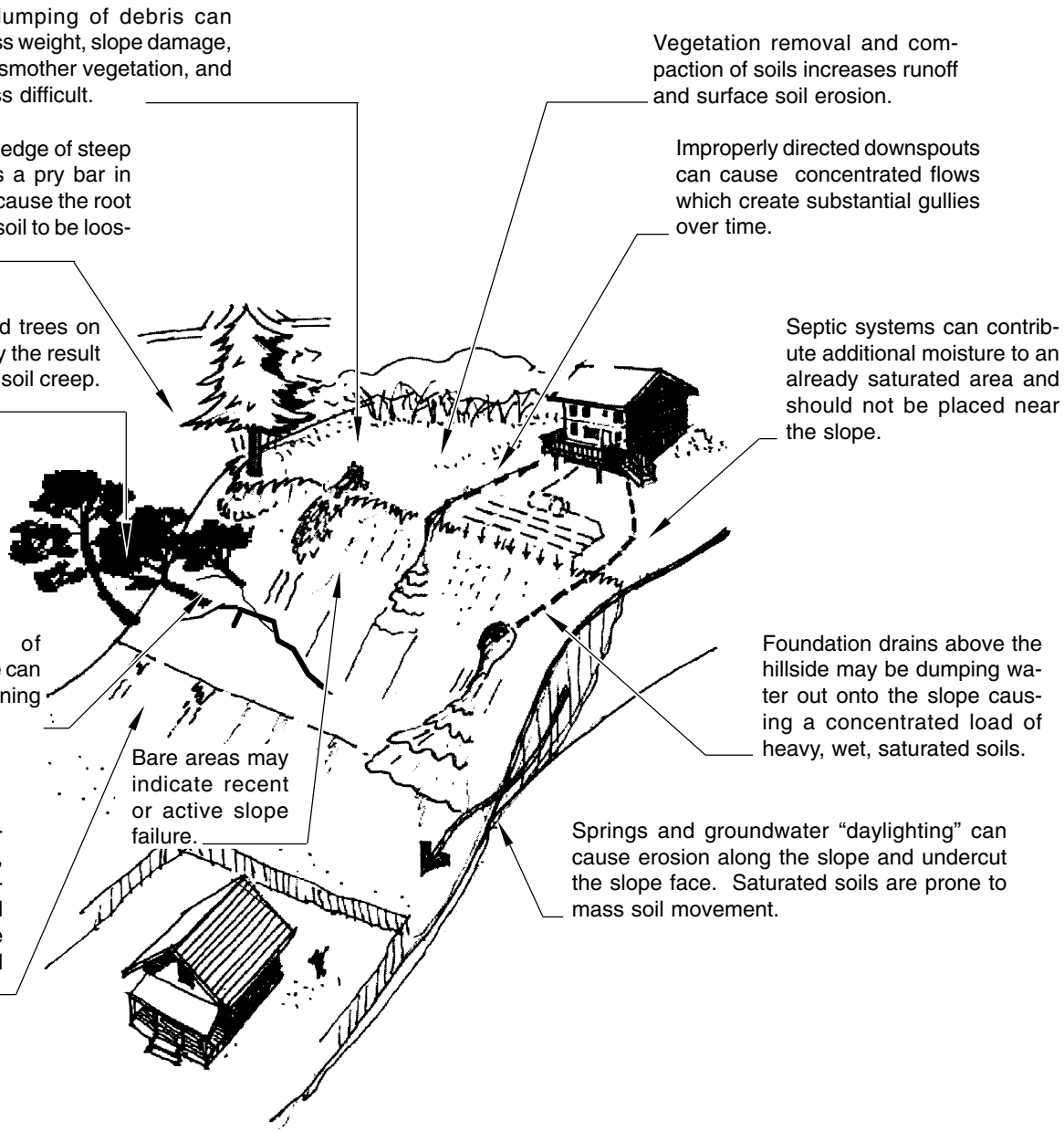
LANDSLIDE ALERT

AND HILLSIDE DRAINAGE PROBLEMS

Many landslides are triggered by improper drainage of water from different sources uphill from the slide. These sources can cause concentrations of extremely heavy saturated soils. When the saturated soils become heavier than the soils surrounding them, they can easily trigger a landslide.

Source: *Federal Emergency Management Agency. Hillside Drainage Flyer. Bothell, Wash.: FEMA Region 10 (2000).*

Seek the assistance of a geotechnical engineer for site specific design or consultation. Before undertaking any construction on your slope, check with your local permitting agency.



Hillside Drainage Flyer 3/12/97 **Federal Emergency Management Agency**

2.6 How can My Community Identify Landslide-Prone Locations?

Communities can identify landslide-prone locations by knowing the geologic and geographic factors of their environment, and through mapping and inventories.

2.6.1 Geologic and Geographic Factors

Geologic and geographic factors are important in identifying landslide-prone locations because of their influence on landslide processes. Stream channels, for example, have major influences on landslides, due to undercutting of slopes by stream erosion and long-term hillside processes.

Deep-seated landslide hazards are high in parts of Josephine and Curry Counties, and are fairly common in certain rock units of the western Cascade Mountains, and in fine-grained sedimentary rock units of the Coast Range. Infrequent, very large landslides and debris flows may occur in any of the larger mountains or in deep gorges in the Cascade, Wallowa, Elkhorn, or Siskiyou mountain ranges.[21]

The Oregon Department of Forestry (ODF) Storm Impacts Study, conducted after the 1996-97 landslide events, found the highest probability for the initiation of shallow, rapidly moving landslides was on slopes of over 70 percent to 80 percent steepness (depending on landform and geology). A moderate hazard of shallow rapid landslide initiation can exist on slopes of between 50 percent and 70 percent.[22]

In general, slopes over 25 percent, or a history of landslides in or very close to your community means there could be some level of landslide hazard within your jurisdiction. The steeper the slopes, or the greater the history of landslides, the more severe the landslide hazard. While some drier areas may not have hazards at slopes of 25 percent or greater, existing landslides at slopes under 15 percent may still be subject to movement. In otherwise gently sloped areas, landslides can occur along steep river and creek banks. At natural slopes of under 30 percent, most landslide hazards are related to excavation and drainage practices, or re-activation of preexisting landslide hazards.[23]

2.6.2 Soil Type

Soil type may, in some cases, be useful in identifying landslide-prone locations. The U.S. Natural Resources Conservation Service (NRCS) produces a number of useful soils map products including paper copy county soils reports and digital State Soil Geographic (STATSGO) and Soil Survey Geographic (SSURGO) databases. STATSGO soil surveys are more generalized statewide digital soils maps and the SSURGO data sets are typically more detailed (1:24,000 scale) and often follow county boundaries. Both STATSGO and SSURGO products can be incorporated into Geographic Information Systems (GIS). NRCS soils maps determine slope very roughly, and do not identify existing landslide hazards. The maps are based on agricultural soil properties and do not reflect underlying geology or engineering properties of the soils.[24]

TRG Key

The first step of hazard assessment is hazard identification, estimating the geographic extent, intensity and occurrence of a hazard. More information on the three levels of hazard assessment can be found in Chapter 2: Elements of a Comprehensive Plan.

Landslide Key

Contact information for the Natural Resources Conservation Service can be found in Section 6.

Landslide Key

Refer to Section 6 of this guide for ODF and DOGAMI contact information.

The STATSGO database is already available for Oregon and the NRCS is expanding the SSURGO coverage. Much of western Oregon has been completed or is within the certification process. Field mapping methods using national standards are used to construct the soil maps in the SSURGO database and they incorporate the most detailed level of soil mapping done by NRCS.[25] To utilize the full capabilities of this system, GIS software and expertise is required. NRCS is also developing a Soil Data Viewer to facilitate use of the technical soil information.[26]

2.6.3 Mapping and Inventories

Mapping of landslide hazards in Oregon began in the early 1970s when the Oregon Department of Geology and Mineral Industries (DOGAMI) mapped existing landslides in much of coastal Oregon. These maps are found in DOGAMI's Environmental Geology Bulletins. Particular types of landslides are mapped in portions of some counties, including most of the Oregon coast. The Oregon Department of Forestry (ODF) produced debris flow maps for Western Oregon that are accessible from the ODF website. DOGAMI began conducting field investigations in 2000 to further refine the ODF debris flow maps and determine "further review areas" to address rapidly moving landslides as required by Senate Bill 12, 1999 Oregon legislature.[29] Local planners and the public can access the Nature of the Northwest Information Center through the DOGAMI Website, or contact DOGAMI directly to find out whether or not landslide maps are available for their community.

Tip Box

Landslide and debris flow-prone locations can include:[28]

- V-shaped valleys, canyon bottoms, and steep stream channels
- Fan-shaped areas of sediment and boulder accumulation at the outlets of canyons
- Areas with large boulders (2 to 20 feet diameter) perched on soil near fans or adjacent to creeks
- Steep hillslopes above a home or lot
- Logjams in stream above a home or lot
- Steepened roadcuts
- Areas that have been extensively disturbed by excavation into steep slopes
- Existing landslides or places of known historic landslides
- Moderately steep slopes that are exposed to high water flow

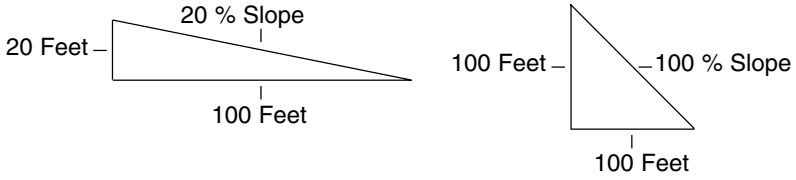
Tip Box

Calculating Percent Slope[27]

Engineers describe slope steepness using percent slope. This number is calculated by taking the vertical distance from the bottom to the top of the slope and dividing that distance by the horizontal distance from the bottom to the top of the slope. The result of this division is the slope. The slope is multiplied by 100 to give the percent slope.

An example would be a slope that rises 20 vertical feet over a horizontal distance (not distance along the slope surface) of 100 feet. The slope would be represented as 20 divided by 100 equals 0.20. Multiplying by 100 gives 20% slope.

A very steep slope that rises 100 vertical feet over 100-foot horizontal distance is 100 divided by 100 equals 1. Multiplying 1.00 by 100 gives a 100% slope, the same as a 45-degree angle slope.



Data collected on landslide occurrences associated with the severe storms of 1996 demonstrate the wide distribution of the landslide hazard, particularly in the western portion of the state. A three-year study by ODF took a close look at landslides that occurred in eight forestland study regions. Within the eight study sites (45.8 square miles total), ODF surveyed over 500 landslides. A study conducted by Portland State University showed that in the Portland metropolitan area, 17 homes were completely destroyed and 64 were badly damaged in over 700 landslides associated with the 1996 storms.

FEMA provided funds to generate a statewide inventory of known landslide occurrences associated with the major storm events of 1996 and 1997. DOGAMI collected evidence of over 9000 landslide and slope failure locations in the state. The study helped to gather and consolidate the available data on landslide occurrences from both public and private sources. The generation of the statewide landslide inventory is intended to provide a means for developing and verifying hazard models as well as to facilitate various efforts aimed at minimizing risk and damage in future storm events. The database includes a digital Geographic Information System (GIS) file with slide locations, a digital database with details on each slide, and an accompanying report. Communities need appropriate software and expertise to make full use of this GIS product. These products are available from DOGAMI by requesting: Database of Slope Failures in Oregon For Three 1996/97 Storm Events. Hofmeister, R.J., (2000) Oregon Department of Geology and Mineral Industries Special Paper. The database can also be accessed on the Internet at **http://sarvis.dogami.state.or.us/landslide/inventory/project.htm#Project.Summary.**

Tip Box

Maps only provide a general indication of a landslide hazard. The ODF Storm Impacts Study found that forest canopy obscures the ability to identify or accurately measure landslide areas, specifically for debris flows, and that coarse-scale digital elevation models underestimate slope steepness, especially in areas with irregular, steep slopes. Ground-based investigation has provided the most reliable information on landslide occurrence and characteristics in the forests of Western Oregon.

Tip Box

Debris flow maps developed by the Oregon Department of Forestry can be accessed on the web at: **http://www.odf.state.or.us/gis/debris.html**, or by contacting ODF. ODF's Debris Flow Geographic Information System maps exist for the following counties: Benton, Clackamas, Columbia, Coos, Curry, Eastern Douglas County, Western Douglas County, Hood River, Jackson, Josephine, Eastern Lane County, Western Lane County, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington and Yamhill.

2.7 Summary: Resources to Help Your Community Identify Landslide Hazards

- *Landslide maps and identification of landslide-prone areas*, including the type, conditions, history and severity of landslide hazards, can help your community strengthen the factual base of your comprehensive plan.
- *Technical assistance*, including mapping, soil surveys, and calculating percent-slope, that can assist in identifying landslide-prone locations. DOGAMI and ODF are the principal state agencies providing technical assistance for identifying landslide-prone locations. Soil surveys provided by the Natural Resources Conservation Service can also provide limited assistance.
- *Local comprehensive plans* should include landslide identification and vulnerability assessment as a part of their inventory. Existing maps and information on historic slides can help you update the natural hazards component of your comprehensive plan.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment will examine identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following questions in determining whether or not its comprehensive plan has adequately inventoried landslide hazards.

- Are there landslide hazards in your community?
- Does your comprehensive plan hazard inventory describe landslides in terms of the geographical extent, the severity and the frequency of occurrence?
- Has your community conducted a community-wide vulnerability assessment?

Section 3:
What are the Laws in Oregon for Landslide Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Landslide Guide presents laws that Oregon communities are required to address.

The state of Oregon passed landslide legislation in response to the property damage and fatalities from the 1996 flood and landslide events. The Debris Avalanche Action Plan, established by an Executive Order issued by Oregon Governor John Kitzhaber, March 4, 1997, was the initial state response.

The Governor's Debris Avalanche Action Plan included specific recommendations for state and local governments to reduce the occurrence of debris flows and reduce the risk to the public when debris flows occur.[30] The Executive Order calls for specific actions to be taken by state agencies, including Oregon Departments of Transportation, Forestry, Land Conservation and Development, Geology and Mineral Industries; Oregon State Police (OSP)-Office of Emergency Management (OEM); Building Codes Division; and the Governor's office. Outcomes from this action plan included development of ODF debris flow maps, brochures, forest practices deferral, the debris flow warning system (see the ODF Website), the 1998 review of Statewide Planning Goal 7, and creation of the Governor's Interagency Hazard Mitigation Team.

TRG Key

Information on Goal 7 can be found in Appendix A of the Natural Hazards Technical Resource Guide.

3.1 Oregon Laws Related to Landslide Hazards

3.1.1 Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning requirement that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states that "Developments subject to damage or that could result in loss of life shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards..."

3.1.2 Senate Bill 12 – Debris Flows

Following the flood and landslide events of 1996, legislation was drafted to reduce risk from future landslide hazards. The legislature passed Senate Bill 1211 in 1997, which dealt with rapidly moving landslide issues around steep forestlands, and not in typical urban or community settings. Senate Bill 1211 granted authority to the State Forester to prohibit forest operations in certain landslide-prone locations, and created the Interim Task Force on Landslides and Public Safety. SB 1211 charged the Interim Task Force with developing a comprehensive, practicable, and equitable solution to the problem of risks associated with landslides.[31]

The Interim Task Force developed the legislative concept that resulted in Senate Bill 12 in the 1999 session. Senate Bill 12

TRG Key

For information on Goal 17 and coastal shorelands, refer to Chapter 6: the Coastal Hazard Technical Resource Guide and Appendix A.

directs state and local governments to protect people from rapidly moving landslides. The bill has three major components affecting local governments: detailed mapping of areas potentially prone to debris flows (i.e., "further review area maps"); local government regulating authority; and funding for a model ordinance. The legislature allocated funding to the Department of Geology and Mineral Industries (DOGAMI) to prepare the "further review area maps," and provided $50,000 for a grant to a local government to develop a model program to address rapidly moving landslides. *Senate Bill 12 applies only to rapidly moving landslides, which are uncommon in many communities, but are very dangerous in areas where they do occur.*

Local Government Responsibilities under Senate Bill 12

In order to reduce the risk of serious bodily injury or death resulting from rapidly moving landslides, Senate Bill 12 requires local governments to:[32]

- Exercise all available authority to protect the public during emergencies;
- Decide when to require a geotechnical report and, if a report is required, provide for a coordinated review of the geotechnical report by DOGAMI or ODF, as appropriate, before issuing a building permit for a site in a Further Review Area;
- Regulate through mitigation measures and site development standards the siting of dwellings and other structures designed for human occupancy in Further Review Areas where there is evidence of substantial risk for rapidly moving landslides; and
- Maintain a record, available to the public, of properties for which a geotechnical report has been prepared within the jurisdiction of the local government.[33]

Further Review Area Maps

Senate Bill 12 requires mapping of areas with potential for rapidly moving landslides. The language defines "Further Review Areas" as: an area of land within which further site specific review should occur before land management or building activities begin because either DOGAMI or ODF determines that the area reasonably could be expected to include sites that experience rapidly moving landslides as a result of excessive rainfall.[34]

DOGAMI will prepare further review area maps that include at a minimum all regions in Western Oregon mapped by ODF as high or extreme hazard debris flows by 2002. Communities can contact the Nature of the Northwest Information Center to access the DOGAMI maps or existing ODF maps (See contact information in Section 6 of this Guide). Developers may be required by local government to attain a geotechnical site report if the property is determined to be in a Further Review Area. However, local governments can request that a site report be prepared prior to granting a building permit, regardless of

whether the site has been determined to be in a further review area. Local governments may need to include language in their ordinances requiring such site reports. Some of these "further review areas" may lie within Urban Growth Boundaries. Cities and counties may therefore need to modify their comprehensive plans and ordinances to meet requirements of Senate Bill 12 if DOGAMI maps show a landslide hazard in their community.

Forest Practices Public Safety Regulations

Senate Bill 12 requires the Oregon Board of Forestry to adopt regulations that reduce the risks associated with rapidly moving landslides which will replace the interim prohibition of certain forest operations. This bill also recognizes, however, that rapidly moving landslides can and do commonly occur on steep slopes regardless of past timber harvesting, therefore it will take the combined actions of homeowners, road users, forestland owners, and state and local government to protect the public.

Development of Model Ordinances

Senate Bill 12 also provided for a pilot program, under the guidance of the Department of Land Conservation and Development, to develop model ordinances, regulations and procedures for mitigation of hazards and for allowing the transfer of development rights. The grant of $50,000 for the pilot program was awarded to Douglas County. Douglas County began development of a model ordinance in February 2000 and can be contacted at (541) 440-4289 for more information.

Senate Bill 12 can be obtained online from the State of Oregon Home page at **http://www.leg.state.or.us/billsset.htm.**

3.1.3 Oregon State Building Codes Division - Landslides

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by the state and local municipalities throughout Oregon. The One- and Two- Family Dwelling Code and the Structural Specialty Code contain provisions for lot grading and site preparation for the construction of building foundations.

Both codes contain requirements for cut, fill and sloping of the lot in relationship to the location of the foundation. There are also building setback requirements from the top and bottom of slopes. The codes specify foundation design requirements to accommodate the type of soils, the soil bearing pressure, and compaction and lateral loads from soil and ground water on sloped lots. The building official has the authority to require a soils analysis for any project where it appears the site conditions do not meet the requirements of the code or that special design considerations must be taken. ORS 455.447 and the Structural Code require a seismic site hazard report for projects that include essential facilities such as hospitals, fire and police stations and emergency response facilities, and special occupancy structures, such as large schools and prisons. This report includes consideration of any potentially unstable soils and landslides.

State building codes do not set standards for lot grading that is not associated with the construction of buildings. However, the state has recognized the Uniform Building Code Appendix Chapter 70 as an appropriate standard for excavation and fill of such properties. Local municipalities have the option of adopting this standard or their own to regulate lot grading in areas other than the building foundation. Many jurisdictions use these standards in conjunction with local planning ordinances. Building codes do not address "off-site" or deep-seated landslide hazards. Local governments can take the initiative to address these hazards.

3.2 Summary: Laws for Landslide Hazards

- ❒ Oregon Statewide Planning Goal 7: Areas Subject to Natural Hazards
- ❒ Senate Bill 12: Addressing Rapidly Moving Landslide Hazards in Oregon
- ❒ Oregon State Building Codes Division

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. Section 3 of the Landslide Technical Resource Guide describes laws that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying landslide hazards in your area:

- ❒ Does your community's comprehensive plan contain an inventory of landslide hazards, a vulnerability assessment and policies addressing landslide hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on landslide hazards in your community, the current laws for rapidly moving landslides and the State Building Codes?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in landslide hazard areas?

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Section 4:
How can Your Community Reduce Risk from Landslide Hazards?

Avoiding development in hazard areas is the most effective way to reduce risk. There are, however, many areas in Oregon where some degree of hazard is unavoidable, such as much of the Coast Range and the Cascade Mountains. Communities in vulnerable areas should manage and reduce their risk from landslide hazards if the risk cannot be completely eliminated.

Section 4 describes methods to evaluate site-specific development and other implementing measures to reduce risk from landslide hazards. Implementing measures are the ordinances and programs used to carry out decisions made in the comprehensive plan. They include zoning ordinances, development standards and other land use regulations, which directly regulate land use activities.

TRG Key

For more information on specific hazards mitigation techniques see Appendix C: Land use Tools and Techniques in the Natural Hazards Technical Resource Guide.

4.1 How can Your Community Plan for Landslide Hazards?

It is possible to plan, at least to some degree, for landslide hazards. The nature of your community's response will depend on the severity of the hazard. Avoiding, or significantly limiting development in landslide areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

Landslide Key

Section 2 of this document provides information that can assist your community in identifying landslide hazards.

To successfully plan for a landslide hazard, consider the following steps:

- ✓ **Identify the hazard**
  Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.
- ✓ **Avoid the hazard**
  Restrict development in hazard-prone areas. For landslide-prone areas with high density and potential for severe property damage or loss of life, this option should be followed.
- ✓ **Evaluate site-specific development**
  Communities can require geotechnical reports to evaluate site-specific development in landslide areas. Techniques for evaluating these hazards during the land use and permitting process are described below.
- ✓ **Implement risk reduction measures through land use planning**
  Minimizing development in hazard areas through low density and regulated development can reduce risk of property damage and loss of life. This section provides information on specific land use planning and zoning measures.

✓ **Implement non-regulatory measures**
Additional mitigation strategies and non-regulatory measures can further reduce risk from landslide hazards. These strategies are further explored in this section.

4.2 How is Development in Landslide-Prone Areas Evaluated?

Geotechnical reports can be required for development in locations that may have significant landslide hazards. Geotechnical reports are appropriate for new developments located on known landslides, and for areas where significant excavation may be required to develop the site. Other factors, such as the proposed construction activity may influence the decision to require a site report. For excavations, a combination of hillslope steepness and maximum cut and fill dimensions are generally appropriate criteria for determining when such a report is needed.

Who can Prepare Geotechnical Reports?

Professional Engineers (PE) and Certified Engineering Geologists (CEG) regularly produce geotechnical reports. However, local governments may not be aware of the differences in the types of geotechnical professionals. Such specialists may have a Professional Engineers (PE) stamp or a Certified Engineering Geologist (CEG) stamp, but they must also be competent in the field within which they are practicing.[35]

"Procedures and capability of technical experts qualified to do site specific investigations should be clearly specified. Engineering geological registration and performance guidelines exist and are established by the State Board of Geologist Examiners, but geotechnical engineering certification and procedural guidelines have not yet been established. Qualified technical experts (PEs with geotechnical competency) are available, but not identified by registration."[36]

A *Certified Engineering Geologist* is an Oregon-registered professional geologist who has been trained and tested by the Oregon State Board of Geologist Examiners (OSBGE). An engineering geologist is a person who applies geologic data, principles, and interpretation to naturally occurring materials so that geologic factors affecting planning, design, and construction and maintenance of civil engineering works are properly recognized and utilized ORS 672.505(5).[37] An engineering geologist uses the knowledge of past and potential events to identify and characterize geotechnical problems that could affect the location, design, construction, and maintenance of structures and engineering works.[38] The Oregon Board of Geologist Examiners has adopted guidelines for engineering geologic reports.

A *professional engineer* is an Oregon-registered professional engineer. An engineer is defined as "…a person who has knowledge of mathematics, physical, chemical and other sciences and the principles and methods of engineering analysis and design acquired by engineering education and engineering experience" ORS 672.002(2).[39]

A *geotechnical engineer* is usually a civil engineer who considers the effects of earth materials and geologic processes on structures and

Tip Box

The Three Levels of Hazard Assessment

1. Hazard Identification
2. Vulnerability Assessment
3. Risk Analysis

If your community identifies landslide hazards through a hazard identification process or a vulnerability assessment, you should adopt a process to review individual development permits in those landslide-prone areas. For further description of the three levels of hazard assessment, refer to Chapter 2: Elements of a Comprehensive Plan.

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engineering works. Geotechnical engineers often use information provided by engineering geologists in analyzing the effects of geologic conditions on proposed structures and in engineered designs to effectively address the geologic conditions. Thus, the geotechnical engineer accomplishes analyses and provides recommendations for geotechnical design, and completes an evaluation of the expected performance of the engineering work.[40]

After a geotechnical review is completed, local governments need to be sure the study has accountability (i.e. the PE or CEG stamp) and competency. Local governments should evaluate the study based on the qualifications of the geotechnical professional. The presence of a State of Oregon Stamp (PE or CEG) alone does not constitute competency. The "Boards" of registration (Oregon Board of Examiners for Engineering and Land Surveying - OSBEELS and the Oregon State Board of Geologist Examiners - OSBGE) can evaluate competency on a case-by-case basis.

There are several ways to ensure the competency of geotechnical studies. Peer review or internal review can help to ensure competency. Local governments can also consider sharing a qualified geotechnical engineer or engineering geologist between agencies to reduce cost, maximize expertise and ensure competency.[41] Private sector specialists can be found in the Yellow Pages.

The Board of Geologist Examiners has adopted guidelines for engineering geologic reports. There are no specific guidelines for Geotechnical Engineering Reports. ODF and DOGAMI plan to work with the Board of Examiners for Engineering and Land Surveying and the Board of Geologist Examiners to develop additional guidelines for rapidly moving landslides.

4.3 What Land Use Tools can be Used to Reduce Risk from Landslide Hazards?

Land use planning and zoning can assist local governments in regulating development and mitigating natural hazards. The following are land use tools communities can use to reduce risk from landslide hazards.

4.3.1 Overlay and Combining Zones

Overlay and combining zones are independent zones that coexist with the base-zoning district. Development is usually regulated in accordance with the uses allowed by the base-zoning district. However, under certain conditions, the requirements of the overlay and combining zones can take precedence over the underlying zoning district. For example, a community could create an overlay-zone for landslide-prone areas and establish special review requirements for development in those areas.[42] Landslide mitigation requirements might include geotechnical reports for development proposals, or structural mitigation measures during construction.

Tip Box

Peer Review

Many of Oregon's local governments require geotechnical reports before they will allow a structure to be located in a landslide or steep slope hazard area. In some cases, local governments require the developer to pay for another engineer to review the geotechnical report. This "peer review" procedure allows the local government to get a "second opinion" regarding the substance of the geotechnical report and the potential risks associated with the proposed development. Marion County is in the process of adopting a new landslide/steep slope overlay zone. The following language regarding peer review is included in the draft ordinance: "All assessments and reports required by this chapter shall be reviewed by a qualified professional or professional firm…of the county's choice prior to acceptance of the development permit application. Such review shall include examination to ensure required elements or guidelines have been completed, report procedures and assumptions are generally accepted and all conclusions and recommendations are supported and reasonable." The proposed ordinance authorizes the county to require the developer to pay the cost of the "peer review."

4.3.2 Incentive Zoning

Incentive zoning requires developers to exceed limitations imposed upon them by regulations, in exchange for specific concessions. For example, if developers avoid developing in landslide-prone areas, the local government might allow them to build on other portions of their land at a higher density than is allowed by the current zoning designation.[43]

4.3.3 Performance Zoning

Performance zoning sets standards that allow for a certain level of impact on the environment from development activities. This technique is usually used in conjunction with traditional zoning. The standards typically address specific environmental conditions, and can include stormwater runoff.[44]

4.3.4 Incorporating Landslide Mitigation Requirements into Subdivision Regulations

Subdivision regulations govern the division of land for sale or development. Additional requirements may be incorporated into these types of regulations. Developers wanting to subdivide a property located in a high landslide-prone area could be required to pay exactions, impact fees or other system development charges.[45] This type of regulation combined with a fee exaction can serve to discourage development in landslide-prone areas. Three mitigation approaches that can be included in subdivision regulations include cluster development, performance bonds and site plans, which are described below.

4.4 What are Additional Methods for Reducing Risk from Landslides?

Some of the techniques listed below are regulatory measures used by local governments. Others are non-regulatory in nature and can be implemented by local government officials, developers and private citizens alike.

4.4.1 Drainage Practices

Ineffective stormwater management and excess runoff can cause erosion and increase the potential for landslides. Drainage can be affected naturally by the geology of an area, but can be exacerbated by the construction of large impervious surfaces (e.g., parking lots). These impervious surfaces impair the natural absorption of water and can adversely concentrate flow onto marginal slopes.[46] Special construction standards can be used to control water runoff, including mulching and seeding disturbed areas, which directs runoff away from potentially hazardous downslope areas.

4.4.2 Soil conservation and Steep Slope Stabilization

Soil conservation and steep slope stabilization are measures that can be implemented by placing restrictions on the grading of hillsides and establishing development limits on landslide-prone slopes. It is possible to reduce erosion and stabilize

slopes using non-invasive structural measures. Activities related to slope stabilization and soil conservation include erosion prevention through regulations that limit development on severe slopes, or through proper site design. These measures can also help avoid costly stabilization work.

4.4.3 Lower Density in Residential Lots

Lower density in landslide-prone areas can result in fewer people and structures being at risk and can also reduce the potential for landslides by reducing the number of cuts and fills for driveways and house pads. Density in hazard areas can also be minimized through the voluntary dedication of land for open space or public parks, which can reduce potential development on those lands.

4.4.4 Development Standards

Development that fits the terrain and does not use extensive excavation and drainage alterations will reduce risk from landslide hazards. Specifying maximum cuts and fills and compaction standards can further reduce risk. Locating the structure on a part of the property not prone to landslides is another strategy to reduce risk of property damage from landslides.

Special hillside development standards applied to slopes calculated to be high risk can reduce cross-slope cuts and fills. These standards include reduced street widths, hammerheads rather than cul-de-sac bulbs and sidewalks on only one side.

4.4.5 Cluster Development

Cluster development is the concentration of structures on one part of a lot to preserve the remainder of the property for open space. Cluster development usually is permitted only under planned unit development procedures. Clustering offers the potential for savings in some areas: the sewer and water lines and streets needed to serve a cluster may be much shorter than those necessary for a traditional subdivision of comparable density.[47] Cluster development provides the opportunity to avoid developing in hazard areas by maximizing development structures on non-hazard areas.

4.4.6 Performance Bonds

Performance bonds are bonds required of a subdivider or developer to ensure that specified improvements will be carried out after approval for the development is given by the local government. Performance bonds are widely used for a broad range of improvements – such as sidewalks, streets, curbs, storm sewers, street lighting, etc. They are one type in a broader category known as surety bonds.[48] Performance bonds can be used to improve drainage practices or implement other mitigation techniques.

Tip Box

Process for Evaluating Development in Landslide-Prone Areas

Communities can use a regulatory process to assist in evaluating development in landslide-prone areas. For example, when a developer submits a site development plan, local planning officials will apply local hazards regulations. If the site is located within the boundary of a known hazard area, the developer can be required by local regulations to retain a professional to evaluate the level of risk and provide recommendations on mitigation measures. This requirement pertains to the proposed structure, to the construction methods, and natural conditions proposed to be altered on and around the site. During the review of the site development plan, planners must rely on detailed technical information and professionals to obtain the most accurate evaluation.

4.4.7 Site Plans

A site plan is a large-scale map of a proposed development site. Most zoning and subdivision ordinances require that a site plan accompany any application for a partition, variance, conditional use, zone change, or other quasi-judicial action. The standards for the drafting of such maps are not high, but each drawing should have a consistent scale (described on the plan), a north arrow, and a title or legend, and should show property lines, the locations of buildings, and the presence of roads, streams, and other major features of the landscape.[49] If a landslide hazard is present, you can use the site plan to determine the location of the permitted development and to avoid the hazard area.

4.4.8 Restrictions on Uses and Facilities

There can be restrictions made on the types of uses and facilities that can be built in mapped landslide areas. A city or county may decide that critical facilities or large assembly places such as a college, hospital, convention center, or church should not be allowed in an extreme landslide hazard area.

4.4.9 Prohibition

Where supported by the factual base, a community may decide that the landslide hazard is severe enough that development should be prohibited. There may be legal issues with such prohibitions.

4.4.10 Structural Practices

Structural mitigation practices can include those that deflect landslide movement (typically for debris flows) and those that can physically arrest or control landslide movement. These measures should be required at the time the development is approved by the local government.

4.4.11 Vegetation

Limiting or regulating the amount of vegetation cleared off a hillside lot reduces the risk of increasing the number of landslide-prone areas in a community. Planting vegetation or maintaining slope terraces can also reduce slope-runoff.[50]

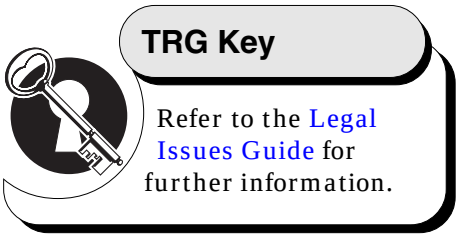
4.5 What are Examples of Plan Policies and Ordinances that Regulate Development in Landslide-Prone Areas?

Oregon cities of Bend and Salem provide examples of landslide policies and ordinances used by communities to regulate development in areas of steep slope and landslide-prone areas. For further information on the Salem ordinance refer to Section 5 of this guide.

4.5.1 Bend General Plan[52]

The Bend general plan establishes performance standards for development in steep slope areas. Bend's plan allows the city to reduce minimum residential density where slopes are greater than 20 percent.

1. The City shall require development on slopes in excess of 10 percent to employ measures to minimize the hillside cuts and fills for streets and driveways.
2. The location and design of streets, structures and other development features on slopes in excess of 10 percent shall give full consideration to the natural contours, drainage patterns, and vegetative features of the site to protect against temporary and long-term erosion.
3. In areas where the natural slope exceeds 20 percent, the city may reduce the minimum residential density (allow larger lots) or alternatively, may require cluster development through the PUD process to preserve the natural topography and vegetation, and improve fire protection.



4.5.2 Salem Ordinance Chapter 68 Section 68.010 Intent and Purpose

The Salem draft ordinance contains a good example of a statement of intent that could be included in a local landslide ordinance. Section (e) clearly indicates the City's position that they cannot completely eliminate the landslide risk in their community.

The intent and purpose of the provisions of this chapter are:

(a) To implement the Geologic Hazards goals and policies of the Scenic and Historic Areas, Natural Resources and Hazards section of the Salem Area Comprehensive Plan;
(b) To review development applications for properties within landslide hazards areas;
(c) To assess the risk that a proposed use or activity will adversely affect the stability and slide susceptibility of an area;
(d) To establish standards and requirements for the use of lands within landslide hazards areas;
(e) To mitigate risk within landslide hazards areas, not to act as a guarantee that the hazard risk will be eliminated, nor as a guarantee that there is a higher risk of hazard at any location. Unless otherwise provided, the landslide hazard regulations are in addition to generally applicable standards provided elsewhere in this code.

4.6 Summary: Reducing Your Community's Risk from Landslide Hazards

- **Avoid the hazard** if possible, since risk reduction techniques can be very expensive or may not be feasible in areas prone to rapidly moving landslides or near a very large landslide.
- **Reduce the level of risk** in hazard-prone areas by minimizing development, reducing density, or implementing mitigation measures if developing in hazard-prone locations is unavoidable.
- **Evaluate development** in landslide-prone locations. Evaluation can be required through local government regulations and by understanding the geology of the area. Technical

Sidebar

Hazard Mitigation Grant Project[51]

The City of Rufus along the Columbia River is bisected by Gerking Canyon which drains a watershed largely comprised of dry land wheat fields. Heavy rainfall associated with summer thunderstorms or rapid snowmelt can cause significant runoff that carries water and rocky debris through town impacting roads, bridges, housing and the community well system. To address this hazard, the upland wheat growers constructed a series of catchment basins designed to control runoff before it reaches town by detaining water and soil. Not only are peak runoff flows reduced, soil erosion in the fields is controlled and the detained water is given a chance to percolate into the ground to improve soil moisture. This project involved the Natural Resources Conservation Service, the Sherman County Soil and Water Conservation District, and funding from FEMA's Hazard Mitigation Grant Program.

assistance from state agencies such as DOGAMI and ODF can assist in hazard mapping and assessment. Section 2 provides information on resources and technical assistance for landslide hazard identification.

- ❒ **Require geotechnical investigations** for development in locations that may have significant landslide hazards. Geotechnical reports are commonly used in evaluating development proposals and must be conducted by professional engineers or certified engineering geologists.
- ❒ **Adopt land use policies and enact regulations**, including overlay zones, incentive zoning, performance zoning, and subdivision regulations. Other useful regulatory strategies include excavation and grading standards, stormwater management, hillside development standards, restrictions on the types of uses of landslide-prone areas, density limits, and regulating vegetation on hillside lots.
- ❒ **Consider non-regulatory strategies** such as soil conservation, slope stabilization, and dedication of land for open space useful to a variety of community organizations for reducing risk from landslide hazards.
- ❒ **Provide public outreach** and information sessions for residents and potential residents living in landslide-prone terrain regarding the hazard and steps residents can take to protect themselves.
- ❒ **Assess the level of risk** for rapidly moving "off-site" landslide hazards, as they pose the highest threat to public safety and can cause loss of human life.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your local government should ask the following questions in assessing the adequacy of your comprehensive plan in addressing the landslide hazard:

- ❒ Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to natural hazards in general?
- ❒ Has your community implemented a process for evaluating site-specific development?
- ❒ Does your community have an approach to reduce risk from landslide hazards through a combination of regulatory and non-regulatory measures?
- ❒ Do the implementing measures carry out your comprehensive plan's policies related to landslides in your community?
- ❒ Does your community require site-specific evaluations and geotechnical reports for proposed developments in landslide hazard areas?

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Section 5:
How are Oregon Communities Addressing Landslide Hazards?

This section describes how several Oregon communities are addressing landslide hazards through a regulatory process. These examples describe development of plan policies, and implementation of the communities' landslide hazard ordinances.

5.1 A Collaborative Planning Approach - Salem & Marion County, Oregon

Salem and Marion County used federal hazard mitigation funding after the 1996 flood and landslide events to reduce risk to life and property through mapping of landslide hazards and development of landslide hazard ordinances.

Background

Salem and Marion County initiated the development of their landslide hazard ordinances in 1996, after heavy rains and flooding resulted in landslide activity. Funding was secured from Federal Emergency Management Agency (FEMA) presidentially declared disaster funds. Funds were provided to the state through the Hazard Mitigation Grant Program, administered by the OSP-Office of Emergency Management (OEM). The city, county, and the Oregon Department of Geology and Mineral Industries (DOGAMI) worked together to produce a landslide hazard study of the South Salem Hills. This project was expanded to include a similar study of the Eola Hills in Polk County after additional grant funds became available.

The study included landslide mapping and characterization of the Salem Hills and Eola Hills project areas coordinated by DOGAMI, the formulation of landslide hazard ordinances by the city and county, and development of a technical reference manual on mitigating geologic hazards in Oregon. The Department of Land Conservation and Development (DLCD) and OEM provided technical support for the study and ordinance development. FEMA funded 75 percent of the study and DOGAMI, Salem, and Marion County contributed the remaining 25 percent of project costs.

The approach taken by city and county staff was a key aspect in developing these ordinances. Collaboration among local government, project participants, and a broad group of stakeholders resulted in a citizen advisory committee. Project staff, together with the citizen advisory committee, agreed upon and adopted a set of principles for the development of the ordinances. With these principles in mind, staff collected, reviewed and summarized for the committee, hillside development ordinances and resource/reference materials from around the country but primarily from the northwest and California. A matrix was developed outlining these resource materials to assist staff and the committee.

Tip Box

Protecting Life and Property in Oregon – Public Education and Response

Oregon residents in landslide-prone areas can obtain additional information on landslides, from the "Oregon Landslide Brochure." Communities can develop an emergency response plan for areas prone to rapidly moving landslides. This plan should include evacuation routes that expose residents to the least hazards. Communities should also consider structural controls along essential evacuation routes, especially if these routes are at high or extreme hazard for rapidly moving landslides. Provisions in the land development code can provide access to landslide hazard areas (such as roads) to ensure emergency vehicle access and resident evacuation. Communities can develop regulations to ensure that homes are not located in the potential paths of rapidly moving landslides.

(The brochure is available by contacting DOGAMI - refer to Section 6 of this guide for contact information.)

TRG Key

Refer to the Comprehensive Plan Evaluation Guide Chapter 2 for more information on developing inventories and a listing of critical facilities.

The Draft Ordinance

The draft Salem ordinance for landslide hazards developed in 2000 requires the preparation and approval of a geological assessment before development occurs in areas identified with a moderate degree of hazard. These areas then undergo a preliminary review of geologic conditions. The ordinance requires staff to determine if a geotechnical report requiring more information and detail than the geological assessment is necessary. This approach ensures adequate review of proposed development on private property where potentially greater risk requires more detailed information to fully identify and address the hazard. Current mapping for landslide susceptibility in Salem covers portions of the Salem Hills and Eola Hills. The city is also incorporating the DOGAMI earthquake hazards maps for the Salem area to further assist in determining the degree of landslide risk for site-specific development. There are no existing city regulations on grading activities, though proposals for this kind of review are being considered.

The citizen advisory committee, city and county public works staff, building inspection staff, and legal counsel reviewed the draft ordinance in spring 2000. The State Board of Geologist Examiners and Engineering and Land Surveying Examiners Board were also asked for input on the draft ordinance. Revisions made the draft more specific to identified hazard areas, simpler to understand, easier to implement, and more clear and objective. The consensus process and collaboration between project staff, the advisory committee, and other interests participating in the study were beneficial to the public hearing process. The advisory committee presented and approved the draft landslide hazard ordinance. Respective city and county decision-makers were considering the draft ordinance at the time of publication of this document.

Landslide Key

Contact the City of Salem and Marion County Community Development Departments for the status of the ordinances. The summary of this section provides information on how to contact these local agencies.

The landslide hazard study resulted in two separate, but similar ordinance proposals. Salem will apply its ordinance to mapped landslide areas within the city limits and the county to mapped geological hazard areas and identified excessive slope areas. A Graduated Response Table, a key element of the Salem landslide ordinance, provides the mechanism that will be used to evaluate future development sites. The table factors the degree of hazard at a site with the level of proposed development activity to determine the extent of geological study needed before development can occur on the site.

The city and county ordinances establish a provision for independent review to ensure compliance with the criteria for a geological assessment or geotechnical report. Geotechnical studies will undergo an independent review process to ensure compliance with the ordinance and ensure that recommended mitigation measures provide for safe development. Prior to development, a declaratory statement indicating the property is within an identified hazard area needs to be recorded on the property deed. Compliance with the ordinance will be required as part of any land use permit and building permit for regulated activities within identified hazard areas.

DRAFT Ordinance – City of Salem - Chapter 68 – Landslide Hazards

(Ordinance under review in May 2000. Final language may be different.)

The following sections of ordinance language are considered ordinance provisions from the Salem Ordinance Chapter 68 Landslide Hazards. For more information or to obtain the draft ordinance in its entirety, contact the Salem Community Development Department.

68.010 INTENT AND PURPOSE

The intent and purpose of the provisions of this chapter are:

a) To implement the Geologic Hazards goals and policies of the Scenic and Historic Areas, Natural Resources and Hazards section of the Salem Area Comprehensive Plan;
b) To review development applications for properties within landslide hazards areas;
c) To assess the risk that a proposed use or activity will adversely affect the stability and slide susceptibility of an area;
d) To establish standards and requirements for the use of lands within landslide hazards areas;
e) To mitigate risk within landslide hazards areas, not to act as a guarantee that the hazard risk will be eliminated, nor as a guarantee that there is a higher risk of hazard at any location. Unless otherwise provided, the landslide hazard regulations are in addition to generally applicable standards provided elsewhere in this code.

68.030 REGULATED ACTIVITIES; PERMIT & APPROVAL REQUIREMENTS; APPLICABILITY

Except as may be exempted under SRC 68.040, no person shall engage in the following regulated activities on geological hazard areas, maps of which are adopted under this chapter, without first obtaining permits or approvals as required by this chapter:

1) Excavations;
2) Fills;
3) Installation or construction of an accessory structure greater than 500 square feet in area;
4) Construction, reconstruction, structural alteration, relocation or enlargement of any building or structure for which permission may be require pursuant to this code;
5) Land division, planned unit development, manufactured dwelling park development;
6) Tree removal on slopes greater than 60 percent.

68.050 MAP ADOPTION: AMENDMENT

The approximate location and extent of geological hazard areas are shown on Landslide Hazard Susceptibility Maps, which shall be adopted by council and shown on the official zoning map of the city. The Landslide Hazard Susceptibility Maps have been developed to indicate the general location of areas of low, moderate, and high susceptibility to landslides, and areas of known landslide hazards. These maps are based on the best

Tip Box

The Salem draft ordinance contains a number of provisions that other communities might consider adopting to address development in their jurisdiction's landslide hazard area:

1. Intent and purpose statement – purpose is clear and tied to the identified risk.
2. Clear statement of where ordinance applies and to what activities.
3. The ordinance is based on mapping of the risk. The factual base clearly supports the implementing measures.
4. The classification criteria provide clear and objective review standards.

available information and may be amended based upon the receipt of corrected, updated or refined data or the revision of studies upon which the maps were initially based.

68.060 CLASSIFICATION CRITERIA AND REVIEW REQUIREMENTS.

The Graduated Response Table 68-1 shall be used by city staff to determine the level of site investigation for various types of regulated activity on property any portion of which is shown on Landslide Hazard Susceptibility Maps. Using a rating system, slope and physiographic conditions at the site are evaluated in relationship to a proposed activity. If a rating meets or exceeds quantified thresholds provided in the table, a geologic assessment or geotechnical report or both shall be provided by the applicant and action specified therein undertaken or insured before any regulated activity may be permitted, approved, or processed. Where any portion of the subject property on which regulated activities are proposed is identified under two slope conditions, or two or more categories, the highest condition or category will apply.

Table 68-1: Graduated Response – Draft July 2000

Graduated Response Table Note:

Select one assigned value from PARTS (I or II, and III and IV) and proceed to PART V.

PART I.

Reference: Public Works Slope Contour Map	Slope Ratings Environmental Constraints Category			
	Low	Moderate	High	Assigned Value
Slope Conditions	1	2	3	
Regulated Slopes Less Than 10%	N.A.	N.A.	N.A.	
Regulated Slopes between 10%-15% but Not Including 15% (N/A to Category 5 on GMS 105)	X			
Regulated Slopes between 15%-25% and Including 25% (N/A to Category 5 on GMS 105		X		
Regulated Slopes over 25% (N/A to Category 5 on GMS 105)			X	
Score				* Points

PART II.

Reference: Geologic Map Series (GMS/105)	Earthquake-Induced Landslide Susceptibility Ratings Environmental Constraints Category			
	Low	Moderate	High	Assigned Value
Physiographic and Geologic Categories	1	2	3	
Property Identified under Categories 1, 2, 3 or 4 on GMS/105 Reports	N.A.	N.A.	N.A.	
Property Identified under Category 5 on GMS/105 Report			X	
Score				** Points

PART III.

Reference: Interpretive Map Series (IMS-5), Interpretive Map Series (IMS-6), Geological Map Series (GMS/105), and Public Works Slope Contour Map	Water-Induced Landslide Susceptibility Ratings Environmental Constraints Category			
	Low	Moderate	High	Assigned Value
Physiographic and Geologic Categories	1	2	3	
Property Identified under Category 1 on IMS-5 & IMS-6 Reports	N.A.	N.A.	N.A.	
Property Identified under Categories 1, 2, 3 or 4 on GMS/105 Reports	N.A.	N.A.	N.A.	
Property Outside GMS/105 and IMS-6 and Greater Than 15%		X		
Property Identified under Categories 2 or 3 on IMS-5 & IMS-6 Reports		X		
Property Identified under Categories 4, 5a, 5b or 6 on IMS-5 & IMS-6 Reports			X	
Score				*** Points

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Table 68-1: Graduated Response cont. – Draft July 2000

PART IV.

Type of Activity	Activity Ratings for Potential Site Impact Land Use Category			
	Low	Moderate	High	Assigned Value
	1	2	3	
Installation or Construction of an Accessory Structure Greater Than 500 Square Feet	X			
Single Family, Manufactured Dwelling Building Permit (Structural Expansion/Remodel)	X			
Multiple Family Building Permits (Structural Expansion/Remodel)		X		
Partition		X		
Grading (as Independent Activity)			X	
Subdivision, Planned Unit Development, Manufactured Dwelling Park			X	
Schools, Hospital and Public Building Permits (Structural Expansion/Remodel)			X	
Commercial and Industrial Building Permits (Structural Expansion/Remodel)			X	
Tree Removal on Regulated Slopes Greater than 60% (as Independent Activity)			X	
Score				**** Points
Add scores from PART I or II, and III and IV. Proceed to PART V.				*****Points

PART V.

*See Adopted Requirements for Geologic Assessments and Geotechical Reports in the City of Salem Public Works Design Stadards	Total Risk Assessment Policy Provision	
Category 1- Low Landslide Risk Assessments	Category 2 – Moderate Landslide Risk Assessments	Category 3 – High Landslide Risk Assessments
(4 points or less)	(5-8 points)	(9 points or greater)
No Requirements	Grading Permit, Geologic Assessment* *If the Geologic Assessment indicates landslide hazards on the site, the director of public works or building and safety administrator may specify the requirements of High Landslide Risk Assessments.	Grading Permit, Geotechnical Report* *The director of public works and building and safety administrator may require a qualified independent review of a geotechical report.

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5.2 Applying Land Use Tools in Myrtle Creek, Oregon

The Myrtle Creek Zoning ordinances regulate development in steep-slope and landslide-prone areas.

Background

Myrtle Creek's 1990 Comprehensive Plan states that over 300 acres of buildable land within the Myrtle Creek urban growth boundary are designated "Steep Slope Residential." These areas of steep slope are determined suitable for residential development, recognizing that actual development densities will vary according to the degree of the slope. Since hillsides present a potential hazard to life and property from the mass movement of underlying soils, the city developed, and continues to update, its steep slope ordinances. Policies within the comprehensive plan (Chapter 5: Natural Disasters & Chapter 14 Land Use and Urbanization) require a mandatory evaluation of proposed development in areas affected by steep slopes to ensure proper consideration of all potential hazards.

Myrtle Creek has jurisdiction within the city limits and the northern portion of the Urban Growth Area (UGA) (urban growth boundary), while Douglas County (through an Urban Growth Management Agreement) has planning jurisdiction over the southern half of the Myrtle Creek UGA. This southern portion of the UGA is known as Tri City and is an Urban-Unincorporated community. County regulations are enforced through Article IX of the Douglas County Zoning Ordinance.

Local implementation of the Myrtle Creek Zoning Ordinance has shown that the ordinance does a good job of regulating hillside developments. The language in the ordinance is specific enough to make clear and objective interpretations while remaining flexible enough to deal with site-specific issues. The strength of the ordinance is its comprehensiveness.

Tip Box

How to Use a Graduated Response Table

The advantage of the graduated response table is that it links development review standards to the degree of risk. For example: Development on slopes of 10-15% would have 1 point; if it is located on an area of relatively low risk of earthquake-induced landslides (category 1,2,3,or 4), the development would be assessed no additional points, a rating of 2 and 3 on the water-induced landslide report would add 3 points. If the activity is a subdivision, an additional 3 points would be assessed for a total of 7 points requiring a grading permit and geologic assessment.

Myrtle Creek Zoning Ordinance No. 508

The following excerpts of ordinance language are from the Myrtle Creek Zoning Ordinance pertaining to steep slopes and landslides. For more information or to obtain the ordinance in its entirety, contact the Myrtle Creek Planning Office.

Section 1.03.0 Intent

> The intent of these regulations is to provide a means of ensuring that land uses of the community are properly situated in relation to one another; and that development is sufficiently open to provide light, air and privacy; that adequate space is available for each type of development; that density of development in each area is held at a level which can be properly serviced by such governmental facilities as the street, fire protection, school, recreation, and utility systems; and in general, to promote the public health, safety, order, convenience, prosperity and welfare of the people living in the community.

Tip Box

Myrtle Creek

Local governments might want to adopt language like Myrtle Creek's. The ordinance has a clear statement of intent, clear and objective standards for site review, and a requirement to address both the major causes of landslides (e.g., slopes; drainage..) and the effects on surrounding properties. The required elements of a site investigation report are beneficial, and the ordinance includes the following tools to address hazard areas: density limits, open space requirements and performance standards.

Section 5.01.1 Site Review Criteria

The site review will be conducted in accordance with the criteria set forth herein. Any development proposal, which deviates from the established criteria, shall be referred to the Planning Commission for determination. The Planning Commission shall have the power to impose any or all of the supplemental conditions set forth in Section 5.01.2 in making their determination.

(1) Identify areas of potential natural hazards where area protection requirements shall be imposed and which shall include, but are not limited to, the following:

a) Areas of mass movement and areas of greater than 25% slope shall require a written Site Investigation Report (Section 5.02.0) prior to any excavation or change in topography.
b) Areas of potential flooding hazards where the floodplain site criteria of the Flood Hazard Area (SD-FHA) shall apply.
c) Areas of lesser hazard where the imposition of supplemental conditions may be appropriate.

(8) Establish the adequacy of the grading and drainage plan for the collection and transmission of storm and ground water in order that the drainage from the proposed development will not adversely affect adjoining properties of public rights of way.

(9) Consider the effects of slope alteration (cut and fill) on erosion and run-off for surrounding properties and impose restrictions when appropriate.

(11) Establish where the retention of existing vegetation and natural topographic features will be beneficial as a soil stabilizer or is of scenic significance and impose restrictions where appropriate.

Section 5.02.0 Site Investigation Report

A site investigation report shall be submitted as part of the site review process when the proposed development involves identified mass movement hazard areas or areas of greater than 25 % slope. Also, the Planning Commission may require a site investigation report to be submitted for development in other areas of potential natural hazards based on the recommendation of the City Engineer for just cause. The Site Investigation Report provides information on the site of development adjacent land that is likely to be affected by the proposed development. Unless the City Engineer determines that certain specifications are not required, the Report shall include the information described in Subsection (1) through (6) herein, together with appropriate identification of information sources the date of information the methods use in the investigation and approximate man-hours spent on site.

(1) Qualifications To Conduct a Site Investigation Report

The Site Investigation Report shall be prepared by an engineering geologist or an engineer who certifies he is

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qualified to evaluate soils for stability or a person or team of persons qualified by experience and training to assemble and analyze physical conditions in flood or slope hazard areas. The person or team shall be employed by the applicant but shall be subject to approval as to qualifications by the City Administrator.

(2) Background Data in Report

The Site Investigation Report shall contain the following information:

a) A general analysis of the local and regional topography and geology including the faults, folds, geologic and engineering geologic units and any soil, rock and structural details important to engineering or geologic interpretations.
b) A history of problems on and adjacent to the site, which may be derived from discussions with local residents and officials and the study of old photographs, reports and newspaper files.
c) The extent of the surface soil formation and its relationship to the vegetation of the site, the activity of the landform and the location of the site.
d) Ground photographs of the site with information showing the scale and date of the photographs and their relationship to the topographic map and profiles. The photographs will include a view of the general area, the site of the proposed development and unusual natural features, which are important to the interpretation of the hazard potential of the site, including all sites of erosion or accretion.

(3) Topography Map
(4) Subsurface Analysis
(5) Development Proposal
(6) Conclusions

The following conclusions should be stated:

a) Whether the intended use of the land is or is not compatible with the conditions.
b) Any existing or potential hazards noted during the investigation.
c) The manner for achieving compliance with the ordinance and other requirements.
d) Mitigating recommendations for specific areas of concern and the degree to which they mitigate the concerns.

Section 5.04.0 Protection Standards for Natural Features

All development shall be preceded by the identification of any environmental or natural feature described in Section 5.04.1 through 5.04.6 below and shall meet the environmental protection standards applicable to each natural resource identified therein. Reference in this Section to “open space” is intended to mean the term as it is defined in Article II.

Section 5.04.1 Steep Slopes

In areas of steep slope, the following standards shall apply:

1) Twelve to less than 16% slope: Nor more than 40% of such areas shall be developed and/or regraded or stripped of vegetation.
2) Sixteen to 25% slope: No more than 30% of such areas shall be developed and/or regraded or stripped of vegetation, with the exception that no more than 20% of such areas may be disturbed in the case of poor soil suitability.
3) More than 25% slope: Not more than 15% of such areas shall be developed and/or regraded or stripped of vegetation, with the exception that no more than 5% of such areas may be disturbed in the case of poor soil suitability.
4) All erodible slopes shall be protected in accordance with the control standards contained in Section 5.04.6.

Section 5.04.3 Ravines and Ravine Buffers

1) At least 98% of all ravines shall remain in permanent open space. At least 80% of all ravine buffers shall remain in permanent open space. No uses or improvements other than those permitted herein shall be permitted in any area consisting of ravines or ravine buffers as defined by this ordinance.
2) Ravines shall not be the site of any land use or development, with the exception that access to other areas may be provided in ravine areas. In this event, an environmental assessment (or Site Investigation Report) shall provide the basis for location of such access. Minimum damage to the area shall be the guide in location of the access. The protected areas of ravine buffers shall be used only for passive recreation.
3) All erodible slopes shall be protected in accordance with the control standards contained in Section 5.04.6.

Section 5.04.6 Soil Erosion and Sedimentation Control

1) SESC Plan
In order to prevent both soil erosion and sedimentation, a soil erosions and sedimentation control plan shall be required as part of an application for development whenever any land located in a stream, stream channel or body of water is disturbed and whenever a development will involve any clearing, grading, transporting, or other form of disturbing land by removal of earth, including the mining of minerals, sand, and gravel provided that any one of the following descriptions applies to said movement of land:

    a) Excavation, fill, or any combination thereof will exceed 500 cubic yards.
    b) Fill will exceed three feet in vertical depth at its deepest point as measured from the natural ground surface.
    c) Excavation will exceed four feet in vertical depth at its deepest point as measured from the natural ground surface.

d) Excavation, fill, or any combination thereof will exceed an area of 5000 square feet.
e) Plant and/or tree cover is to be removed from an area exceeding 5000 square feet on any parcel of land.

(Note: Specifically exempted from the requirement of a soil erosion and sedimentation control plan are agricultural uses.)

5.3 Summary: Lessons from Oregon Communities Addressing Landslide Hazards

- The development of the **Salem** and **Marion County** Landslide ordinances began with updated inventory information, which included landslide mapping and characterization of the project areas. After adoption by their respective governing bodies, city and county staff will be able to implement the ordinances. For more information on the Salem and Marion County Landslide hazard ordinances, contact:

  Marion County Planning Division
  P.O. Box 14500
  3150 Lancaster Drive NE, Suite B
  Salem, Oregon 97309
  Website: **www.open.org/mcplann**
  (information on the study/ordinance)
  Phone: (503) 588-5038
  Fax: (503) 589-3284

  City of Salem
  555 Liberty St. SE/Room 305
  Salem, OR 97301-3503
  Phone: (503) 588-6211
  Fax: (503) 588-6005

- The **Myrtle Creek Zoning Ordinance** is another good example of regulating development in steep-slope and landslide-prone areas. For more information on the Myrtle Creek Zoning Ordinance, contact:

  City of Myrtle Creek
  P.O. Box 940
  207 Pleasant St.
  Myrtle Creek, OR 97457
  (541) 863-3171

- Communities interested in developing a steep-slope or landslide ordinance can contact DOGAMI and DLCD for additional technical assistance.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Your comprehensive plan should be coordinated with and reflect other comprehensive plans and implementing measures of other communities within your region. Natural hazards do not respect community boundaries making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plan, your community should ask the following questions in developing plan policies for landslide hazards:

- ❒ What plan policies should be added or amended to assist your community in dealing with landslide hazards?
- ❒ Are there communities that face similar landslide threats that have developed ordinances or non-regulatory programs that could be adopted by your community ?
- ❒ Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park, and transportation districts?)

Section 6:
Where can Your Community find Resources to Plan for Landslide Hazards?

This section is a resource directory including contacts, programs, documents and internet resources to assist planners, local governments and citizens in obtaining further information on landslide hazards.

TRG Key

For more information on public agency coordination refer to the discussion on coordination in Chapter 2: Elements of a Comprehensive Plan.

6.1 State Agency Resources

Oregon Department of Geology and Mineral Industries (DOGAMI)

DOGAMI is an important agency in landslide mitigation activities in the state of Oregon. Some key functions of DOGAMI include development of geologic data for Oregon, producing maps, and acting as a lead regulator for mining and drilling for geological resources. The agency also provides technical assistance to communities and provides public education on geologic hazards. DOGAMI provides data and geologic information to local, state and federal natural resource agencies, industry and other private sector groups.

Contact: DOGAMI
Address: 800 NE Oregon St., Suite 965
Portland, Oregon 97232
Phone: (503) 731-4100
Fax: (503) 731-4066
Website: http://sarvis.dogami.state.or.us/homepage/mission.html
Deputy State Geologist: (503) 731-4100 ext. 228
Earthquake Team Leader: (503) 731-4100 ext. 226
Coastal Team Leader: (541) 574-6642

The Nature of the Northwest Information Center

The Nature of the Northwest Information Center is operated jointly by the Oregon Department of Geology and Mineral Industries and the USDA Forest Service. It offers a selection of maps and publications from state, federal and private agencies.

Contact: The Nature of the Northwest Information Center
Address: 800 NE Oregon Street # 5, Suite 177
Portland, OR 97232
Phone: (503) 872-2750
Fax: (503) 731-4066
Hours: 9am to 5pm Monday through Friday
E-mail: Nature.of.NW@state.or.us
Website: http://www.naturenw.org/

Oregon Department of Forestry

In addition to its other functions, ODF regulates forest operations to reduce the risk of serious bodily injury or death from rapidly moving landslides directly related to forest operations, and assists local governments in the siting review of permanent dwellings on and adjacent to forestlands in further review areas.

Contact: Geotechnical Specialist, Eastern Oregon, Policy Issues
Address: 2600 State Street
Salem, Oregon 97310
Phone: (503) 945-7481
Fax: (503) 945-7490
Website: http://www.odf.state.or.us

Contact: Geotechnical Specialist, Linn and Lane County, Southern Oregon
Address: 1785 NE Airport Road
Roseburg, Oregon 97470-1499
Phone: (541) 440-3412

Contact: Geotechnical Specialist, Northwest Oregon
Address: 801 Gales Creek Road
Forest Grove, Oregon 97116-1199
Phone: (503) 359-7448

Oregon Department of Forestry Debris Flow Warning Page

The ODF debris flow-warning page provides communities with up-to-date access to information regarding potential debris flows. The ODF warning system is triggered by rainfall and monitored in areas that have been determined high hazard for debris flows. As the lead agency, ODF is responsible for forecasting and measuring rainfall from storms that may trigger debris flows. Advisories and warnings are issued as appropriate. Information is broadcast over NOAA weather radio, and on the Law Enforcement Data System. DOGAMI provides additional information on debris flows to the media that convey the information to the interested public. ODOT also provides warnings to motorists during periods determined to be of highest risk for rapidly moving landslides along areas on state highways with a history of being most vulnerable.

Contact: ODF Debris Flow Warning Page
Website: http://www.odf.state.or.us

Sidebar

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Department of Land Conservation and Development (DLCD)

Oregon's Department of Land Conservation and Development (DLCD) administers a natural hazards program to assist local governments in meeting Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards. Activities relating to landslide mitigation include:

- Distribution of model ordinances through which hazards can be mitigated. DLCD advises local governments on which ordinance best meets their needs;
- Review of local land use plan amendments for consistency with state landslide programs and regulations and providing direct technical assistance;
- Provides liaison between pertinent local, state, and federal agencies. DLCD representatives serve on a variety of commissions and ad hoc committees which deal with natural hazards;
- Adopts and amends Statewide Planning Goals and Administrative rules relating to natural hazards.

Contact: Department of Land Conservation and Development
Address: 635 Capitol Street NE, Suite 150
Salem, OR 97301
Phone: (503) 373-0050
Fax: (503) 378-6033
Website: http://www.lcd.state.or.us/

Oregon Department of Consumer and Business Services

The Building Codes Division (BCD) of the Oregon Department of Consumer and Business Services sets statewide standards for design, construction and alteration of buildings that include standards for grading, excavation and fill in the area surrounding the building foundation. The Structural Code also contains requirements for site evaluation of soil and seismic hazard conditions that impact landslides.

Contact: Building Codes Division
Address: 1535 Edgewater ST. NW, P.O. Box 14470
Salem, OR 97309
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/external/bcd

Oregon Department of Transportation (ODOT)

Under Senate Bill 12, ODOT provides warnings to motorists during periods determined to be of highest risk of rapidly moving landslides along state highways with a history of being most vulnerable to rapidly moving landslides.

Contact: ODOT Transportation Building
Address: 355 Capitol St. NE
Salem, OR 97310
Phone: 888-275-6368
Website: http://www.odot.state.or.us/

Oregon State Police (OSP)-Office of Emergency Management (OEM)

In relation to Senate Bill 12 and rapidly moving landslide hazards, OEM coordinates state resources for rapid and effective response to landslide-related emergencies. The Oregon Emergency Response System (OERS) of OEM is a key player in the dissemination of debris flow advisories and warnings. OEM chairs the GIHMT, a body which develops landslide hazard mitigation strategies and measures. OEM administers the FEMA Hazard Mitigation Grant Program, which provides a source of funding for implementing hazard mitigation projects. OEM works with other state agencies to develop information for local governments and the public on landslide hazards.

Contact:	OEM
Address:	595 Cottage Street NE Salem, OR 97301
Phone:	(503) 378-2911
Fax:	(503) 588-1378
OEM State Hazard Mitigation Officer:	(503) 378-2911 ext.247
Recovery and Mitigation Specialist:	(503) 378-2911 ext.240
Website:	http://www.osp.state.or.us/oem/

Department of Geology, Portland State University

Portland State University conducts research and prepares inventories and reports for communities throughout Oregon. Research and projects conducted through the Department of Geology at Portland State University includes an inventory of landslides for the Portland metropolitan region after the 1996 and 1997 floods and a subsequent susceptibility report and planning document for Metro in Portland.

Contact:	Portland State University, Department of Geology
Address:	17 Cramer Hall; 1721 SW Broadway PO Box 751 Portland, OR 97207
Phone:	(503) 725-3389
Website:	http://www.geol.pdx.edu

6.2 Federal Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA Region 10 serves the northwestern states of Alaska, Idaho, Oregon and Washington. The Federal Regional Center (FRC) for Region 10 is located in Bothell, Washington. FEMA is an agency of the federal government whose purpose is to reduce risks, strengthen support systems, and help people and their communities prepare for and cope with disasters regardless of the cause. FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response and recovery."

Contact: Federal Regional Center, Region 10
Address: 130-228th St. SW
Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: www.fema.gov

Natural Resource Conservation Service (NRCS)

The NRCS produces soil surveys. These may be useful to local governments who are assessing areas with potential development limitations including steep slopes and soil types. The NRCS is "a federal agency that works in partnership with the American people to conserve and sustain our natural resources."[55] Their mission is to "provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment."[56] They operate many programs dealing with the protection of these resources.

Contact: Natural Resource Conservation Service, Oregon State Branch
Address: 101 S.W. Main Street, Suite 1300
Portland, OR 97204-3221
Phone: (503) 414-3200
Fax: (503) 414-3103
Website: http://www.or.nrcs.usda.gov/Welcome.html

Contact: Federal Natural Resources Conservation Service
Address: 14th and Independence Ave.
Washington, DC 20250
Website: http://www.nrcs.usda.gov/

Sidebar

Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[53]

Benton, Deschutes, and Tillamook counties, and Multnomah County with the city of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the OSP-Office of Emergency Management in Salem.[54] For more information about Project Impact visit http://www.fema.gov or (http://www.fema.gov/impact/impact00.htm), or contact the OSP-Office of Emergency Management.

6.3 Recommended Landslide Publications

The following documents provide information on a particular aspect of landslide hazard mitigation. These documents represent the principal resources communities can use to better plan for landslide hazards. They are key tools for reducing the risks associated with landslide-prone areas.

Geologic Hazards: Reducing Oregon's Losses, Special Paper 32. Beaulieu, J.D. and Olmstead, D.O. (1999) Dept. of Geology and Mineral Industries

Characterization of geologic hazards, specific multi-hazard considerations and the interrelationships of geologic hazards, and geologic hazard risk reduction. Outlines the responsibilities and limitations of state agencies including OEM, DLCD, ODF, Building Codes, local agencies, and DOGAMI's coordination role in risk reduction activities. Provides a matrix on strategies to reduce risk and legal considerations.

To obtain this resource contact: DOGAMI (see State Resources for contact information).

Joint Interim Task Force on Landslides and Public Safety - Report to the 70th Legislative Assembly (1998).

Glossary of key terms and relationship to the Statewide Planning Goals – specifically Goal 7. Discussion on forest practices and landslides, best management practices and the authority of ORS 527.630. Discusses non-forest area slides and case studies (West Hills area in Portland) and provides a summary of insurance issues.

To obtain this resource contact: The state library in Salem.

Landslide Loss Reduction: A Guide for State and Local Government Planning. World, Robert L & Jochim, Candace L., FEMA, Colorado Division of Disaster Emergency Services and Colorado Geological Survey

Comprehensive information on landslide related issues. Addresses the benefits of mitigation, planning as a means of loss reduction, local government roles, causes and types of landslides and the relationships between landslides and floods, and landslides and seismic activities. The journal also looks at the planning process, an inventory of landslide costs, and evaluation of mitigation projects and techniques.

To obtain this resource contact: FEMA (see Federal Resources for contact information).

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Landslides in Oregon Brochure, Oregon Department of Forestry, Oregon Department of Geology and Mineral Industries, Department of Consumer and Business Services, OSP-Office of Emergency Management

Oregon-specific information on landslides and debris flows. Provides, pictures and graphics, and information on state agencies and their roles in landslide mitigation activities.

To obtain this resource contact: DOGAMI (see State Resources for contact information).

Landslides Investigation and Mitigation, Special Report 247. Turner, Keith A., Schuster, Robert L. (Editors)(1996) Transportation Research Board, National Research Council, National Academy Press, Washington DC.

Mitigating Geologic Hazards in Oregon: A Technical Reference Manual, Special Paper 31. Beaulieu, J.D., and Olmstead, D.O. (1999) Department of Geology and Mineral Industries

To obtain this resource contact: DOGAMI (see State Resources for contact information).

Planning for Hillside Development. Olshansky, Robert B. (1996) American Planning Association Planning Advisory Service Report Number 466

This document describes the history, purpose and functions of hillside development and regulation, the role of planning, and provides excerpts from hillside plans, ordinances and guidelines from communities throughout the U.S.

To obtain this resource: Check your local library or contact the American Planning Association.

Regulation of Hillside Development in the United States. Olshansky, Robert B. (1998) In Environmental Management (Vol. 22, No.3, pp 383-392)

Provides a history of hillside development and the differing views on how and why regulations are developed. Discussion regarding the purpose of hillside regulation including aesthetics, natural phenomena, health, safety and general welfare, natural resources, geologic hazards, fire protection and access.

To obtain this resource: Check your local library.

State of Oregon - Natural Hazards Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) OSP-Office of Emergency Management

To obtain this resource contact: Oregon Emergency Management (see State Agency Resources for contact infor mation).

Unstable Ground: Landslide Policy in the United States. Olshansky, Robert B. and Rogers, J. David (1987) Ecology Law Quarterly pg.939

To obtain this resource: Check your local library.

USGS Landslide Program Brochure. National Landslide Information Center (NLIC), United States Geologic Survey

Good, general information in simple terminology. Information on the importance of landslide studies and a list of databases, outreach and exhibits maintained by the NLIC. The brochure also includes information on types and causes of landslides, falls and flows, features that may indicate catastrophic landslide movement.

To obtain this resource contact:

USGS - MS 966, Box 25046
Denver Federal Center
Denver, CO 80225
Tel. (800) 654-4966
Fax (303) 273-8600
Email: highland@gldvxa.cr.usgs.gov
Web: http://geohazards.cr.usgs.gov/

Database of Slope Failures in Oregon For Three 1996/97 Storm Events. Hofmeister, R.J., (2000) Oregon Department of Geology and Mineral Industries, Special Paper.

To obtain this resource contact: DOGAMI (see State Resources for contact information).

Storm Impacts and Landslides of 1996 Final Report. (1999) Oregon Department of Forestry.

This 145-page technical document contains the findings of a three-year monitoring project to evaluate the effects of the extreme storms that struck Oregon in 1996. This ground-based study sought to determine the accuracy and precision of remote sensing data in identifying landslides, stream channel impacts and landslide-prone areas. The study reports on landslide frequency and channel impacts, particularly as they relate to forest practices. The study also evaluated different timber harvesting, road construction and road drainage practices.

To obtain this resource contact: Oregon Department of Forestry, Forest Practices Section, (503) 945-7470.

6.4 Internet Resources

DOGAMI

http://sarvis.dogami.state.or.us
The DOGAMI web page includes information on landslide databases, coastal programs, earthquakes, an oil and gas page, a list of publications and access to the Nature of the Northwest Information Center. There is also a mined-land reclamation section and contact information for the Salem headquarters and other field offices.

Oregon Department of Forestry – Debris Flow

http://www.odf.state.or.us/gis/debris.html
This website provides a listing and access to Geographic Information System maps for counties in Western Oregon that have been mapped by Oregon Department of Forestry for debris flow hazards.

Landslide Web Page - U.S. Geological Survey

http://landslides.usgs.gov/
The landslide web page of the U.S. Geological Survey and the website for the National Landslide Information Center (NLIC) offers compehensive landslide information, as well as indexes to landslide publications available both in hard copy and on-line. The first site describes the National Landslide Hazards Program, lists landslide program publications and current projects, and describes recent landslide events. The NLIC site provides "real-time" monitoring of an active landslide in California, San Francisco Bay area landslide maps, links to landslide information for each state, landslide images, other useful links, a virtual fieldtrip of a Colorado landslide, and access to a new on-line bibliographic database.

Natural Hazards Research and Applications Information Center

http://www.colorado.edu/hazards
Publisher of Natural Hazards Observer newsletter, containing articles on hazards mitigation and listings of other hazard websites.

The International Landslide Research Group

http://ilrg.gndci.pg.cnr.it/
The International Landslide Research Group (ILRG) is an informal group of individuals concerned about mass earth movement and interested in sharing information on landslide research. The ILRG website currently provides all back issues of the group's newsletter, with information about landslide programs, new initiatives, meetings and publications, and the experiences of people engaged in landslide research.

Federal Emergency Management Agency (FEMA)

http://www.fema.gov/pte/prep.htm
The Federal Emergency Management Agency (FEMA) website provides "fact sheets" - including preparedness tips - concerning most natural and technological hazards. A fact sheet on landslides is available at http://www.fema.gov/library/landslif.htm.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce landslide risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical information and assistance provided by Oregon agencies to assist your community in planning for landslide hazards?
- ❒ What documents or technical assistance does your community need to find to further understanding of landslide hazards and begin the process of assessing community risk from landslide hazards?

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PLANNING FOR NATURAL HAZARDS:

Coastal TRG

July 2000

Oregon Department of Land Conservation & Development

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Community Planning Workshop

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Section 1:
Introduction to the Coastal Technical Resource Guide

Coastal hazards include: ocean flooding, beach and dune erosion, dune accretion, bluff recession, and landslides. Human activities can contribute to and increase the severity of hazards, and coastal communities in Oregon must know what hazards they are subject to and be prepared to address them. The purpose of this guide is to help planners, local decision-makers, and community leaders reduce risk to life and property from coastal hazards. The guide is designed to help your local government address coastal hazard issues through effective comprehensive plan inventories, policies and implementing measures.

1.1 The Threat of Coastal Hazards to Oregon Communities

Coastal communities are subject to a variety of life threatening geologic and climatic hazards. Nationally, weather related losses from hurricanes and other storms cause billions of dollars in damage and many deaths each year. Chronic erosion, landslides and flooding all result from an annual barrage of wind and waves driven by storms battering the Oregon Coast, causing ever-increasing property damage and loss. Geologic hazards, such as offshore subduction zone earthquakes and the resulting tsunamis, occur on the Pacific Coast and can have catastrophic impacts on coastal communities' residents and infrastructure. There is no location on the Oregon coast that is immune to coastal hazards.

Population changes on the coast and development pressures have led to construction in hazard areas, and the most desirable locations are often the most at risk. The economic impacts of natural disasters on businesses, private citizens, the public sector, and infrastructure can be quite significant. Storm damage to infrastructure in Oregon results in significant long-term costs due to road closures, lost business and reduced services.[1] By regulating development in areas of known risk, communities can better protect life, property and economic livelihood.

Tip Box

Organization of the Natural Hazards Technical Resource Guide

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goal 2,7,17 and 18, a resource directory and a land use tools matrix for hazard mitigation.

1.2 How to Use the Coastal Technical Resource Guide:

The Coastal Technical Resource Guide provides information to help communities in Oregon plan for coastal hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about coastal hazards.

Section 2:
Is Your Community Threatened by Coastal Hazards?

Section 2 presents an overview of the causes and characteristics of coastal hazards, and provides information to assist communities in coastal hazard identification.

Section 3:
What are the Laws in Oregon for Coastal Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for coastal hazards.

Section 4:
How can Your Community Reduce Risk from Coastal Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from coastal hazards.

Section 5:
How are Oregon Communities Addressing Coastal Hazards?

Section 5 examines how three Oregon communities are reducing risks from coastal hazards. These examples illustrate plan policies and implementing measures for coastal hazards.

Section 6:
Where can Your Community find Resources to Plan for Coastal Hazards?

Section 6 is a resource directory listing contacts, programs, and documents that planners, local governments and citizens can use to get more information on coastal hazards.

Section 2:
Is Your Community Threatened by Coastal Hazards?

Identifying hazard areas is a key step in developing effective plan policies and implementing measures. This section assists local planners and decision-makers in understanding how coastal hazards may affect current and future development. An overview of the causes and characteristics of coastal hazards, and information on identifying coastal hazards in your community is also included.

2.1 What are Coastal Hazards?

The Oregon coastal zone is subject to the same natural hazards that exist in non-coastal regions: flooding, landslides resulting from slope instability, forest fires, and earthquakes. In addition, a variety of processes at work in the near-shore zone present hazards that are unique to coastal areas. These include coastal flooding from storm surges or tsunamis, periodically high rates of beach erosion, and mass wasting of sea cliffs due to wave attack and geologic instability. These processes can interact in complex ways, increasing natural hazard risk in coastal areas.

2.2 How are Coastal Hazards Classified?

Natural hazards that affect coastal regions can be divided into two general classes - chronic and catastrophic.

> *Chronic hazards* are those we can see clear evidence of along the shore – beach, dune, and bluff erosion, landslides, slumps, gradual weathering of sea cliffs, and flooding of low-lying lands during major storms. The damage caused by chronic hazards is usually gradual and cumulative. The regional, oceanic and climatic environments that result in intense winter storms determine the severity of chronic hazards along the coast.
>
> *Catastrophic hazards* are regional in scale and scope. Cascadia Subduction Zone earthquakes, and the ground shaking, subsidence, landsliding, liquefaction, and tsunamis that accompany them are catastrophic hazards.

Chronic hazards are local in nature, and the threats to human life and property that arise from them are generally less severe than those associated with catastrophic hazards. However, the wide distribution and frequent occurrence of chronic hazards makes them a more immediate concern.

Oregon coastal communities should focus planning efforts on the chronic coastal hazards of flooding, erosion and landslides. Due to the relative infrequency of catastrophic events, this guide does not provide detailed evacuation plans or other information to assist in planning for catastrophic hazards. The coastal guide does provide information on the occurrence of coastal earthquakes and tsunamis.

Tip Box

Hazard Inventories

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

TRG Key

More information on tsunamis and seismic events can be found in the Seismic Hazard Technical Resource Guide.

Sidebar

Sand Inundation

The concepts of sand supply and the sediment budget involve viewing a given segment of shoreline in terms of the positive or negative transfers of sediment that occur within it. The resultant balance of the sediment budget is determined by comparing the volume of sediment gained from sources (positive transfers) to the volume lost to sinks (negative transfers). A negative balance means that more sand is leaving than is arriving and, as a result, that segment of shoreline is eroding. Conversely, a positive balance means that more sand is arriving than is leaving so that the segment of shoreline is expanding. Along the Oregon coast, potential sources of sand include rivers, bluffs, dunes, and the inner shelf. Potential sinks include, bays, dunes, offshore dredging, and mining.

Attention is often focused on the effects of beach and dune erosion. Yet, there are segments of Oregon's coast where the principal dilemma is too much sand deposition. These areas tend to be located at the north ends of headland-bounded segments of shoreline. While growth in the height and width of the foredune in these areas has enhanced ocean flood/erosion protection potential, the rapid and heavy sand accumulation has also resulted in the inundation of dwellings, restriction of ocean views, and loss of beach access.[5]

2.3 What are the Conditions that Contribute to Coastal Hazards?

Wave attack and *mass wasting* are short term, chronic events resulting in coastal flooding, erosion, and landslides. These natural events operate over relatively short time periods in limited geographic areas and affect shoreline stability. *Human activities* also produce conditions that contribute to coastal hazards.

Factors Affecting Shoreline Stability

Wave attack, mass wasting and human activities are factors that operate across a broad range of geographic areas and time frames. Figure 1 illustrates the distinction between long-term trends and short-term events affecting shoreline stability and should be used as a reference to illustrate the information provided in this section. Because the main factor(s) affecting shoreline stability vary from setting to setting, it is useful to make a distinction between *dune-backed*, *bluff-backed*, *slide-backed*, and *inlet-affected* segments of shoreline.

2.3.1 Wave Attack

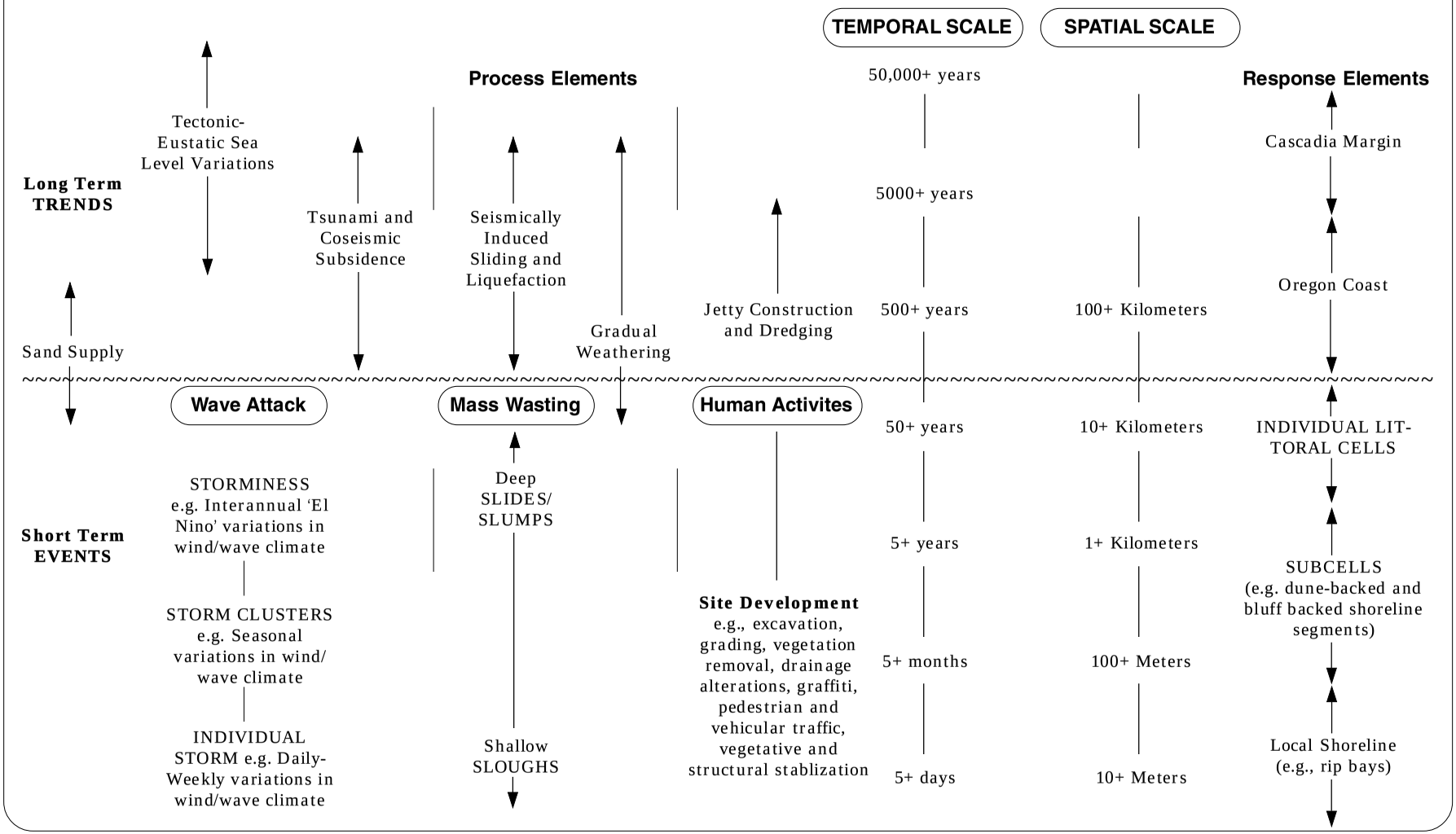
Along dune-backed shorelines, processes of wave attack, including *wave overtopping* (e.g., flooding) and *undercutting* (e.g., erosion), are the primary processes affecting shoreline stability. Ocean flooding occurring during storms is seen at the shoreline as wave runup, and results from the simultaneous occurrence of long-term water level elevations and short-term storm events.

Wave Attack

DLCD Coastal Division

Because winds and waves tend to arrive from the southwest during the winter and from the northwest during the summer, Oregon coast littoral cells (defined later in this section) generally exhibit a seasonal reversal in the direction of sand trans-

Figure 1: Factors Affecting Shoreline Stability along the Oregon Coast



Source: *Shoreland Solutions. Chronic Coastal Natural Hazards Model Overlay Zone. Salem, Ore.: Oregon Department of Land Conservation and Development (1998) Technical Guide-3.*

port along the shoreline. Specifically, net sand transport tends to be offshore and to the north in winter and onshore and to the south during the summer. El Nino events have been shown to exaggerate the characteristic seasonal pattern of erosion and accretion. For example, significant short-term variation in shoreline extent and location has been associated with the 1982-83 and 1997-1998 El Nino events.[2]

The processes of wave attack significantly affect shorelines characterized by indentations, known as inlets. Wave attack processes interact with ocean tides and river forces to control patterns of inlet migration. Recent examples of the importance of inlet dynamics are the Bayshore Spit at Waldport and the Netarts Spit near Oceanside.

2.3.2 Mass Wasting

Along bluff-backed and slide-backed shorelines, processes of mass wasting affect shoreline stability. Mass wasting refers generally to a broad range of gravity-driven rock, soil, or sediment mass movements. This includes weathering processes that result in gradual bluff recession, such as direct wind and rain impact. For the purposes of this guide, the term mass wasting refers to episodic slope movements also known as landslides. The distinction between mass wasting in bluff-backed and slide-backed shorelines results from differences in the scale of slope movement. Simple surface *sloughing* is the dominant process along bluff-backed shorelines. Complex deep-seated *landsliding* and *slumping* are the dominant processes along slide-backed shorelines. Landslides move in contact with the underlying surface and can include rockslides – the downslope movement of a rock mass along a plane surface. Slumps are the sliding of material along a curved (rotational slide) or flat (translational slide) surface.[3]

Mass Wasting

DLCD Coastal Division

A number of factors affect slope stability by acting to increase driving forces and/or reduce resisting forces. The geologic composition of the bluff is a primary control on slope stability. Headlands, generally composed of basalt, while not immune to mass wasting, do not readily give way. In contrast, soft bluff-forming sandstone and mudstone are highly susceptible to slope movement. Prolonged winter rains saturate these porous bluff materials, both loading the slope and lowering cohesive strength to further decrease slope stability. The geometry and structure of bluff materials also affect slope stability by defining lines of weakness and controlling surface and subsurface drainage. By removing sediment from the base of bluffs and by cutting into the bluffs themselves, processes of wave attack may also affect slope stability. The extent to which the beach fronting the bluff acts as a buffer is important in this regard.[4]

2.3.3 Human Activities

Human activities affect the stability of all types of shoreline. Large-scale human activities such as jetty construction and maintenance dredging are factors that affect shoreline stability for longer time periods and larger geographic areas. This is particularly true along dune-backed and inlet-affected shorelines. Cumulative effects of shoreline hardening and specifically, the planting of European Beachgrass, have markedly affected shoreline stability along dune-backed shorelines of the Oregon coast.

Examples of human activities that affect shoreline stability over shorter time periods and smaller geographic areas include those associated with residential and commercial development. Activities such as grading and excavation, surface and subsurface drainage alterations, vegetation removal, and vegetative as well as structural shoreline stabilization can all affect shoreline stability. With the exception of the latter two, these activities tend to be a particular concern along bluff-backed shorelines. Pedestrian and vehicular traffic, typically associated with heavy recreational use, are other types of human activities that affect shoreline stability over shorter time and smaller space scales. Because these activities may result in the loss of fragile vegetative cover, they are a particular concern along dune-backed shorelines. Along bluff-backed shorelines graffiti carving associated with heavy recreational use can be added to the list of human activities that affect shoreline stability.[6]

Tip Box

Tsunami Inundation Zones

Under the authority of ORS 516.090, the Department of Geology and Mineral Industries (DOGAMI) has mapped tsunami inundation zones in coastal communities. The maps should be used by local governments for the purpose of developing evacuation routes and to identify areas where the development of certain critical and essential facilities, and major structures are restricted in accordance with ORS 455.446 and 455.447 (refer to Section 3's examination of Oregon Building Codes in this guide). Local governments can work with DOGAMI to create maps and develop evacuation routes. A listing of DOGAMI maps is included in Section 2 of the Seismic Technical Resource Guide.

2.4 What are the Causes of Catastrophic Coastal Hazards (Earthquakes and Tsunamis)?

Earthquakes and the resulting tsunamis occur over larger geographic areas and time frames than chronic coastal hazards. Although not as frequent in occurrence, the damage caused by these catastrophic events is immediate and life threatening.

Subduction zone earthquakes off Oregon's coast can be generated along the sloping boundary between the descending Juan de Fuca plate and the North American plate. This area — known as the Cascadia Subduction Zone — could produce an earthquake of magnitude 8.0 to 9.0, or greater. An earthquake of this size would cause enormous damage to the coast and large portions of Western Oregon. In many areas, especially on the coast, liquefaction and landslides could damage buildings and their foundations, destroy bridges and cause massive loss of life. A subduction earthquake could last as long as four minutes.[7]

Recently, a great deal of attention has been given to Cascadia Subduction Zone earthquake events. Summarizing the work of a number of investigators, DOGAMI (1995) suggests that the Oregon coast could experience a magnitude 8 or 9 earthquake in the near future. Specifically, they report that there is a 10 percent to 20 percent chance that such an earthquake event could occur in the next 50 years. Geologists, by studying a series of buried wetland soils and trees, discovered that earthquakes of this magnitude occur on average once every 500-600 years, with some gaps between events as little as 200 years and as large as 1,000 years. Analysis of detailed Japanese records (spanning over 400 years) on damage-causing tsunamis suggests that the last Cascadia Subduction Zone earthquake was a magnitude 9 event that occurred at about 9:00 P.M. on January 26, 1700.[8] This is consistent with Native American legends, which say the earthquake occurred on a winter night.[9]

Such an event would produce more than just ground shaking damage. Earthquake induced liquefaction, landsliding, subsidence and tsunami events would also occur. A generalized scenario of such an event includes the following. At the onset, the great subduction earthquake produces severe ground shaking which could last as long as four minutes. During this time, amplification and liquefaction effects occur in areas of unconsolidated, saturated sediment. Massive ancient landslides are reactivated. Rapid, coast-wide subsidence on the order of two to six feet also occurs in association with the release of accumulated strain during the earthquake. Although flooding associated with subsidence would occur immediately in some low-lying areas, the effects of subsidence are more likely to be manifest over the long term as increased flooding and coastal erosion during storms. This scenario is further complicated by the likely occurrence of locally generated tsunamis expected to arrive within 5 to 40 minutes after the initial earthquake and to continue to arrive at intervals over a period of several hours. Shorelines of bays, estuaries, and low-lying sand barriers would experience immediate flooding and erosion.[10]

Back Forward

2.5 How are Coastal Hazards Identified?

Standardized coastwide mapping (1"=1 mile) and assessment of coastal natural hazards was conducted in 1973 by the state's principal hazard research agency, the Department of Geology and Mineral Industries (DOGAMI). Since then, most counties and cities have prepared more detailed hazard assessments for comprehensive land use planning. There have also been other hazard studies for dune management and development site planning or shore protection. FEMA has mapped flood hazards, including oceanfront "velocity" zones. DOGAMI has also mapped tsunami "run-up" zones for coastal areas. There have been significant advances in understanding coastal hazards and processes through research on beach erosion, sea cliff recession, and the impacts of shore protection structures. This research produces information which can enhance existing hazard inventories.

2.5.1 Flood Maps

Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies are also often used in characterizing and identifying flood-prone areas.

The Flood Insurance Studies and FIRMs produced for the National Flood Insurance Program provide assessments of the probability of flooding at a given location. Water surface elevations are combined with topographic data to develop FIRMs. FIRMs illustrate areas that would be inundated during a 100-year flood. In some cases, FIRMS also include floodway areas, elevations marking the 100-year-flood level (the base flood elevation or BFE) and areas located within the 500-year floodplain.[11] FIRMs delineate Special Flood Hazard Areas, or floodplains where National Flood Insurance Program regulations apply.

FEMA conducted many Flood Insurance Studies in the late 1970s and early 1980s. These studies and maps represent flood risk at the point in time when FEMA completed the studies. They do not reflect changes within the study area that might affect flooding since the studies.

TRG Key

For more information on flood maps see Section 2 of the Flood Technical Resource Guide.

2.5.2 Littoral Cells

Headlands divide the Oregon coast into compartments that form ideal planning and scientific boundaries. Basalts deposited some 15 to 45 million years ago form the resistant headlands on the Oregon coast. These prominent features restrict longshore transport of sediment and thereby define discrete segments of shoreline, also known as littoral cells. Twenty-one littoral cells have been identified along the Oregon coast.

Littoral Cells and Planning

A littoral cell management plan is a comprehensive, integrated, area-wide hazard management strategy unique to different physical and social settings found along the Oregon coast. It is focused on the reduction of risk to new and existing oceanfront development from chronic coastal natural hazards. A littoral cell management plan should include: littoral cell inventories, a chronic hazards manage-

ment strategy, and implementing mechanisms. For detailed information contact the Department of Land Conservation and Development (see Section 6) for a copy of Littoral Cell Management Planning along the Oregon Coast.

2.6 Summary: Identifying Coastal Hazards in Your Community

Communities can identify coastal hazard locations by knowing the geologic and geographic factors of their environment, and through mapping and inventories.

Progress is being made by the DLCD and other agencies to increase assistance to communities in developing inventories based on sound technological research. While this process takes significant time to complete, there are a variety of strategies communities and state agencies can use to improve their inventories:

- ❒ *Establish criteria and standards* for collecting, reporting, and mapping information about chronic and catastrophic coastal natural hazards.
- ❒ *Inventory and catalog* existing coastal natural hazards studies, maps, digital data, and other information available from city, county, state, federal, university, private, and other resources.
- ❒ *Develop standardized coastal hazard maps* for priority areas along the Oregon Coast.
- ❒ *Fund basic and applied research* on chronic coastal hazards based on: alternative shore protection methods, effects of hard shore protection structures, near-shore circulation processes and sediment budgets, sea cliff erosion processes, and other hazard processes.[12]

TRG Key

The first step of hazard assessment is hazard identification, estimating the geographic extent, intensity and occurrence of a hazard. More information on the three levels of hazard assessment can be found in Chapter 2: Elements of a Comprehensive Plan.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment will examine identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following questions in determining whether or not your comprehensive plan has adequately inventoried coastal hazards.

- ❒ Are there coastal hazards in your community?
- ❒ Does your comprehensive plan hazard inventory describe coastal hazards in terms of the geographical extent, the severity and the frequency of occurrence?
- ❒ Has your community conducted a community wide vulnerability assessment?

Section 3:
What are the Laws in Oregon for Coastal Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Coastal Technical Resource Guide presents laws that Oregon communities are required to address.

3.1 Oregon Laws Related to Coastal Hazards

3.1.1 Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning requirement that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states that "Developments subject to damage or that could result in loss of life shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards..."

3.1.2 Goal 17: Coastal Shorelands

The purpose of Goal 17 is to conserve, protect, develop, and where appropriate, restore the resources and benefits of all coastal shorelands. In addition, Goal 17 aims to reduce the risks to human life and property. Goal 17 provides for the protection of major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources included in community inventories.

Coastal shoreland *inventories* are required to identify and provide information on the nature and location of areas subject to geologic and hydrologic hazards within the designated coastal shorelands planning area. These areas include lands subject to ocean flooding and within 100 feet of the ocean shore or within 50 feet of an estuary or coastal lake, and adjacent to areas of geologic instability related to or impacting a coastal water body.

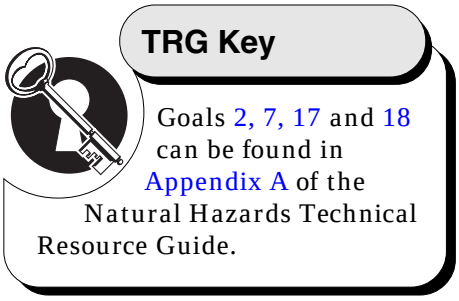
Goal 17's implementation requirements include:

- Development of special practices by the Department of Forestry to protect and maintain the coastal shoreland;
- Identification of shoreland areas that shall be protected to fulfill the mitigation requirement of the Estuarine Resources Goal;
- Maintenance of riparian vegetation;
- Land use management practices and non-structural solutions to problems of erosion and flooding are preferred to structural solutions; and
- Local government and the Oregon Parks and Recreation Department (OPRD) will work to increase and retain public access.

3.1.3 Goal 18: Beaches and Dunes

Goal 18 is designed to conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of coastal beach and dune areas. The goal also aims to reduce the hazard to human life and property from natural or man-induced actions associated with these areas. Coastal areas subject to this goal include beaches, active dune forms, recently stabilized dune forms, older stabilized dune forms and interdune forms.

Uses shall be based on the capabilities and limitations of beach and dune areas to sustain different levels of use or development, and the need to protect areas of critical environmental concern, areas having scenic, scientific, or biological importance, and significant wildlife habitat as identified through application of Goals 5 and 17.



Inventories are required to identify and designate beach and dune uses and policies. The inventories describe the stability, movement, groundwater resource, hazards and values of the beach and dune areas. These areas include beaches, dune and interdune forms.

Goal 18's implementation requirements include the following.

- Decisions on coastal plans will be based on specific findings.
- Local governments, and state and federal agencies shall prohibit developments on active foredunes, dune areas subject to ocean undercutting and wave overtopping, and interdune areas subject to ocean flooding.
- State and local agencies will regulate actions within these areas to minimize erosion and groundwater drawdown. Foredunes shall be breached only to replenish sand supply in interdune access areas and only if breaching and restoration after breaching is consistent with sound principles of conservation.
- Local governments are required to identify areas that were developed prior to January 1, 1977. Only these properties are eligible for permits to have beachfront protective structures.

Goal 18's guidelines suggest that local governments adopt strict controls for carrying-out implementation requirements for evaluating beach and dune plans. These controls should include: the requirement of a site investigation report financed by the developer, the posting of performance bonds to assure that adverse effects of development can be corrected, and the requirement of re-establishing vegetation within a specific time.

Foredune grading needs to be planned for on an area-wide basis because the geologic processes of flooding, erosion, sand movement, wind patterns, and littoral drift affect entire stretches of shoreline. Dune grading cannot be carried-out effectively on a lot-by-lot basis because of area-wide processes and the off-site effects of changes to the dunes.

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3.1.4 Ocean Shore Regulation

The Oregon Parks and Recreation Department (OPRD) is responsible for protecting the scenic, recreational, and natural resource values of the Oregon coast. OPRD accomplishes this through an extensive permitting program for shoreline protection under the authority of The Ocean Shore Law (ORS 390.605 – 390.770), also known as the "Beach Bill." While not responsible for activities above the statutory vegetation line, the survey line, or the line of established vegetation, OPRD is the permitting authority for actions affecting the ocean shorelands. This distinction can be seen visually at the line of established vegetation that backs the shoreline.

The Division of State Lands (DSL) has co-authority with the OPRD over rocky intertidal areas. The DSL manages the state-owned seabed within three nautical miles of low tide at the ocean shore. Specifically, the DSL regulates removal and filling of seabed and estuaries, including any dredged materials or seabed minerals. DSL may also issue leases for the harvest of Bull Kelp, a large seaweed in rocky areas of Oregon's coast.

The Beach Bill requires that a permit be obtained from the OPRD for all "beach improvements" west of a surveyed beach zone line. Communities can check their comprehensive plan or contact OPRD to obtain the location of this surveyed line. The Removal/Fill Law and implementing regulations (ORS 196.800 – 196.990) contain specific standards and requirements for riprap and other bank and shore stabilization projects in areas that extend from the Pacific Ocean shore to the line of established upland vegetation or the highest measured tide, whichever is greater. OPRD administers the removal/fill regulations jointly with the Ocean Shore Permit Authority. Activities permitted under these regulations are required to comply with the Statewide Planning Goals and be compatible with corresponding provisions of local comprehensive plans.[13] *Permits for shoreline protective structures may be issued only when development existed prior to January 1, 1977, as required under Goal 18.*

Foredune management plans, often implemented as hazard mitigation strategies, require a permit from OPRD because these strategies affect the structure of the shoreline. Other hazard mitigation strategies that require OPRD approval include: natural product (dirt) removal, resloping of a vertical bank below the statutory line of vegetation, and mitigating for erosion by altering the course of a stream that flows into the ocean.

When a community expresses interest in implementing hazard mitigation projects, the following process is completed by OPRD:

1. Permit request
2. Public notice and review period
3. Notice posted at site
4. Mailing sent to interested parties
5. Thirty day comment period
6. If a hearing is scheduled, OPRD has 45 days after the hearing to announce its decision.
7. If a hearing is not requested, OPRD has 60 days from the original request to announce its decision.

3.1.5 Oregon State Building Codes

The Oregon Building Codes Division adopts statewide standards for building construction that are administered by state and local municipalities throughout Oregon. ORS 455.447 and the Structural Code establish restrictions on the location of emergency response facilities, critical facilities, such as hospitals, fire and police stations and special occupancy structures, such as large schools and prisons, in tsunami inundation zones along the coast. There are exceptions from the statute for existing facilities and water dependent development as well as exemptions for certain facilities based on the need for strategic location or school district boundaries.

The One- and Two-Family Dwelling Code and the Structural Specialty Code contain provisions for elevating buildings in flood prone areas at least one foot above the base flood elevation. These codes contain provisions for flood proofing, underfloor drainage and directing storm water away from buildings. The local building department having jurisdiction, generally coordinates with others to ensure that permit applications for new construction meet these requirements. Verification of the floor elevation is obtained during the permitting and inspection process. State building codes contain provisions for design and construction of buildings subject to ground shaking from earthquakes.

Coastal areas are subject to significant subduction type seismic activity. The northern coast is currently designated as Zone 3. Zone 4 extends from Otter Rock (just north of Newport) to the southern border of the state. These are the two highest risk zones addressed by building codes. The codes also contain provisions for the design and construction of buildings to resist lateral loads from earthquakes. The Dwelling Code simply incorporates prescriptive requirements for foundation reinforcement and framing connections based on the applicable seismic zone for the area.

TRG Key

For more information on seismic zones, refer to Section 2 of the Seismic Technical Resource Guide.

The Structural Code contains more detailed engineering requirements for the design of larger and unusually shaped buildings. ORS 455.447 and the Structural Code require a seismic site hazard report to be performed for projects including essential facilities such as hospitals, fire and police stations and emergency response facilities, and special occupancy structures, such as large schools and prisons. The report must take into consideration such things as the seismic zone, tsunami inundation zones, soil types including identification of liquefaction soils, any known geologic faults or activity and potential landslides. The findings of the report must be taken into consideration in design of the building. Any site that has a soils report where the lot is found to contain expansive soils is also required to have that information documented and filed with the deed for the property. The building codes do not regulate public utilities and facilities constructed in public right-of-ways such as bridges that are regulated by the Department of Transportation.[14]

3.2 Federal Programs Related to Coastal Hazards

3.2.1 National Flood Insurance Program (NFIP)

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP). The NFIP was created by Congress in 1968 to minimize the response and recovery costs, and reduce the loss of life and damage to property caused by flooding. The four goals of the NFIP are to:

1. Provide flood insurance coverage not generally available in the private market;
2. Stimulate local floodplain management to guide future development;
3. Emphasize less costly nonstructural flood control regulatory measures over structural measures; and
4. Reduce costs to the federal government by shifting the burden from the general taxpayer to floodplain occupants.

The two fundamental objectives of the NFIP are to:

1. Ensure that new buildings will be free from flood damage; and
2. Prevent new developments from increasing flood damage to existing properties.[15]

TRG Key

For a more complete discussion of flood hazards and the National Flood Insurance program, see the Flood Technical Resource Guide.

Community Participation in the NFIP

Participation in the NFIP by a community requires the adoption and enforcement of a floodplain management ordinance that controls development in the floodplain. Such an ordinance should ensure that a community is in compliance with NFIP requirements, under which a jurisdiction is responsible for the following:

1. Requiring development permits for all proposed construction and other developments within the community's designated 100-year floodplain;

2. Reviewing the permit to be sure that sites are reasonably safe from flooding;
3. Reviewing subdivision proposals to determine whether the project is safe from flooding and provides adequate drainage;
4. Requiring residential structures to have the lowest floor (including basement) elevated to one foot above Base Flood Elevation (BFE);
5. Requiring non-residential structures to have the first floor elevated or flood proofed one foot above BFE;
6. Requiring manufactured homes to be elevated and anchored;
7. Requiring water supply systems to be designed to eliminate infiltration of flood waters;
8. Requiring new replacement sanitary sewage systems to be designed to minimize or eliminate infiltration of flood waters;
9. Ensuring flood carrying capacity of altered or relocated watercourses is maintained;
10. Maintaining records of all development permits; and
11. Verifying and documenting first-floor elevations of new or substantially improved structures.

V-Zone Construction

In many of Oregon's coastal communities, FEMA has mapped "V zones" (velocity zones), areas of special flood hazard that are subject to high velocity wave action from storm surges or seismic events. Because of the potential force associated with this wave action, special regulations apply for new construction and substantial improvements in "V zones."

In coastal "V zones," all new and substantially improved structures must be elevated on pilings and columns so that:

- The bottom of the lowest horizontal structural member of the lowest floor is elevated to one foot or more above the 100-year flood level
- The pile or column foundation and attached structure are anchored to resist flotation, collapse, and lateral movement from wind and water loads acting simultaneously on all building components
- The space below the lowest floor is either free of all obstructions or is constructed with non-supporting breakaway walls

In V-zones, fill cannot be used for the structural support of buildings nor can sand dunes be altered in a manner that will increase flood potential.

3.2.2 Army Corps of Engineers Permit Program

The U.S. Army Corps of Engineers is responsible for the protection and development of the nation's water resources, including navigation, flood control, energy production through hydropower management, water supply storage and recreation. The Corps administers a permit program to ensure that the nation's waters are used in the public interest, and requires any person, firm, or agency planning work in the waters of the United States to first obtain a permit from the Corps. Permits are required even when land next to or under the water is privately owned. It is a violation of federal law to begin work before a permit is obtained and penalties of fines and/or imprisonment may apply. Examples of activities in waters that may require a permit include: construction of a pier, placement of intake and outfall pipes, dredging, excavation and depositing of fill. Permits are generally issued only if the activity is found to be in the public interest. Local planning agencies are required to sign off on any permits issued by the U.S. Army Corps of Engineers.[16]

3.3 Summary: State and Federal Coastal Hazard Laws and Programs

State Policies

- ❒ Oregon Statewide Planning Goal 7
- ❒ Oregon Statewide Planning Goal 17
- ❒ Oregon Statewide Planning Goal 18
- ❒ Oregon Parks and Recreation Department / Division of State Lands Fill and Removal Permit Program
- ❒ Oregon State Building Codes

Federal Policies

- ❒ National Flood Insurance Program
- ❒ Army Corps of Engineers Permit Program

A number of state and federal agencies are involved in regulating land use in and near coastal hazards. Local planning departments must coordinate their review of development permits for coastal hazard areas with other agencies. For example:

1. Permits for new structures in coastal hazard areas should be coordinated with the State Building Codes Division;
2. Coastal developments need to comply with State Land Use Goals 17 and 18.[17]

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. Section 3 of the Coastal Technical Resource Guide describes laws that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying coastal hazards in your area:

- ❒ Does your community's comprehensive plan contain an inventory of coastal hazards, a vulnerability assessment and policies addressing coastal hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on ocean shore regulation, V-zone construction, and other coastal policy issues?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in coastal hazard areas?

Section 4:
How can Your Community Reduce Risk from Coastal Hazards?

Avoiding development in hazard areas is the most effective way to reduce risk. There are, however, many areas in Oregon where some degree of hazard is unavoidable. Communities in vulnerable areas should manage and reduce their risk from coastal hazards if the risk cannot be completely eliminated.

Section 4 describes methods for site-specific development evaluation and implementing measures to reduce risk from coastal hazards. Implementing measures are the ordinances and programs used to carry out decisions made in the comprehensive plan. They include zoning ordinances, and other land use regulations, which directly regulate land use activities.

A wide range of techniques is available to reduce risks associated with chronic coastal hazards. While hazard avoidance is the ideal method to reduce risk, it is not always an option and other approaches may be needed. The type of hazard and physical location are fundamental considerations when choosing a technique for risk reduction. For example, methods that address flooding and erosion along dune-backed shorelines may not be applicable to bluff-backed shorelines where landslides rather than flooding are the primary concern. Distinctions between levels and types of development (e.g., density of development and new versus existing construction) should also be made, as they may influence the type of risk reduction needed. A broad range of economic, social, and environmental factors should be considered in evaluating each alternative in order to choose the most beneficial mitigation technique (See Hazard Alleviation Technique table in section 4.2.).[18]

Risk reduction techniques for catastrophic hazards are primarily directed at community education and establishment of tsunami evacuation routes. Priority needs, including development of guidance and maps for local governments, are being met through National Oceanic and Atmospheric Administration (NOAA), FEMA, and state hazard mitigation funding.

4.1 How can Your Community Plan for Coastal Hazards?

It is possible to plan, at least to some degree, for coastal hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in coastal hazard areas through careful planning and zoning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

To successfully plan for coastal hazards, consider the following steps:

✓ **Identify the hazard**
Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.

Coastal Key

Section 2 of this document provides information that can assist your community in identifying coastal hazards.

Back Forward

Tip Box

The Three Levels of Hazard Assessment

1. Hazard Identification
2. Vulnerability Assessment
3. Risk Analysis

If your community identifies coastal hazards through a hazard identification process or a vulnerability assessment, you should adopt a process to review individual development permits in those coastal hazard-prone areas. For further description of the three levels of hazard assessment, refer to Chapter 2: Elements of a Comprehensive Plan.

✓ **Avoid the hazard**
Restrict development in hazard-prone areas. For areas with high density and potential for severe property damage or loss of life, this option should be followed.

✓ **Evaluate site-specific development**
Communities can require geotechnical reports to evaluate site-specific development for coastal hazards. Section 4.2 describes techniques for evaluating these hazards.

✓ **Implement mitigation measures**
Hazard mitigation techniques may be considered individually, and in some cases can be implemented on a site-specific basis. Hazard mitigation techniques are most effective when considered together and implemented on an area-wide basis (an example of a mitigation technique is minimizing development in hazard areas through low density and regulated development which can reduce risk of property damage and loss of life). Section 4.3 provides information on specific mitigation measures.

✓ **Indirect hazard mitigation approaches**
Additional mitigation strategies and non-regulatory measures can further reduce risk from coastal hazards. Section 4.4 and 4.5 provide information on additional methods and indirect approaches for reducing risk from coastal hazards.

TRG Key

For more information on how geotechnical reports are conducted, refer to Section 4 of the Landslide Technical Resource Guide.

4.2 How is Development in Coastal Hazard Areas Evaluated?

Geotechnical reports may be required for proposed development in identified hazard areas. Such reports are appropriate for the siting of new development and also the protection of existing development.

Important factors to consider when conducting a chronic hazard assessment or preparing a geotechnical report include:

Regional Setting

- Major geographic features
- Major geologic features

Long-term Trends of Shoreline Change

- Historical dune/bluff retreat
- Relative sea-level rise
- Sediment budget

Short-term Events

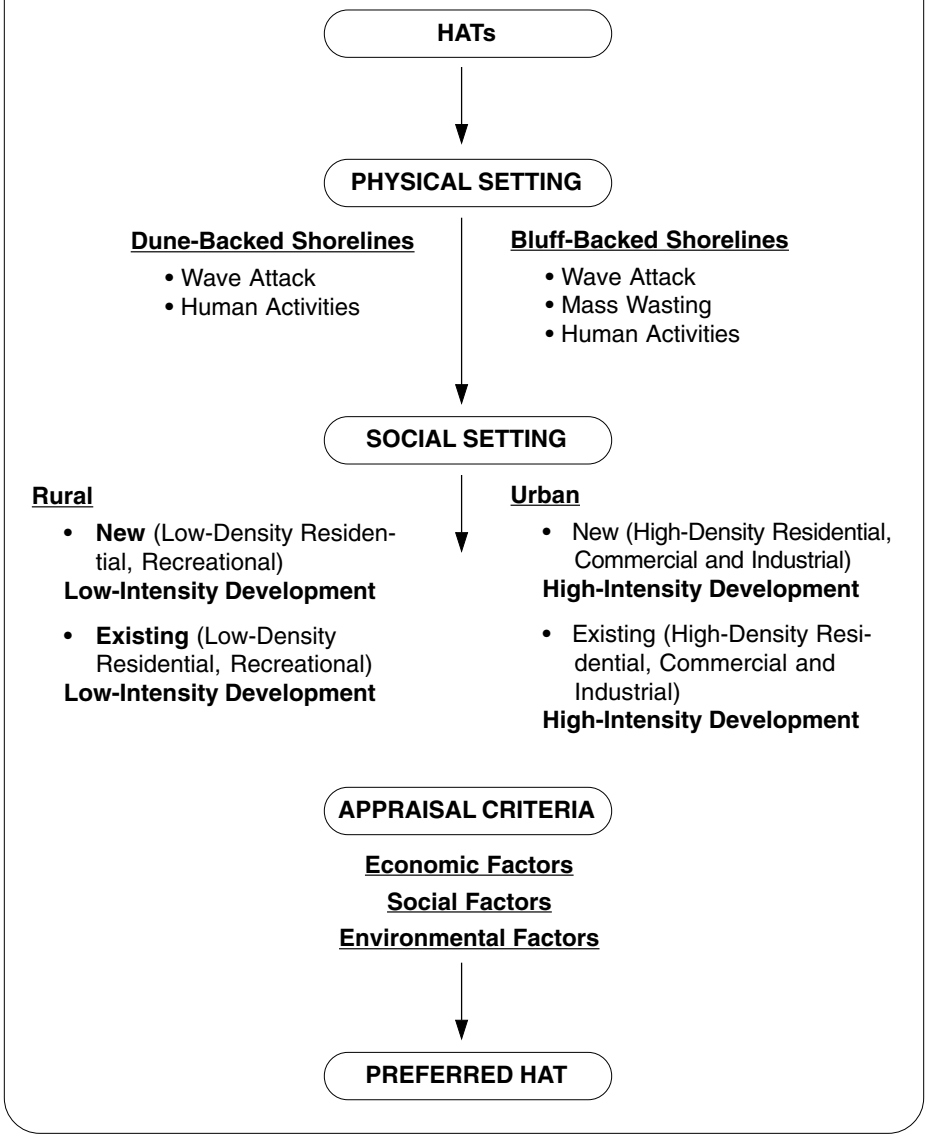
- Episodic Flooding/Erosion
  - Projected wave overtopping/undercutting
  - Direct evidence from existing and antecedent conditions
  - Dune stability

- Episodic Sloughing/Sliding
  - Surface features
  - Material properties and structural characteristics
  - Surface/Subsurface drainage
  - Wave attack
- Inlet Dynamics
- Human Activity

Coastal Key

The full text of the outline is published in the Chronic Coastal Natural Hazards Model Overlay Zone, published by the DLCD. Refer to Section 6 of this guide for information on contacting DLCD and obtaining this publication.

Hazard Alleviation Technique (HAT): Identification and Evaluation Framework



Source: *Shoreland Solutions. Appraisal of Chronic Hazard Alleviation Techniques. Salem, Ore.: Oregon Department of Land Conservation and Development (1994) p. 2.*

Coastal Key

For information on littoral cell planning refer to Section 2 of this guide.

4.3 What Role Does Land Use Planning Play in Reducing Risk from Coastal Hazards?

Land use planning can play an important role in reducing risk from coastal hazards by influencing the location, elevation, and design of existing and new development. The following land use tools do not prevent or retard the processes of wave attack or mass wasting. Rather, they allow these natural processes to occur by minimizing development that would require structural mitigation. Specific hazard mitigation techniques included within this category are: zoning regulations and infrastructure planning; site, design and construction standards; construction setbacks; and relocation incentives and land acquisition programs. These tools are potentially applicable to new and existing development along shorelines with both rural and urban levels of use.[19]

4.3.1 Zoning Regulations and Infrastructure Planning

Zoning regulations can be used to require low development densities in identified hazard areas (e.g., down-zoning, clustering). Infrastructure planning can also be used to encourage low development densities in identified hazard areas by limiting the level of services available. All jurisdictions along the Oregon Coast implement land use planning techniques through local comprehensive plans and zoning ordinances that are acknowledged for compliance with the Statewide Land Use Planning Goals.

4.3.2 Siting, Design, and Construction Standards

Siting, design, and construction standards regulate aspects of development in an identified hazard area. These standards range from site preparation to building design and construction. With respect to site preparation, examples include standards governing the removal of existing vegetation, excavation and drainage controls. For building design and construction, examples include foundation standards, frame, and roof design and required construction materials. Although such standards are generally applied to new or remodeled structures, existing structures may be retrofitted to meet new construction standards.

4.3.3 Construction Setbacks

Construction setbacks are requirements for locating new development (e.g., structure and infrastructure) some minimum horizontal distance landward of an identified hazard. Although construction setbacks are typically applied to new development, they may also be applied to remodeling or repair of existing development. Construction setbacks are appropriate for both dune-backed and bluff-backed shorelines.

4.3.4 Relocation Incentives and Land Acquisition Programs

Relocation incentives and land acquisition programs are provided to move existing development away from an identified hazard. In some instances development is relocated on-site. In other instances it is necessary to move development off the site, or perhaps to demolish it, and reestablish it elsewhere at a new, safer location. Generally, some sort of subsidy is required to encourage relocation. In some instances, rather than partially subsidizing relocation, the most viable option may be to buy the entire parcel at market value. Land acquisition programs have broader applicability than relocation incentives because they may apply to undeveloped areas as well as to areas with existing development. Undeveloped areas can be acquired and preserved for recreation, open space, or other appropriate public purposes. Such programs generally include specific criteria establishing priorities for acquisition.

4.4 What Additional Methods can be Used to Reduce Risk from Chronic Coastal Hazards?

The following hazard mitigation techniques work to prevent and retard the processes of wave attack or mass wasting. The techniques can be divided into the following categories: options for wave attack - soft stabilization; options for wave attack - hard stabilization; and options for mass wasting.

4.4.1 Soft Stabilization

Soft stabilization refers to techniques which reduce potential risk by enhancing the inherent buffering capabilities of the natural shoreline system to retard the effects of wave attack. Although the shoreline is stabilized in a relative sense through the application of these techniques, it is still expected to experience displacements during storm events. Specific hazard mitigation techniques included within this category are: foredune enhancement, beach nourishment, and boulder berms. Soft stabilization techniques are potentially applicable along both dune-backed and bluff-backed shorelines with both high intensity and low intensity use.

4.4.2 Hard Stabilization

Hard stabilization refers to techniques that reduce potential risk by attempting to fix the position of the shoreline to prevent the effects of wave attack. Thus, in most instances the shoreline is stabilized in a real sense through the application of these techniques and does not experience displacements during storm events. Specific hazard mitigation techniques included within this category are: groins, breakwaters, and revetments/ seawalls. Hard stabilization techniques are potentially applicable along both dune-backed and bluff-backed shorelines. They are potentially applicable along shorelines with high as well as low levels of development.

Tip Box

DLCD's Chronic Coastal Natural Hazards Model Overlay Zone

This document outlines a model ordinance for regulating development in hazardous coastal areas. The model ordinance contains provisions to identify potentially hazardous coastal areas, specifies a methodology to assess the potential risks to life and property those hazards may pose, and reduces potential risks by requiring appropriate mitigation. Two guides accompany the model ordinance: a planners guide and a technical guide. The planners guide is intended for city and county planners, planning commissions, city councils, and boards of commissioners considering amending provisions of their plans and ordinances. Copies of the model ordinance are available from the Department of Land Conservation and Development, (503) 373-0050.

4.4.3 Options for Mass Wasting

Options for mass wasting include a variety of techniques which reduce potential risk by improving slope stability and retarding weathering of the slope surface. Specific hazard mitigation strategies included within this category are: vegetation management, drainage controls, slope regrading, reinforcing structures, and surface fixing. Although they are treated separately in the Appraisal of Hazard Alleviation Techniques report, these techniques are typically applied in combination. Options for mass wasting are principally applicable along bluff-backed shorelines with both high and low levels of use.

4.5 What are Indirect Approaches for Risk Reduction?

Indirect approaches to risk reduction influence the location and design of new and existing structures (e.g., residential, commercial, industrial buildings) and infrastructure (e.g., roads, water, sewer). These indirect approaches are potentially applicable along all types of shoreline.[20]

4.5.1 Education Programs

Education programs play a pivotal role in reducing risk from coastal hazards. Techniques used for hazard preparedness by an individual are primarily a function of their level of awareness. Realistic perceptions can minimize potential risk by influencing siting and design decisions.

4.5.2 Natural Resource Protection Laws

Natural resource protection laws are generally designed to protect significant resource areas, but they often result in some degree of hazard mitigation. When viewed as a risk reduction technique, natural resource protection planning is closely related to construction setbacks. Both attempt to reduce potential risk by influencing the location of development. Oregon's Statewide Planning Goal 17 requires protection of "major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources." These requirements, as well as the requirement to maintain riparian vegetation, are all forms of natural resource protection law. With respect to dune-backed shorelines, Statewide Planning Goal 18 requires that local governments and state and federal agencies "prohibit residential developments and commercial and industrial buildings on beaches, active foredunes, on other foredunes which are conditionally stable and that are subject to ocean undercutting or wave overtopping, and on interdune areas that are subject to ocean flooding." These requirements qualify as natural resource protection laws and actually address risk reduction directly. Statewide Planning Goal 5 may indirectly affect risk reduction, particularly flooding, through protection of wetland and riparian areas.

4.6 Summary: Reducing Your Community's Risk from Coastal Hazards

In order to reduce risk of life and property from coastal hazard events, communities can incorporate methods reviewed in this section within their comprehensive plans.

- *Land use tools for coastal hazard management* can influence the location, type, intensity, and design of existing and new structures and infrastructure.
- *Siting, Design, and Construction Standards* encompass standards that govern aspects of development in an identified hazard area. These methods range from site preparation to building design and construction.
- *Additional methods for coastal hazard mitigation* include soft stabilization and hard stabilization techniques. Soft stabilization techniques enhance the inherent buffering capabilities of the shoreline while hard stabilization techniques attempt to permanently fix the position of the shoreline, thus reducing the effects of wave attack.
- *Indirect approaches to coastal hazard mitigation* include education programs and natural resource protection laws. These methods are applicable along any type of shoreline and serve to both educate coastal landowners and preserve the natural environment.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your community should ask the following questions in assessing the adequacy of your comprehensive plan in addressing coastal hazards:

- Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to natural hazards?
- Has your community implemented a process for evaluating site-specific development?
- Does your community have an approach to reduce risk from coastal hazards through a combination of regulatory and non-regulatory measures?
- Do the implementing measures carry out your comprehensive plan's policies related to coastal hazards in your community?

Section 5:
How are Oregon Communities Addressing Coastal Hazards?

This section describes how three Oregon communities are addressing coastal hazards.

5.1 Strengthening Local Review in Lincoln County, Oregon

Lincoln County has taken steps to strengthen its ordinances to implement its comprehensive plan. The new draft ordinances increase standards for geotechnical reports prior to development and provide a quantifiable measure for hazard risk zones.

Background

The initial inventory and factual base used by Lincoln County to map hazard areas was completed in the late 1970's and early 1980's in response to Statewide Planning Goals 7, 17 and 18. The geologic hazards provision was completed separately from the flood hazard inventory. Methods used to complete the geologic hazards provision were considered "state of the art" at the time. Recently, however, planners in Lincoln County have noted aspects of the geologic hazard provision that need to be revised to ensure maximum effectiveness.

Features identified during the inventory process include coastal recession and active landslide areas. Information from DOGAMI is currently used as a catalyst in Lincoln County for site-specific geologic investigations and is compiled in map form. When Lincoln County planners initially review a prospective development proposal, the first step is a review of the maps. If the proposal is located in an identified area of natural hazards, a site-specific geotechnical report must be completed before the proposal is approved.

Investigation into the risks of developing in hazard-prone areas is currently limited by the out-dated nature of the inventory and limited staff resources. DOGAMI has provided additional information for the inventory, but the county is currently taking steps to further update its factual base. With the DOGAMI work complete, the DLCD is incorporating the new information into a Geographic Information System (GIS) for the county. The GIS is only partially complete with one segment of the coast mapped. Work is currently progressing toward completion of a county-wide GIS. The first step in this process is to complete the parcel layer. The parcel layer should be completed late in the summer of 2000. The GIS has already proven to be useful. It serves as an analytical tool for the county as they determine the threat of hazards to a specific site.

The information contained in the completed GIS will be used by the county to define relative risk zones and adopt regulations based on the relative level of risk associated with these zones. Currently, the process of assessing risk is completed with a non-systematic site report. The problem with this existing approach is that there is no way to quantify the risk.

Back Forward

Policy

Lincoln County is currently in the process of revising section 1.1910 Development Guidelines, section 1.1925 Geologic Hazards, and section 1.1930 Beaches and Dunes, of the Lincoln County Land Use Codes. There are two different proposals currently in draft form. The proposals take two different approaches to revising the same section of the current county code. The first draft proposal, "*Development Guidelines*," is intended to clarify and improve the application of this section of the codes by adding content requirements for site-specific geologic hazard reports. In essence, this proposal continues the county's present approach to hazard management, but provides greater clarity and detail.

The second draft proposal, "*Chronic Coastal Natural Hazards*," is also a revision to the development guidelines section of the code. However, it proposes a fundamental change in the approach to managing coastal hazards. The intent of this proposal is to quantify relative levels of risk based on a standardized set of factors. The ordinance then prescribes regulatory standards, based on this relative risk (e.g., the "risk zone").

The Chronic Hazards Ordinance represents a completely different approach from Lincoln County's current system of subjectively evaluating site-specific reports. Although the current system is effective at identifying and disclosing the existence of various hazards, it does not really answer the most basic question of, "Is this an acceptable level of risk?" The Chronic Hazards Ordinance will allow the county to address that question in a quantifiable and systematic way.

Implementation

The Chronic Hazard Ordinance will be effective because it can be applied on a case-by-case basis to site-specific reports. To be successful, the GIS mapping of the risk zones needs to be completed countywide. This work is currently underway, but it will take some time to complete. Negative aspects of the Chronic Hazard Ordinance are that it is fairly technical and complicated, and is conceptually hard to grasp for a lot of planners. However, these obstacles are easily overcome. The DLCD provides expert assistance in interpreting and using the formulas included in the Chronic Hazard Ordinance.

Revisions to both the Chronic Hazard Ordinance and the Development Guidelines Ordinance are only in the draft stage at this point. County decision-makers have not yet considered them. Given the complexity of the Chronic Hazards Ordinance, it could be a fairly lengthy process to build the support needed to put it in place. The Development Guidelines Ordinance, on the other hand, is just a refinement of the present approach, and could represent an interim step in improving hazards management while the concepts behind the Chronic Hazards Ordinance are more fully developed.

Draft Development Guidelines Chronic Hazards Ordinance for Lincoln County

1.1910 Intent

The intent of development guidelines is to provide procedures necessary to secure the desirable attributes of the county from depletion and otherwise protect against hazardous or otherwise undesirable developments. "Development," as used in LCC 1.1910 to 1.1940, means the act, process or result of developing, but excludes those forest operations and associated activities that are governed by the Oregon Forest Practices Act and Rules.

1.1915 Scope

Development guidelines shall apply to those areas of concern as described in the following sections and identified on the Comprehensive Plan and Zoning maps and the Comprehensive Plan Inventory for Lincoln County.

1.1920 Procedure

The following procedure shall be followed in determining the suitability and desirability of development being proposed in areas of concern as described in this section:

(1) *Application:* Applicants requesting approval of (land use actions) *development* in areas subject to the provisions of this section shall be required to submit, along with any application for a building permit or other *required* development *approval*, a detailed site plan and/or written statement demonstrating how the proposed activity takes into account each of the applicable considerations and conforms to each applicable standard specified in this section.

(2) *Review: The provisions of this section shall be applied in the review of all applications conducted pursuant to LCC 1.1210.* Statements and diagrams of recognition of considerations and conformance with standards submitted along with requests for development will be reviewed in the following manner:

(a) *Building Permits Approval:* For development proposed which has impact only to the immediate area, as determined by the Planning Division, the above mentioned statements and diagrams will be reviewed by the Planning Division as part of the Building Permit approval procedures. If the proposed development appears to adequately recognize the applicable considerations and conforms to all applicable standards outlined above, the Building Permit will be approved. If questions are raised regarding recognition of considerations or conformance with standards, a meeting date shall be set by the Planning Division to discuss the areas in question. If such questions can be resolved satisfactorily, the building permit will be approved. For development proposed which has an impact greater than the surrounding vicinity, as determined by the Planning Division, or for development proposed which the Planning Division cannot satisfactorily resolve questions regarding recogni-

tion of considerations, the requests will be referred to the County Planning Commission for resolution.

(b) *Other Approvals:* Statements and diagrams of considerations and standards for subdivisions, land partitioning, conditional uses, rezones, and other development activities which do not require building permit approval shall be reviewed by the Planning Division for those activities which have an impact only to an immediate area. If the Planning Division determines such considerations are satisfactorily recognized, requests will be approved for those decisions, which this Chapter authorizes. If such a proposal is determined by the Planning Division to have an impact greater than the surrounding vicinity; or if the Planning Division is not authorized to make a decision on the matter; or if agreement is not reached between the requestor and the Planning Division that the considerations have been satisfactorily recognized, the item will be referred to the Planning Commission for resolution.

Draft Chronic Coastal Hazards Development Guidelines

The second approach being considered by Lincoln County, the "Chronic Coastal Hazards Development Guidelines," provides a method to assess the risks associated with site development in reviewing a permit application.

1.1925 Coastal Hazard Assessment

In areas subject to the provisions of this section, a coastal hazard assessment is required for any application to construct new structures or to expand existing permanent structures, semi-permanent structures and regular infrastructure. A coastal hazard assessment shall be prepared by a registered professional geologist or certified engineering geologist. A coastal hazard assessment shall:

(a) Examine the full range of geologic and oceanographic factors affecting chronic shoreline stability including short term events and long term trends attributable to processes of wave attack (overtopping/undercutting), mass wasting (sloughing/landsliding), wind-driven dune erosion or accretion, inlet migration, and human activities, as well as relative sea level rise and the sediment budget (sources/sinks);

(b) Identify areas of high and moderate relative risk, or 'risk zones', pursuant to the requirements of this section;

(c) Describe the proposed development, including plan maps and cross-sections showing the location of proposed structures on the property and the structures in relation to property lines and identified risk zones; and

(d) Describe potential adverse impacts to adjacent development and measures to avoid or minimize such impacts.

Determination of Relative Risk Zones

(a) Dune Hazard Areas: In designated dune hazard areas the horizontal extent of high and moderate risk zones shall be determined according to the following formula: Relative Risk in Dune Hazard Areas = $[(S_{dune} + D) + (L_R \times T_p)+(L_r \times T_p)]$

(Formula 210) where S_{dune} = the total horizontal extent of shoreline erosion (wave undercutting) projected to occur during a design storm event or cluster of storm events (feet). A storm having a two percent chance of being equaled or exceeded in any given year (50-year storm) shall be used to calculate high relative risk and a storm having a one percent chance of being equaled or exceeded in any given year (100-year storm) shall be used to calculate moderate relative risk;

D = the dune topographic stability factor (feet). This factor shall be calculated as 1.5 times the height of the primary dune;

L_R = the average annual rate that the shoreline is projected to migrate landward due to

L_r = the average annual rate that the shoreline is projected to migrate landward due to relative sea level rise (feet/year); and

T_p = the planning period (years). Time spans of 50 years and 100 years shall be used to calculate high and moderate relative risk respectively.

The distances determined through the application of Formula 210 shall be measured landward from the following reference locations:

- The Ocean Shores Vegetation Line; or
- The existing vegetation line, whichever is further landward.

(b) Bluff Hazard Areas: The horizontal extent of high and moderate risk zones in designated bluff hazard areas shall be determined according to the following formula: Relative Risk in Bluff Hazard Areas = $[S_{bluff} + (L_R \times Tp)+(L_r \times Tp)]$ (Formula 220) where S_{bluff} = the total horizontal extent of erosion projected to occur during a simple, shallow sloughing event (feet);
L_R = the average annual rate that the bluff line is projected to migrate landward due to mass wasting (feet/year);
L_r = the average annual rate that the shoreline is projected to migrate landward due to relative sea level rise (feet/year); and
T_p = the planning period (years). Time spans of 50 years and 100 years shall be used to calculate high and moderate relative risk respectively.
The distances determined through the application of For-

mula 220 shall be measured landward from the following reference locations:

- The Ocean Shores Vegetation Line; or
- The toe of the bluff, whichever is further landward.

(c) Slide Hazard Areas:
The horizontal extent of high and moderate risk zones in designated bluff hazard areas shall be determined by the following formula: Relative Risk in Slide Hazard Areas = [S_{slide} + S_{bluff}]

(Formula 230) where S_{slide} = the total horizontal extent of erosion projected to occur during a complex, deep-seated landsliding event (feet); and

S_{bluff} = the total horizontal extent of erosion projected to occur during a simple, shallow sloughing event (feet).

The distances determined through the application of Formula 230 shall be referenced to one of the following locations:

- The Ocean Shores Vegetation Line;
- The toe of the bluff; or
- The landward-most active headscarp crest.

(d) Inlet Hazard Areas:
The horizontal extent of risk zones in inlet hazard areas shall be determined by the following formula: Relative Risk in Inlet Hazard Areas = L_{inlet}

(Formula 240) where L_{inlet} = the maximum historical extent of along shore inlet migration (feet).

The distances determined through the application of formula 240 shall be referenced to one of the following locations:

- The location of the ebb channel;
- The location of the toe of the scarp on the eroding bank; or
- Relevant cultural features (e.g., property boundaries, existing structures, etc.).

5.2 Improving the Hazard Inventory in Waldport, Oregon

The initial inventory used by the City of Waldport to map hazard areas was completed in the late 1970's and early 1980's in response to the Statewide Planning Goals 7, 17 and 18. Problems with landslides led planners to reorganize and update provisions for Waldport. The city's efforts initially focused on improving elements of the inventory identifying coastal hazard areas. This triggered the need for a site-specific geologic investigation.

Inventory documents, such as DOGAMI maps and reports, were collected and reviewed. They were used to identify four types of hazard areas: oceanfront/bayfront lots; geologically recent landslide areas; weak foundation soils; and slopes greater than 20 percent with weak foundation soils and all slopes greater than 30 percent. Standards applying to each of these hazard areas were then developed.

For example, if development is proposed in an area known to have weak foundation soils, then a qualified soils expert shall make a detailed soils analysis. Similarly, a site-specific geological investigation is required for all development proposed within 100 feet of a geologically recent landslide. For oceanfront/bayfront lots where the only known hazard is coastal recession or minor slope sloughing, a site specific geological investigation is required only if the proposed development would deviate from an established minimum setback.

Done as a comprehensive plan periodic review work task, Waldport has created development guidelines listed below under *Natural Hazard Areas*. The guidelines, which use the enhanced inventory and new standards, are waiting for adoption by Waldport's city council at the time of this guide's production.

Article 9. Waldport Development Guidelines

Intent: The intent of development guidelines is to provide procedures necessary to secure the desirable attributes of the city from depletion, and to protect against hazardous or otherwise undesirable development activities.

Scope: Development guidelines shall apply to those areas of concern delineated on the City of Waldport Zoning Map and in its Comprehensive Plan and Plan Inventories or any area determined potentially hazardous by the Planning Commission and shall also apply to any property that has a 30 percent slope or greater as defined by a (3:1) ratio, 3 horizontal: 1 vertical. Development guidelines do not apply to development limitations within the Coastal Shorelands overlay zone and federally designated flood hazard areas, which are discussed in Sections 3.380 and 3.390 respectively.

Natural Hazard Areas: The following development guidelines are applicable to hazards identified above and in the State Department of Geology and Mineral Industries, Bulletin 81, Environmental Hazard Inventory, Coastal Lincoln County, Oregon, RNKR Associates, 1978. The above documents and mapping are referenced and adopted as a part of the Comprehensive Plan and available at the office of the City Recorder.

1. Purpose: Various geological formations in the city have different characteristics with respect to suitability for development because of landslide potential, high groundwater, and soil characteristics. The following development guidelines have been prepared in order that geological hazards will be recognized and the losses resulting therefrom will be lessened.
2. Areas of Concern: The primary areas of concern are active and potential landslides, high groundwater, weak foundation soils, coastal recession, and steep slopes.
3. Considerations: The most important consideration with respect to natural hazard factors are:
   A. That development approved is not hazardous to buildings, structures or the inhabitants thereof.
   B. That protection to unsuspecting purchasers of property having natural hazards is provided.

Back Forward

C. That unjustified expenditure of public funds or losses incurred due to natural hazards resulting in damage to development which should not have been approved initially, is prevented.

4. Standards: The following shall be required in hazard areas as identified:

A. Oceanfront/Bayfront Lots: A site specific geotechnical analysis by a qualified registered professional geologist or engineering geologist *except* when the only known or suspected hazard is coastal recession and minor slope sloughing which can be compensated for by using the established minimum setbacks as set forth in the Environmental Hazard Inventory; RNKR (page 35) rates of coastal erosion are identified on the Comprehensive Plan hazard maps. *Deviations from required shore front setbacks may be permitted upon submission of a site specific geotechnical analysis prepared and stamped by a professional geologist or certified engineering geologist which specifies adequate safeguards to compensate for the reduced setback.*

B. Geologically Recent Landslide Areas: A site specific geotechnical analysis by a qualified professional geologist or engineering geologist including all property outside of known or suspected hazard that is within 100 feet. *The geotechnical analysis, which shall be stamped by the professional geologist or certified engineering geologist, shall identify the nature and extent of the hazard or hazards present and shall provide specific recommendations for measures adequate to safeguard the proposed development from the identified hazard or hazards.*

C. Weak Foundation Soils: In areas known to have weak foundation soils for construction of buildings and roads, a detailed soils analysis shall be made by a qualified soils expert. The analysis shall include a recommendation to overcome identified limitations prior to development approval.

D. Slopes Greater than 20 percent with Weak Foundation Soils and All Slopes Greater than 30 percent: A site specific geotechnical analysis by a qualified professional geologist or engineering geologist will be required. *The analysis, which shall be stamped by the professional geologist or certified engineering geologist, shall determine the suitability of the site for development and shall recommend specific measures which may be required to safeguard life and property.*

5.3 Planning for Shoreline Stability in Manzanita, Oregon

Since the late 1960's the shoreline fronting Manzanita has exhibited a net westward migration due to sand accumulation in the foredune area. Typically, attention is focused on the threats posed by beach and dune erosion. However, there are segments of the Oregon coast where too much sand is the problem. Over the last 10 years sand accumulation has been particularly dramatic in Manzanita. This

increase in beach and dune sand volume has enhanced ocean flood/erosion protection potential. It has also presented problems for local residents and visitors alike, as the accumulating sand and the accompanying growth in height and width of the foredune area has led to the inundation of oceanfront homes, the restriction of ocean views, and the blockage of beach access points.

In Manzanita, efforts were undertaken by individual homeowners to implement provisions of Statewide Planning Goal 18, Implementation Requirement #7, that provide for dune grading or sand movement necessary to maintain views or prevent sand inundation as part of an overall foredune management plan. Manzanita residents formed the Manzanita Neah-Kah-Nie Dunes Management Association Inc., and hired a consultant to complete the work. Throughout the development of the plan they worked in cooperation with state, county, and city government representatives, and held numerous public meetings in the Manzanita area.

The plan consists of a Background Report, which reviews the factors affecting the stability of shoreline in the management area; a Management Strategy, which details the types of sand management practices to be applied in the management area; a Monitoring Program, which outlines a program for the regular collection and analysis of information needed to evaluate the success of the management strategy; a Maintenance Program, which outlines follow-up activities needed to ensure the success of the management strategy; and an Implementing Ordinance, which formally outlines the procedures for carrying out prescribed management practices.

The plan was approved and adopted by the City of Manzanita. At the time of this writing the plan has been in implementation for over four years. To date it has been a success. Since initial grading and planting, minimal amounts of sand have accumulated along the crest and backslope of the primary foredune. Also, the bulk of the foredune area has maintained its integrity during several episodes of wave attack.

Manzanita's efforts are unique in that, while the City of Manzanita was very supportive, the planning activities were homeowner-based. Manzanita's efforts provide an example of proactive, area-wide planning that may be applicable to other areas of coastal hazards management.

5.4 Summary: Lessons from Oregon Communities Addressing Coastal Hazards

- *Lincoln County* has taken steps to address weak aspects of ordinances used to implement its comprehensive plan. They are also working to develop a county-wide GIS that will improve the county's ability to address natural hazards. The new draft ordinances increase standards for geotechnical reports prior to development and provide a quantifiable measure for hazard risk zones.
- *Waldport* offers an example of how one community inventoried known hazards and improved standards for site-specific reports to address the hazards found within their community.
- *Manzanita* offers an example of proactive, community driven action designed to mitigate for hazardous levels of sand inundation.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Your comprehensive plan should be coordinated with and reflect other comprehensive plans and implementing measures of other communities within your region. Natural hazards do not respect community boundaries making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plan, your community should ask the following questions in developing plan policies for coastal hazards:

- ❒ What plan policies should be added or amended to assist your community in dealing with coastal hazards?
- ❒ Are there communities that face similar coastal threats that have developed ordinances or non-regulatory programs that could be adopted by your community ?
- ❒ Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park, and transportation districts?)

TRG Key

For additional resource information on flood, landslide and seismic hazards, refer to Section 6 of the appropriate hazard-specific guide.

Sidebar

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Section 6:
Where can Your Community find Resources to Plan for Coastal Hazards?

This section is a resource directory including contacts, programs, documents and internet resources available to communities as they plan for coastal hazards.

6.1 State Agency Resources

Department of Land Conservation and Development (DLCD)

DLCD is an important resource for coastal communities making land use planning decisions. DLCD administers Oregon's Statewide Planning Program and the federally approved Oregon Coastal Management Program (OCMP). Detailed information on the OCMP is included in the first recommended coastal publication listed below.

Contact: Coastal Specialist
Address: 635 Capitol St. NE, Suite 150
Salem 97301-2540
Phone: (503) 373-0050 ext. 249
Fax: (503) 378-5518
Web: http://www.lcd.state.or.us

Oregon State Police (OSP)-Office of Emergency Management (OEM)

OEM assists coastal jurisdictions (counties, cities, and fire protection districts) with tsunami warnings and evacuation planning. For example, OEM has helped coastal jurisdictions develop and print evacuation map brochures. The brochures (distributed to residents and tourists) contain general tsunami information, evacuation safe zones and, if identified by the community, evacuation routes and sites. In addition, many tsunami hazard zone, evacuation route and evacuation site signs have been distributed to counties and placed by the jurisdictions in various locations on the coast.

Contacts: Earthquake and Tsunami Program Coordinator: ext. 237
OEM Hazard Mitigation Officer: ext. 247
Recovery and Mitigation Specialist: ext. 240
Address: 595 Cottage Street NE,
Salem OR 97310
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: http://www.osp.state.or.us/oem

Department of Geology and Mineral Industries (DOGAMI)

DOGAMI assists communities by producing maps and reports on coastal erosion, bluff hazards, tsunami inundation, and landslide hazard analysis in the coastal zone. DOGAMI staff chair the interagency State Map Advisory Council, which coordinates the preparation of various types of geologic maps, and computerized information. DOGAMI develops, stores and disseminates geologic information about the state that in turn serves as a basis for prudent decision-making in resource development and land management.

Contact: Coastal Field Office
Address: 313 SW 2nd, Suite D
Newport, OR 97365
Phone: (541) 574-6642
Fax: (541) 265-5241
Website: http://sarvis.dogami.state.or.us

Oregon Parks and Recreation Department (OPRD)

OPRD has the authority over the "Ocean-shore Recreation Area" (that width of the ocean shore that is submerged by the daily tides) as well as the adjacent "dry sands beach" up to the "beach zone line" set by state law. OPRD has management authority over rocky intertidal areas as well as upland state parks. Contact the OPRD coastal land use coordinators for information on the permit application process and recommendations.

North Coast
Address: 5580 South Coast Highway
Newport, OR 97366

Phone: (541) 867-3340
Fax: (541) 867-3254
Website: http://www.prd.state.or.us

South Coast
Address: 10965 Cape Arago Hwy
Coos Bay OR 97420
Phone: (541) 888-9324
Fax: (541) 888-5650
Website: http://www.prd.state.or.us

Sidebar

Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[53]

Benton, Deschutes, and Tillamook counties, and Multnomah County with the city of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the OSP-Office of Emergency Management in Salem.[54] For more information about Project Impact visit **http://www.fema.gov** or **(http://www.fema.gov/impact/impact00.htm**), or contact the OSP-Office of Emergency Management.

6.2 Federal Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA Region 10 serves the northwestern states of Alaska, Idaho, Oregon and Washington. The Federal Regional Center (FRC) for Region 10 is located in Bothell, Washington. FEMA is an agency of the federal government whose purpose is to reduce risks, strengthen support systems, and help people and their communities prepare for and cope with disasters regardless of the cause. FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response and recovery."

Contact: FEMA, Federal Regional Center, Region 10
Address: 130-228th St. SW
Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: http://www.fema.gov

To obtain FEMA publications,
Phone: (800) 480-2520

To obtain FEMA maps,
Contact: Map Service Center
Address: P.O. Box 1038
Jessup, Maryland 20794-1038
Phone: (800) 358-9616
Fax: (800) 358-9620

6.3 Recommended Coastal Publications

A variety of documents exist to assist communities as they develop strategies for natural hazard mitigation. The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should have in its resource library. Secondary documents may not be as essential as primary documents or as readily accessible, yet they still provide useful information to communities. Technical documents are those that focus on a specialized aspect of coastal hazard mitigation. In addition, there are many DOGAMI publications on coastal hazards. Visit the DOGAMI website to find these resources.

Primary Resources

A Citizen's Guide to the Oregon Coastal Management Program.
Oregon Department of Land Conservation and Development (1997)

This document is a how-to book about coastal management. It explains who makes the decisions, the legal requirements for decisions, and gives elected and appointed officials useful information as they decide how and where new development will occur.

To obtain this resource contact: Oregon Department of Land Conservation and Development

Oregon's Statewide Planning Goals & Guidelines. Oregon Department of Land Conservation and Development (1995)

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of that program is a set of 19 Statewide Planning Goals. The goals express the state's policies on land use and on related topics, such as citizen involvement, housing and natural resources. This booklet contains the complete text of the 19 goals.

To obtain this resource contact: Oregon Department of Land Conservation and Development

The Pacific Northwest Coast: Living with the Shores of Oregon and Washington. Komar, P.D., (1997) Duke University Press

This book serves as a source of information about the coast of the Pacific Northwest, its geological setting, the natural responses of beaches and cliffs to ocean processes, and the ever-present problem of erosion. It examines lessons taught by human interactions with the coast.

To obtain this resource contact: Oregon State University or your local bookstore

Improving Natural Hazards Management on the Oregon Coast. Natural Hazards Policy Working Group (1994)

This document contains 23 issues and 79 recommendations developed by a 20-member hazard policy-working group over a two-year time period. Information on natural hazard policy in Oregon, hazard assessment and information access, beach and shore protection procedures, land use planning, and tsunami preparedness is also included in this document.

To obtain this resource contact: Oregon Sea Grant or the Department of Land Conservation and Development

Secondary Documents

Appraisal of Chronic Hazard Alleviation Techniques. Shoreland Solutions / Oregon Coastal Zone Management Association, (1994) Oregon Department of Land Conservation and Development

Littoral Cell Management Planning along the Oregon Coast. Shoreland Solutions (1995) Oregon Department of Land Conservation and Development

Chronic Coastal Natural Hazards Geographic Information System. National Oceanic and Atmospheric Administration (1999) Department of Land Conservation and Development

Chronic Coastal Natural Hazards Model Overlay Zone. Shoreland Solutions (1998) Oregon Department of Land Conservation and Development

TRG Key

For more information on public agency coordination refer to the discussion on coordination in Chapter 2: Elements of a Comprehensive Plan.

Contents of Geotechnical Reports Related to the Impacts of Coastal Erosion and Related Hazards. Komar, P.D. (1993) Department of Land Conservation and Development

Technical Resources

Department of Geology and Mineral Industries Explanation of Mapping Methods and Use of the Tsunami Hazard Maps of the Oregon Coast. DOGAMI (1995) Open File Report 0-97-67

Impacts of Climate Variability and Change – Pacific Northwest. JISAO/SMA Climate Impacts Group (1999, November) University of Washington (pg. 109)

Inventory of Critical and Essential Facilities Vulnerable to Earthquake or Tsunami Hazards on the Oregon Coast. Charland, J.W. and Priest, G.R. DOGAMI (1992) Open File Report 0-95-02.

Beach Processes and Sedimentation. Komar, P.D. (1998) Prentice-Hall Inc (2nd Edition, pp. 544)

Erosion Impacts Along the Oregon Coast: Report to the Oregon Department of Land Conservation and Development. Komar, P.D., Diaz-Mendez, G., and Marra, J.J. (1999) Department of Land Conservation and Development (pp. 39)

The Rational Analysis of Setback Distances: Applications to the Oregon Coast. Komar, P.D., McDougal, W.G., Marra, J.J. and Ruggiero, P., (1999) Shore and Beach (Vol. 67, pp. 42-49)

The Wave Climate of the Pacific Northwest (Oregon and Washington): A Comparison of Data Sources. Tillotson, K. and Komar, P.D. (1997) Journal of Coastal Research (Vol. 13:2, pp. 440-452)

Erosion of Netarts Spit, Oregon: Continued Impacts of the 1982-83 El Nino. Komar, P.D., Good, J.W., and Shih, S.M. (1989) Shore and Beach (Vol. 56, pp. 11-19)

Regional Sediment Dynamics and Shoreline Instability in Littoral Cells of the Pacific Northwest. Peterson, Curt D., Hansen, M., Briggs, G., Yeager, R., Saul, I.A., Jackson, P.L., Rosenfeld, C.R., White, G., Booth, B., Zhang, H., Assail, D., Terich, T., (1992) CZM 309 Program: Final Project Report

Cliff Erosion Along the Oregon Coast: A Tectonic – Sea Level Imprint Plus Local Controls by Beach Process. Komar, P.D., and Shih, M. (1993) Journal of Coastal Research (Vol. 9, pp. 747-765)

The Budget of Littoral Sediments – Concepts and Applications. Komar, P.D. (1996) Shore and Beach 64 (n. 3): 18-26

The Wave Climate of the Pacific Northwest. Komar, P.D., and Tillotson, K. (1997) Journal of Coastal Research (Vol. 13, pp. 440-452)

Coastal Erosion – Underlying Factors and Human Impacts. Komar, P.D. (2000, January) Shore and Beach

Analysis of the Magnitudes of Foredune Erosion on the Oregon Coast. Komar, P.D. (1993) Department of Land Conservation and Development

Contents of Geotechnical Reports Related to the Impacts of Coastal Erosion and Related Hazards. Komar, P.D. (1993) Department of Land Conservation and Development

Coastal Erosion Processes and the Assessment of Setback Distances. Komar, P.D. et. al. (1997) Department of Land Conservation and Development

Analysis of the Susceptibility of Coastal Properties to Wave Erosion. Komar, P.D. (1993) Department of Land Conservation and Development

Cascadia Subduction Zone Tsunamis: Hazard Mapping at Yaquina Bay, Oregon. Priest, G.R., Myers, E., Baptista, A.M., Fleuck, P., Wang, K., Kamphaus, R.A., Peterson, K.D., (1997) Department of Geology and Mineral Industries

Explanation of Mapping Methods and Use of the Tsunami Hazard Maps of the Oregon Coast. Priest, G.R., (1995) Department of Geology and Mineral Industries

Estimates of Coastal Subsidence from Great Earthquakes in the Cascadia Subduction Zone, Vancouver Island, B.C., Washington, Oregon, and Northernmost California. Peterson, C.D., Barnett, E.T., Briggs, G.C., Carver, G.A., Clague, J.J., and Darienzo, M.E. (1997) Department of Geology and Mineral Industries

6.4 Internet Resources

The Oregon Coastal Index

http://www.lcd.state.or.us/coast/index.htm

The primary purpose of The Oregon Coastal Index is to provide access to information about the state's program for managing coastal resources for present and future Oregonians. The index is a doorway to sites that have some relationship to Oregon's coast, to its coastal communities and to the resources that support those communities.

Department of Geologic and Mineral Industries

http://sarvis.dogami.state.or.us/coastal/default.htm

DOGAMI has compiled a variety of information specific to coastal programs. Questions regarding El Nino and La Nina, tsunami inundation maps, and the Pacific Marine Environmental Laboratory, can all be researched at this site. You will also find numerous links to other sites relevant to coastal processes and hazards.

Pacific Marine Environmental Laboratory (PMEL)

http://www.pmel.noaa.gov/tsunami-hazard

The Pacific Marine Environmental Laboratory Tsunami Program was created to mitigate the tsunami hazards affecting the Pacific Coast, Alaska, and Hawaii. The program is designed to reduce the impact of tsunami inundation through warning, guidance, mitigation, and hazard assessment. The PMEL web site includes sections on field observations, modeling and forecasting, tsunami events and data, inundation mapping, and the National Tsunami Hazard Mitigation Program, a joint effort of a consortium of state and federal agencies.

HazNet

http://www.haznet.org

In 1998, when El Nino had spawned violent weather around the globe, and when many scientists anticipated continuing weather extremes, the national Sea Grant network created HazNet, a Web site devoted to coastal hazards awareness and mitigation. The HazNet site gathers information and resources from Sea Grant programs, the National Oceanographic and Atmospheric Administration, and other public and private sources to help people meet the challenges presented by such natural hazards as riverine flooding, storm surge, coastal erosion, seismic events, and hurricanes. The site includes fact sheets, examples of community hazard mitigation plans, and a discussion of mitigation policy and planning tools relating to hazards and the built environment.

State of the Coast Report

http://state-of-coast.noaa.gov

The National Oceanic and Atmospheric Administration (NOAA) created the *State of the Coast Report* provided at this Web site in response to Al Gore's challenge to federal agencies to create a "report card" of environmental issues. The foundation of the report is a series of essays on important coastal issues; two of these essays are entitled "Population at Risk from Natural Hazards," and "Reducing the Impacts of Coastal Hazards." These thorough articles include overviews of the problem on a national scale, regional analyses, specific case studies, interviews with experts, suggested readings and references, and glossaries.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce landslide risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical information and assistance provided by Oregon agencies to assist your community in planning for coastal hazards?
- ❒ What documents or technical assistance does your community need to find to further understanding of coastal hazards and begin the process of assessing community risk from coastal hazards?

Coastal Endnotes:

[1] Klarin, Paul. Personal Interview. May, 2000

[2] Department of Land Conservation and Development. (1998). Chronic Coastal Natural Hazards Model Overlay Zone. Oregon: Shoreland Solutions.

[3] State Hazard Mitigation Plan. The Interagency Hazards Mitigation Team, (2000) Oregon State Police - Office of Emergency Management.

[4] Department of Land Conservation and Development. (1998). Chronic Coastal Natural Hazards Model Overlay Zone. Oregon: Shoreland Solutions.

[5] Marra, John. Personal Interview. May, 2000

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PLANNING FOR NATURAL HAZARDS:

Wildfire TRG

July 2000

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Section 1:
Introduction to the Wildfire Technical Resource Guide

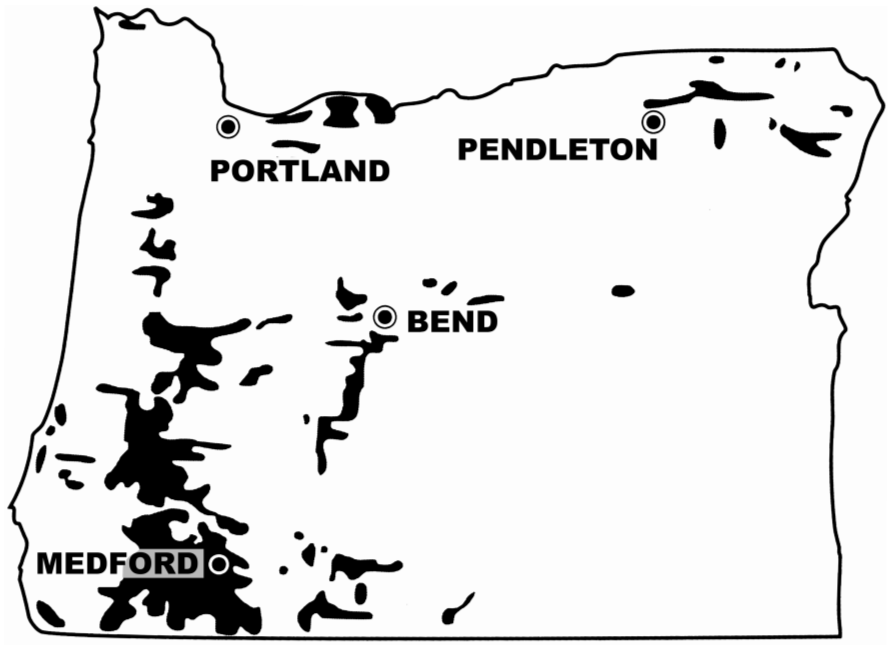
Wildfire poses a significant threat to many communities in Oregon. The purpose of this guide is to help planners, local decision-makers, and community leaders reduce risk to life and property from wildfire. The guide is designed to help your local government address wildfire hazard issues through effective comprehensive plan inventories, policies, and implementing measures.

1.1 The Threat of Wildfire Hazards to Oregon Communities

Wildfire has caused tremendous destruction in Oregon communities. The severe fire season of 1987 resulted in a record setting mobilization of resources in the state.[1] In 1990, Bend's Awbrey Hall Fire destroyed 21 homes, causing approximately $9 million in damage and costing over $2 million to suppress.[2] In 1996, Bend's Skeleton Fire burned over 17,000 acres and damaged or destroyed 30 homes and structures. In that same year 218,000 acres were burned, 600 homes were threatened, and 44 homes were lost statewide.[3]

People in Oregon are becoming more vulnerable to wildfire by living near wildland settings characterized by large areas of flammable vegetation. Whether in populated urban areas or in remote locations, more people are living in wildfire-prone areas.[4] Figure 1-1 shows regions of Oregon particularly prone to wildfire. As the map illustrates, areas of high risk exist throughout the state. The areas of highest risk are central, southwest, and northeast Oregon. There are around 200,000 Oregon homes built in areas where the risk of wildfire is high.[5] Information in this Wildfire Technical Resource Guide can help your community reduce the level of risk to existing homes and future development.

Figure 1-1: High Risk Wildfire Areas in Oregon



Source: *Oregon Department of Forestry. Disaster in the Making. Salem, Ore.: Oregon Department of Forestry Brochure.*

Sidebar

Organization of the Natural Hazards Technical Resource Guide

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goal 2,7,17 and 18, a resource directory and a land use tools matrix for hazard mitigation.

1.2 How to Use the Wildfire Technical Resource Guide:

The Wildfire Technical Resource Guide provides information to help communities in Oregon plan for wildfire hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies, and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about wildfire.

Section 2:
Is Your Community Threatened by Wildfire Hazards?

Section 2 presents an overview of the causes and characteristics of wildfire, and provides information to assist communities in wildfire hazard identification.

Section 3:
What are the Laws in Oregon for Wildfire Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for wildfire hazards.

Section 4:
How can Your Community Reduce Risk from Wildfire Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from wildfire hazards.

Section 5:
How are Oregon Communities Addressing Wildfire Hazards?

Section 5 examines how two communities have addressed wildfire hazards through non-regulatory and regulatory approaches. These examples illustrate plan policies and implementing measures for wildfire.

Section 6:
Where can Your Community find Resources to Plan for Wildfire Hazards?

Section 6 is a resource directory listing contacts and documents that planners, local governments, and citizens can use to access additional information on wildfire hazards.

Section 2:
Is Your Community Threatened by Wildfire Hazards?

Identifying hazard areas is a key step in developing effective plan policies and implementing measures to reduce loss of life and property damage. This section will assist your community in determining how wildfire may affect current and future development. An overview of the causes and characteristics of wildfire is included, along with information on identifying wildfire hazards in your community.

2.1 What are the Wildfire Hazards?

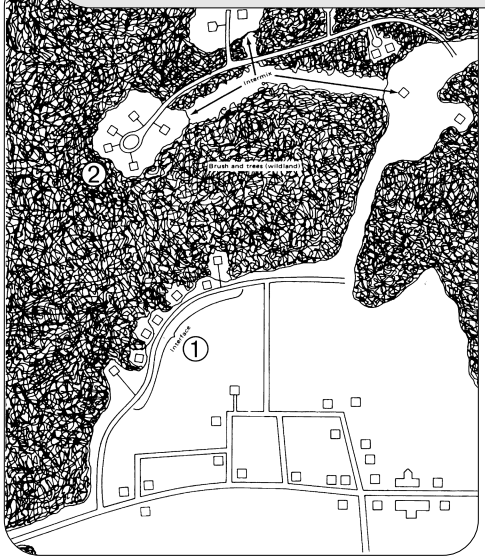
Wildfire can be divided into four categories: interface fires**,** wildland fires, firestorms, and prescribed fires.[6] **Interface fire,** as defined below, is the primary fire hazard discussed in this Technical Resource Guide. Additional types of fire are also described in this section, as they potentially play roles in interface fire.

Interface

Interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel.[7] The catastrophic Oregon fires described in the introduction of this guide are examples of interface fire. The wildland/urban interface has three categories:[8]

- *The classic wildland-urban interface* exists where well-defined urban and suburban development presses up against open expanses of wildland areas.
- *The mixed wildland-urban interface* is more characteristic of the problems being created by exurban development: isolated homes, subdivisions and small communities situated predominantly in wildland settings.
- *The occluded wildland-urban interface* exists where islands of wildland vegetation occur inside a largely urbanized area.

Interface and Intermix Diagram



1 = Interface

2 = Intermix

Source: *National Wildland / Urban Interface Fire Protection Program. Fire Protection in the Wildland / Urban Interface. Boise, Idaho: National Interagency p. 3.*

Tip Box

Hazard Inventories

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

TRG Key

Chapter 2: Elements of a Comprehensive Plan examines natural hazard inventory and factual base development.

Back Forward

Wildfire Key

The Oregon Department of Forestry (ODF) administrative rules include criteria for determination of Wildfire Hazard Zones (Oregon Administrative Rules Chapter 629, Division 44). These criteria include rating systems for fuel, topography and weather. Refer to Section 4 of the Wildfire Technical Resource Guide for more information on ODF's Wildfire Hazard Zone program.

As a result of the Oregon Forestland-Urban Interface Fire Protection Act of 1997 (described further in Section 3 of this guide) additional criteria are being developed for the evaluation of interface areas in ODF Fire Protection Districts.

The distinctions above are not used in general literature, and the term "interface" is used to describe all three types of interface throughout this guide. The definitions are included to make clear that the interface is virtually everywhere — from the pine forests of Eastern Oregon, to the fir stands of the Coast Range, and even within the city limits of Portland.[9]

2.2 What Are Other Types of Fire?

2.2.1 Wildland

A wildland fire's main source of fuel is natural vegetation. These fires primarily occur in national forests and parks, rangeland, and privately owned timberland. A wildland fire may become an interface fire if it encroaches on developed areas. Fire in dryland farm areas may similarly affect development.

2.2.2 Firestorms

Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during dry, windy weather and generally burn until conditions change or the available fuel is exhausted. The disastrous 1991 East Bay Fire in Oakland, California is an example of an interface fire that developed into a firestorm.

2.2.3 Prescribed

Prescribed fires and prescribed natural fires are intentionally set or selected natural fires that are allowed to burn for beneficial purposes. An increasingly recognized beneficial purpose is to keep fuel from building up that might otherwise feed an interface fire. The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildfire Ecosystems, listed in Section 6 of this guide, examines prescribed fire in depth.

2.3 What are the Conditions that Contribute to Wildfire?

Ignition of a wildfire may come from a lightning strike or, more frequently, one of many possible human sources (most often arson or debris burns).[10] Once a fire has started, four main conditions influence its behavior: fuel, topography, weather, and development.

2.3.1 Fuel

Fuel is the material that feeds a fire, and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of "fuel loading," the amount of available vegetative fuel. If fuel-loading doubles, the energy released can also be expected to double.[11] The type of fuel also influences wildfire. Oregon, as a western state with prevalent conifer, brush, and rangeland fuel types, is subject to more frequent wildfires than other regions of the nation.[12] Another important element of fuel is its continuity. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread.

Back Forward

2.3.2 Topography

Topography influences the movement of air, directing a fire's course. Slope is a key topographic feature in fire behavior. If the percentage of uphill slope doubles, the rate of spread in wildfire will likely double.[13] Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Similarly, saddle-shaped lands on ridge-tops lower resistance to the passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope drafts that can complicate fire behavior.[14] Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities.

Tip Box

By providing information from hazard identification to local building departments, wildfire roofing standards can be applied to reduce risk from interface wildfire.

2.3.3 Weather

Weather is the most variable factor affecting wildfire behavior, with some geographic locations having a favorable overall climate for wildfire activity. High-risk areas in Oregon (Figure 1-1) share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. Predominant wind directions may guide a fire's path, as demonstrated by New Mexico's wind driven Los Alamos fire in 2000. It is often a change in weather that marks the end of a wildfire's growth.[15]

TRG Key

For information on calculating percent slope, refer to Section 2 of the Landslide Guide of this Natural Hazards Technical Resource Guide.

2.3.4 Development

Development of interface areas is increasing in Oregon. While there are many reasons people want to live in interface areas, homes in such areas often create risk. Fire has historically been a natural wildland element, and can sweep through vegetation that is adjacent to a combustible home. Major wildland fires may rapidly grow to sizes that require many fire fighters to control. New residents in remote locations are often surprised to find that in escaping urban areas, they left behind readily available fire services for structure protection.[16]

Wildfire has an obvious effect on development, yet development can also play an influencing role with wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation, and use natural materials (wood shake roofing, for example). A private setting may be a location far from public roads, or at least hidden behind a narrow, curving driveway. These conditions make evacuation and firefighting difficult. The scenic views found along mountain ridges and valley slopes can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.[17] Wildfire can threaten buildings, or, conversely, a burning structure can introduce fire into wildlands with the potential of destroying valuable natural resources such as timberlands, habitat and watersheds.[18]

Sidebar

Wildfire and Other Hazards

By removing vegetative cover within a watershed, wildfires can contribute to landslides and floods.[19] Earthquakes and volcanoes have the potential to cause wildfires.

Wildfire Key

Because development has a strong influence on the behavior of interface wildfire, identification of hazard areas benefits from site-specific evaluation of development. For more information refer to Section 4 of this guide.

2.4 How Can Your Community Identify Wildfire Hazard Areas?

The Wildland/Urban Interface Fire Protection Program (the formal name given to a national initiative spawned by destructive fires of 1985) developed a generic five-step method for assessing wildfire hazard. By assessing components such as fuel, topography, weather, fire history, and development, a community can identify specific wildfire hazard areas. This information can strengthen the inventory of a comprehensive plan, providing further support for policies and implementing measures.

Wildland/Urban Interface Hazard Assessment Methodology

Step 1:

Select the areas to be evaluated.
Define the area or scope of the assessment.
Using a map, display the interface areas.
Name or number each area.

Step 2:

Select the hazard components to be considered in the assessment.
Assemble the list of hazard components that will be included in the assessment (fuel, topography, weather, fire history, roofing materials, etc.)

TRG Key

The first step of hazard assessment is hazard identification, estimating the geographic extent, intensity and occurrence of a hazard. More information on the three levels of hazard assessment can be found in Chapter 2: Elements of a Comprehensive Plan.

Step 3:

Rank the hazard components.
Define a system to rank the hazard level of the components.
Evaluate and rank each individual component included in the assessment.
Develop an overall hazard rating system.
Calculate the overall hazard rating.

Step 4:

Compile the hazard rankings in a useable format.
Use a variety of display methods to make the data usable and understandable.
Consider maps, clear overlays and computer modeling as methods for analyzing and displaying data.

Step 5:

Develop Future Actions.
Use the information developed to reduce the fire-loss potential in the wildland/urban interface.

Further information on the five-step method is included in the pamphlet: *Wildland/Urban Interface Hazard Assessment Methodology*. The pamphlet also includes profiles on 16 effective hazard assessment systems.

Wildfire Key

Refer to the list of Wildfire Publications in Section 6 of this guide for ordering information.

Mapping the results of your wildfire assessment may prove difficult. Information about hazard mapping processes can be found in the following locations of this Wildfire Guide:

- Section 3 - ORS 477.015-061;
- Section 4 - Wildfire Hazard Zones;
- Section 5 - Bend and Ashland Case Studies;
- Section 6 - Oregon Department of Forestry Mapping;
- Section 6 - Risk Mitigation of Wildfire Hazards at the Wildland/ Urban Interface of Northwest Arkansas - web site; and
- Section 6 - Wildfire Hazard Maps of the Eastside Sierra Nevada - web site.

Once hazard areas are identified, compiling information about population and structural value in those areas helps assess a community's vulnerability to wildfire. This information can be a powerful tool in building support for wildfire risk reduction. Vulnerability assessment for wildfire hazards requires the cooperation of different local government departments, particularly planning, fire, and emergency management departments. Section 4 provides a profile of Wildfire Hazard Identification and Mitigation System (WHIMs) as an example of an applied wildfire vulnerability assessment.

Wildfire Key

The National Fire Protection Association's Standard 299: Protection of Life and Property from Wildfire is a resource to help planners assess wildfire hazards. It includes basic standardized rating systems for fuel, slope, structure, and additional factors. A profile of the standard is included in Section 4: Reducing Risk from Wildfire Hazards.

2.5 Summary: Wildfire Hazard Identification

- ❒ The principal type of wildfire affecting communities is interface wildfire.
- ❒ Fuel, slope, weather, and development are key components in wildfire hazard area identification.
- ❒ Following a standard methodology can assist a community in identifying wildfire hazard areas.
- ❒ By identifying wildfire hazard areas, a community can increase public support for policy and implementing measures.
- ❒ Once wildfire hazard areas are identified, communities can perform a vulnerability assessment, which examines loss potential and may further increase support for wildfire hazard mitigation.
- ❒ Has your community conducted a community wide vulnerability assessment?

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Chapter 2: Elements of a Comprehensive Plan provides information on three phases of hazard assessment: hazard identification, vulnerability assessment and risk analysis. The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment examines identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following questions in determining whether or not its comprehensive plan has adequately inventoried wildfire hazards.

- ❒ Are there wildfire hazards in your community?
- ❒ Does your comprehensive plan hazard inventory describe wildfire in terms of the geographical extent, the severity and the frequency of occurrence?

Back Forward

Section 3:
What are the Laws in Oregon for Wildfire Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Wildfire Hazard Technical Resource Guide presents laws that Oregon communities are required to address.

TRG Key

Information on Goal 7 can be found in Appendix A of the Natural Hazards Technical Resource Guide.

3.1 Oregon Laws Related to Wildfire Hazards

3.1.1 Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning requirement that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states "Developments subject to damage, or that could result in loss of life, shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards…"

3.1.2 Oregon Revised Statute 215.730: Additional Criteria for Forestland Dwellings

ORS 215.730 (County Planning; Zoning, Housing Codes) provides additional criteria for approving dwellings located on lands zoned for forest and mixed agriculture/forest use. Under its provisions, county governments must require, as a condition of approval, that single-family dwellings on lands zoned forestland meet the following requirements:

1. Dwelling has a fire retardant roof;
2. Dwelling will not be sited on a slope of greater than 40 percent;
3. Evidence is provided that the domestic water supply is from a source authorized by the Water Resources Department and not from a Class II stream as designated by the State Board of Forestry;
4. Dwelling is located upon a parcel within a fire protection district or is provided with residential fire protection by contract;
5. If dwelling is not within a fire protection district, the applicant provides evidence that the applicant has asked to be included in the nearest such district;
6. If dwelling has a chimney or chimneys, each chimney has a spark arrester; and
7. Dwelling owner provides and maintains a primary fuel-free break and secondary break areas on land surrounding the dwelling that is owned or controlled by the owner.

If a governing body determines that meeting the fourth requirement is impractical, local officials can approve an alternative means for protecting the dwelling from fire hazards.

Tip Box

For more information on forestland zones consult the Oregon Department of Land Conservation and Development; Statewide Goal 4 -Forest Lands and Oregon Administrative Rules 660-006.

This can include a fire sprinkling system, on-site equipment and water storage, or other methods that are reasonable, given the site conditions.

If a water supply is required under this subsection, it must be a swimming pool, pond, lake or similar body of water that at all times contains at least 4,000 gallons or a stream that has a minimum flow of at least one cubic foot per second. Road access must be provided to within 15 feet of the water's edge for fire-fighting pumping units, and the road access must accommodate a turnaround for fire-fighting equipment.

3.1.3 Oregon Revised Statute 477.015-061 Urban Interface Fire Protection

These provisions were established through efforts of the Oregon Department of Forestry, the Office of the State Fire Marshal, fire service agencies from across the state, and the Commissioners of Deschutes, Jefferson, and Jackson Counties.[20] It is innovative legislation designed to address the expanding interface wildfire problem within Oregon Department of Forestry Fire Protection Districts. Full implementation of the statute will occur on or after January 1, 2002. The statute does the following:[21]

1. Directs the State Forester to establish a system of classifying forestland-urban interface areas;
2. Defines forestland-urban interface areas;
3. Provides education to property owners about fire hazards in forestland-urban interface areas. Allows for a forestland-urban interface county committee to establish classification standards;
4. Requires maps identifying classified areas to be made public;
5. Requires public hearings and mailings to affected property owners on proposed classifications;
6. Allows property owners appeal rights;
7. Directs the Board of Forestry to promulgate rules that set minimum acceptable standards to minimize and mitigate fire hazards within forestland-urban interface areas; and
8. Creates a certification system for property owners meeting acceptable standards. Establishes a $100,000 liability limit for cost of suppressing fires, if certification requirements are not met.

3.2 Summary: Laws for Wildfire Hazards

- ❒ Oregon Statewide Planning Goal 7: Areas Subject to Natural Hazards
- ❒ Oregon Revised Statute 215.730: Additional Criteria for Forestland Dwellings
- ❒ Oregon Revised Statute 477.015-061 Urban Interface Fire Protection

Wildfire Key

Refer to Internet Resources in Section 6 for information on accessing a map of the Oregon Department of Forestry Fire Protection Districts. Implementation of ORS 477.015-061 will occur in these districts.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. The laws in Section 3 of the Wildfire Technical Resource Guide are those that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying wildfire hazards in your jurisdiction:

- ❒ Does your community's comprehensive plan contain an inventory of wildfire hazards, vulnerability assessment and policies addressing wildfire hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on wildfire hazards in your community and current laws related to wildfire?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in wildfire hazard areas?

Wildfire Key

Section 2 of this document provides information that can assist your community in identifying wildfire hazard areas.

Section 4: How Can Your Community Reduce Risk from Wildfire Hazards?

Avoiding development in hazard areas is the most effective way to reduce risk. The appreciation of land values, however, and other short-term economic advantages of development in wildfire hazard areas often create an active constituency strongly opposed to regulatory efforts.[22] This section presents strategies to reduce risk from wildfire including site-specific evaluation, land use planning tools, and non-regulatory activities. These strategies can further assist communities planning for wildfire hazards through strengthened factual base, policies, and implementing measures.

4.1 How Can Your Community Plan for Wildfire Hazards?

It is possible to plan, at least to some degree, for wildfire hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in wildfire areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

TRG Key

Chapter 2: Elements of a Comprehensive Plan provides further information on hazard identification.

To successfully plan for wildfire hazards, consider the following steps:

✓ **Identify the hazard**
Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.

✓ **Avoid the hazard**
Restrict development in hazard-prone areas. For areas with high potential for severe property damage or loss of life, this option should be followed.

✓ **Evaluate site-specific development**
Evaluating site-specific development may assist in further identifying wildfire hazard areas, and can help determine site-specific measures needed for risk reduction. Site-specific evaluation processes, examples of which are described below, may enhance the factual base upon which policies and implementation measures are built. They may also be of use in the development permit process. Programs described in this section include:

- Wildland Home Fire Risk Meter & Forest Home Risk Form
- Colorado State Forest Service (CSFS) Wildfire Hazard Mitigation and Response Plan
- Woodland Home Forest Fire Hazard Rating
- NFPA Standard 299: Protection of Life and Property from Wildfire

✓ **Conduct a community-wide vulnerability assessment**
A vulnerability assessment can provide a basis for wildfire hazard policy and implementing measures. This section includes a profile of Boulder, Colorado's Wildfire Hazard Identification and Mitigation System (WHIMs), which contains an example of wildfire vulnerability assessment.

✓ **Implement risk reduction measures through land use planning**
Regulating development in hazard areas through land use planning can reduce risk of property damage and loss of life. This section describes a Wildfire Hazard Overlay District for Jefferson County, Colorado.

✓ **Implement additional non-regulatory measures**
Non-regulatory measures can further reduce risk from wildfire. Programs described in this subsection include:

- FireFree
- Firewise
- Oregon Wildfire Hazard Zones

4.2 How is Development in Wildfire-Prone Areas Evaluated?

This subsection describes methods for evaluating site-specific development, including home-site evaluations, subdivision evaluations, and a comprehensive program that includes various elements of site-specific evaluation.

4.2.1 Wildland Home Fire Risk Meter & Forest Home Risk Form

Home site evaluation tools like the Risk Meter, Risk Form, FireFree checklist, and Wildfire Hazard Assessment and Mitigation System (WHIMs) questionnaire can be used to increase public involvement by prompting homeowners to think about interface wildfire. Information produced by using these tools can also help assess a community's risk to interface fire and enhance a community's factual base of the wildfire hazard.

The *Wildland Home Risk Meter* is designed simply (multiple cardboard dials on a placard), and provides a model for communities interested in designing similar evaluation tools. The meter computes a wildfire hazard level using the following four steps:

1. Estimate the terrain slope around the home and line up the first dial.
2. Select the vegetation type rating from a given chart, and line up the rating on the second dial.
3. Select the roof material.
4. The wildfire risk meter then points to the danger rating from low to extreme.

Created under the Great Lakes Forest Fire Compact, the *Forest Home Risk Form* is an online evaluation tool. The user checks the appropriate answers to a series of questions and is presented with an automatic calculation of site risk. The user can then use the form to calculate risk reduced from using different prevention measures. To access the Risk Form visit **http://www.dnr.state.mi.us/www/fmd/fire/hazardform.htm**.

4.2.2 Colorado State Forest Service (CSFS) Wildfire Hazard Mitigation and Response Plan

This state agency plan can be used as a model to guide wildfire hazard assessment at the local level. Information gathered from the assessment can be used to increase public awareness and enhance a community's factual base for wildfire hazard.

In an effort to increase uniformity and improve the quality of wildfire hazard assessment, the CSFS evaluated existing assessment models to produce this dynamic system for the state of Colorado. The system acts as a baseline for local jurisdictions and was created with the understanding that, "To be accepted and utilized such a system must be easy to understand, simple to apply, not require excessive time and effort, and provide consistent results regardless of who conducts the evaluation."[23]

The hazard assessment system is enhanced by the use of standards and codes, and it may be updated as new techniques are developed. This system includes techniques for assessing both individual homes and subdivisions and a response plan outline (for use by local fire agencies) combining the information gathered in the assessments.

The Plan is available by contacting:

Colorado State Forest Service
Colorado State University
Fort Collins, CO 80523
Phone: (970) 491-6303
Fax: (970) 491-7736
http://www.colostate.edu/Depts/CSFS/fire/mitplan.pdf (a downloadable Plan)

Wildfire Key

Refer to Internet Resources in Section 6 for more information on CSFS.

4.2.3 Woodland Home Forest Fire Hazard Rating

This user-friendly evaluation tool for subdivisions is included in the National Wildland/Urban Interface Fire Protection Program document Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. The evaluation can be used in the approval process for a proposed subdivision or in the development of factual base for a community's wildfire hazard. The rating system uses the following criteria to calculate subdivision fire hazard:

- Fuel Hazard Rating;
- Slope Hazard Rating;
- Structure Hazard Rating;
- Emergency Vehicle Access Rating;
- Safety Zone Rating (the zone of cleared vegetation around a house); and
- Additional Factor Rating (street signs, power lines, water sources, density, etc.)

4.2.4 National Fire Protection Association (NFPA) Standard 299: Protection of Life and Property from Wildfire

This national standard provides suggested criteria for fire agencies, land use planners, architects, developers, and local government for fire-safe development in areas that may be threatened by wildfire.[24] NFPA Standard 299 presents minimum planning criteria for the protection of life and property from wildfire, and it outlines standardized procedures for addressing the following issues:

- Evaluation of the wildland/urban interface (includes fuel, slope, hazard ratings, additional factors);
- Street design;
- Signage of streets and buildings;
- Emergency water supplies; and
- Structural design and construction.

This document is an excellent resource for evaluating existing or proposed development. It is also useful for development of sound local interface wildfire policies and implementing measures.

4.2.5 Wildfire Hazard Identification and Mitigation System (WHIMs)

In response to Colorado's Black Tiger Fire of 1989, which destroyed 44 homes and 2,086 acres, the Boulder Board of County Commissioners established the Boulder County Wildfire Mitigation Group.[25] The mission of this group was to discuss and coordinate actions that could be taken to help minimize the loss of lives and property from the next wildfire. They used the spatial analysis and mapping abilities of the county's computer Geographic Information System (GIS) for identification of wildfire hazards. A technical working group was formed to design WHIMs, a program to coordinate all the components of wildfire mitigation, while providing motivation for homeowners and residents to actively participate. WHIMs combines elements of evaluation and implementation.

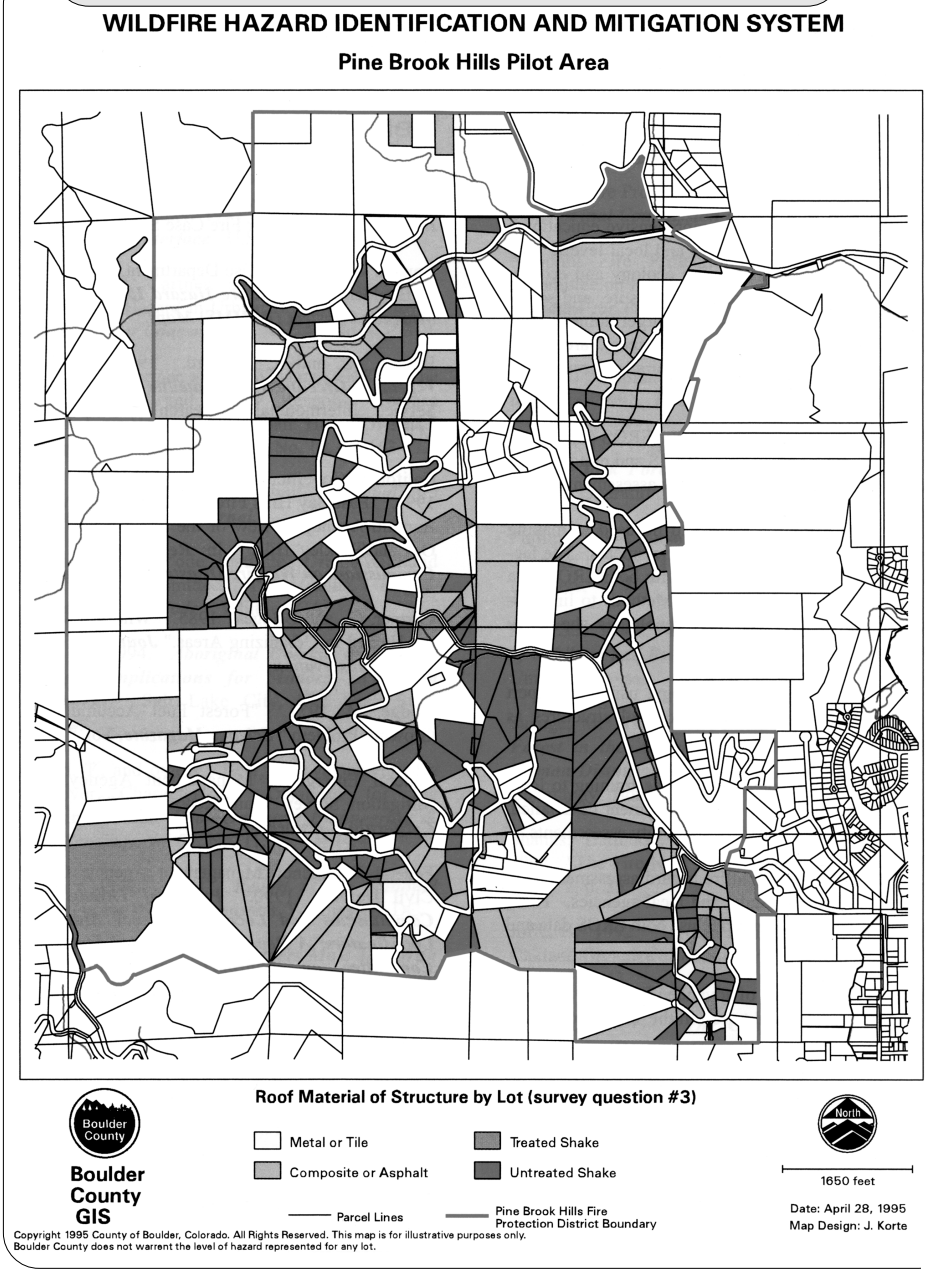
WHIMs assesses community vulnerability by using GIS to create hazard maps which relate county assessor's parcel ownership and structure data to physical data (such as slope or fuel type). It then compiles a hazard rating survey of the individual parcels. The survey is in the form of a questionnaire produced using the advice of wildfire hazard experts. The questionnaire is taken to individual properties and residents by volunteer fire fighters within the fire district.

Wildfire Key

Water Supply

Increased risk in some interface locations can be caused by lack of emergency water supplies. Creative methods for addressing this problem can be found in the National Wildland/Urban Interface Fire Protection Program's Planning for Water Supply and Distribution in the Wildland/Urban Interface. You can obtain this document through the National Fire Protection Association's Public Fire Protection Division. Refer to Section 6 for more information on accessing this Wildfire publication.

Boulder County Wildfire Hazard Pilot Map



Source: *Federal Emergency Management Agency. Multi-Hazard Identification and Risk Assessment. Washington, D.C.: FEMA (1997) p. 243.*

WHIMs is a multi-faceted program. From the vulnerability assessment comes a stronger factual base for planning. Increased public involvement and fire agency interaction also increases support for wildfire mitigation. The WHIMs system accomplishes its objectives using four main components: data collection and entry, analysis, dissemination, and maintenance. A thorough review of how these components function within the system (as well as cost and staffing considerations, results, and future developments) can be obtained using the contact information below. It is not suggested that a program like WHIMs could be applied the same way in any location.

Sidebar

Contact Boulder County

You can contact Boulder County to find out how elements of WHIMs might function in your area.

Boulder County Land Use Department
P.O. Box 471
Boulder, CO 80306
Telephone: (303) 441-3930
http://www.co.boulder.co. us/gislu/whims.html

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4.3 What Land Use Tools can be Used for Wildfire Hazards?

Land use planning for wildfire hazards often involves identifying a community's hazard areas and developing regulations applying specifically to those areas. This method is used in places like Ashland, Oregon and Jefferson County, Colorado. A profile of Ashland is included in Section 5 of this guide. Jefferson County's regulation is discussed below. Another effective land use tool for reducing wildfire risk is subdivision regulation. Subdivision regulations used in Bend, Oregon are described in Section 5.

4.3.1 Wildfire Hazard Overlay District - Jefferson County, CO

Once areas prone to wildfire are evaluated and mapped, a community can regulate land use within those areas by creating an overlay zone. This kind of land use tool builds directly from the hazard identification process often used for comprehensive plan hazard inventories. The general provisions of the wildfire hazard overlay district in Colorado are listed below (complete ordinance language can be accessed on-line at **http://www.co.jefferson.co.us/dpt/planning/zoning/sec45.html**).

A. INTENT AND PURPOSE OF DISTRICT

This District is intended to promote the public health, safety and general welfare of the citizens of Jefferson County; minimize the risk of loss of life and property in Wildfire Hazard Overlay Zone District; encourage and regulate prudent land use in the Wildfire Hazard Overlay Zone District so as not to increase the danger to the public health, safety and property; reduce the demands for public expenditures for relief and protection of structures and facilities permitted in the Wildfire Hazard Overlay Zone District; regulate buildings and structures so as to minimize the hazard to public health, safety, welfare, and to public or private property.

B. GENERAL PROVISIONS

1. Boundaries (a statement of applicability)
2. Wildfire Hazard District Overlays Other Zone Districts (an illustration of how the overlay zone applies)
3. Warning and Disclaimer of Liability

C. USE REGULATION

D. BUILDING PERMITS (performance standards, key issues for wildfire mitigation)

1. Building Permits
2. Site Plans
3. Design Standards
4. Defensible Space Certification Procedures

E. MAPPING CONFLICTS

Tip Box

Jefferson County, Colorado Ordinance

This Jefferson County, Colorado zoning ordinance demonstrates several key elements that your community should include to safeguard against legal challenges: 1. A clear statement of the "intent and purpose" of the district. Note that the intent of the district is to "promote health, safety and general welfare" and "to minimize the risk of loss of life and property in Wildfire Hazard Overlay Zone District." 2. A clear statement of applicability – property owners know if they are in or out of the hazard overlay district. 3. Performance standards that provide information to the property owner on what activities they can or must take to minimize risks of wildfire.

Wildfire Key

Refer to section 6 for information on FEMA's Project Impact.

4.4 What are Non-Regulatory Programs to Reduce Risk from Wildfire Hazards?

This subsection profiles a variety of non-regulatory programs available in Oregon for interface fire mitigation at the local level.

4.4.1 FireFree

FireFree is a unique private/public program for interface wildfire mitigation involving partnerships between an insurance company and local government agencies. It is an example of an effective non-regulatory approach to hazard mitigation. Originating in Bend, the program was developed in response to the city's "Skeleton Fire" of 1996, which burned over 17,000 acres and damaged or destroyed 30 homes and structures.[26] Bend sought to create a new kind of public education initiative that emphasized local involvement. SAFECO Insurance Corporation was a willing collaborator in this effort.

Bend's pilot program included:

- A short video production featuring local citizens as actors, made available at local video stores, libraries, and fire stations;
- Two city-wide yard debris removal events;
- A 30-minute program on a model FireFree home, aired on a local cable television station; and
- Distribution of brochures, featuring a property owner's evaluation checklist and a listing of fire-resistant indigenous plants.

The success of the program helped to secure $300,000 in Federal Emergency Management Agency (FEMA) "Project Impact" matching funds.[27] By fostering local community involvement, FireFree also has the potential for building support for sound interface wildfire policy. To obtain information regarding how FireFree might work in a particular community contact:

SAFECO
SAFECO Plaza T-8
Seattle, WA 98185
(206) 545-6188
http://www.FireFree.org

4.4.2 Firewise

Firewise is a program developed within the National Wildland/ Urban Interface Fire Protection Program, and it is the primary federal program addressing interface fire. It is administered through the National Wildfire Coordinating Group whose extensive list of participants includes a wide range of federal agencies.

The program can empower planners and decision-makers at the local level. Through conferences and information dissemination, Firewise increases support for interface wildfire mitigation by educating professionals and the general public about hazard evaluation and policy implementation techniques. Firewise offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive home page allows users to ask fire protection experts questions, and to register for new information as it becomes available. For more information on the Firewise program, contact:

The Wildland/Urban Interface Fire Program
c/o The National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269
http://www.firewise.org

Applegate Watershed Partnership (Southern Oregon)

Integrated approaches to wildfire hazard mitigation can provide multiple community benefits. An example of an integrated approach is the Applegate Watershed Partnership, in Josephine County, which has cooperated with federal agencies and a private timber company.

Before European settlement of the watershed, Native Americans set frequent, low-intensity fires throughout the watershed. This resulted in forests with large, widely spaced trees and diverse under-story, while reducing the danger of catastrophic fires.[28] After a period of extensive stand-clearing fires set by Euro-Americans in the mid-to-late 1800's, followed by nearly a century of fire suppression,[29] much of the forested slopes have grown into dense, choked stands of small-diameter trees, which pose an extreme fire danger in an increasingly populated valley.[30]

A project to reduce fire hazard and enhance the local economy involves contract sales to thin large numbers of smaller trees. This reduces fire hazard in the Applegate watershed while leaving the largest trees to begin reestablishing old growth characteristics. The small trees, which traditionally would have little value as lumber, have tight growth rings and superior tensile strength because of their age. Some of the proceeds from the timber sales go to restoration of pine-oak savannas, which historically have been an important element in regional biodiversity, but for which there currently is no economic market to support their restoration.[31]

Wildfire Key

For more information on ORS 215.730, refer to the State Wildfire Policies in Section 2. For more information on ODF's Wildfire Hazard Zones, refer to ODF contact information in Section 6 of this guide.

4.4.3 Oregon Wildfire Hazard Zones

A statute enacted by the 1993 Legislature and changes to Oregon's Building Code encourage local governments to *voluntarily* designate those portions of their jurisdictions subject to catastrophic fire as "Wildfire Hazard Zones". The purpose of these zones is to define those areas where buildings need to be more resistant to fires spreading through adjacent wildlands.

The determination of wildfire hazard zones involves the inventorying and mapping of the wildfire hazard at the jurisdiction level. The mapping must be done using the Oregon Department of Forestry's criteria as defined in Oregon Administrative Rules chapter 629, Division 44.

When a jurisdiction adopts a Wildfire Hazard Zone the provisions of ORS 93.270(4) become active. These provisions state that legal action cannot be brought against a property owner for using fire resistant roofing material, even if a flammable material, such as cedar shakes, is specifically required by covenants which run with the land. Several provisions in the 1993 Building Code also become active. These provisions require that fire safe roofing materials be used and that street addresses be clearly posted. The roofing material provisions compliment similar existing requirements in ORS 215.730, which sets standards for new dwellings built on land zoned for forest use.[32]

4.5 Summary: Reducing Your Community's Risk from Wildfire Hazards

- ❒ Reduce the level of risk in hazard prone areas by minimizing development, or implementing mitigation measures such as building code standards when developing in hazard-prone locations is unavoidable.
- ❒ Possible steps in planning for the wildfire hazard include:
  - Identifying the hazard;
  - Evaluating existing or proposed site-specific development;
  - Performing community vulnerability assessment and risk analysis;
  - Implementing risk reduction measures through land use planning; and
  - Implementing additional mitigation activities.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Refer to Chapter 2: Elements of a Comprehensive Plan for more information on developing inventories. Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your local government should ask the following questions in determining the strength of your comprehensive plan in addressing wildfire hazards:

- ❒ Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to natural hazards in general?
- ❒ Has your community implemented a process for evaluating site-specific development requests in wildfire hazard areas?
- ❒ Does your community have an approach to reduce risk from wildfire through a combination of regulatory and non-regulatory measures?
- ❒ Do the implementing measures carry out your comprehensive plan's policies related to wildfire in your community?

Tip Box

All implementing ordinances should have clear intent and purpose sections to help withstand legal challenges.

Section 5: How are Oregon Communities Addressing Wildfire Hazards?

This section summarizes background, policy development, and implementing measures for Oregon communities addressing wildfire hazards and development in wildfire-prone areas.

5.1 Creating Public/Private Partnerships in Bend, Oregon

Bend, having experienced interface fire destruction, has addressed the wildfire hazard through a unique effort involving fire and planning department cooperation and a public/private, action-oriented educational program.

5.1.1 Background

The city of Bend, located in Deschutes County, has direct experience with destructive interface wildfire. The Awbrey Hall fire of 1990 destroyed 21 homes, burning approximately 3,400 acres.[33] In 1996, the city's Skeleton fire burned over 17,000 acres and damaged or destroyed 30 homes and structures. Losses from the fire reached over $7 million.[34]

Deschutes County's wildfire hazards have been mapped using Oregon Department of Forestry criteria for Wildfire Hazard Zones. Under the criteria, the entire county is considered a Wildfire Hazard Zone. Within Bend's Urban Growth Boundary (UGB), some risk is offset by central city development that incorporates built-in fuel breaks in the form of roads and an adequate water supply. Yet, the interface (which is constantly changing in Bend and many other communities) remains an area of high risk when sufficient mitigation efforts are not taken.

Hazard mapping was facilitated by a Central Oregon Community College Geographic Information System (GIS) specialist, which demonstrates the positive role academia can play in hazard mitigation.

Greater initiative for wildfire hazard mitigation in Bend came after the devastating incidents mentioned above. Unfortunately, that initiative had to compete with the many other planning demands of a rapidly growing city, and an opportunity to strengthen city wildfire policies had to be postponed. Policies in Bend's General Plan providing a link to wildfire protection include the following:

- Narrow streets may have limited parking to ensure emergency vehicle access;
- Emergency vehicle access will be considered in review of new residential development; and
- A shortened block length under Street System Policies to create more of a grid system.
- In areas where the natural slope exceeds 20 percent, the city may reduce the minimum residential density (allow larger lots) or alternatively, may require cluster development through the Planned Unit Development (PUD) process to preserve the natural topography and vegetation, and improve fire protection.

TRG Key

For further information on academic research for inventory and factual base development, refer to Chapter 2 of the Natural Hazards Technical Resource Guide, Elements of a Comprehensive Plan.

Back Forward

After the Skeleton fire of 1996, the community came together to support wildfire mitigation through a unique public/private program involving the Bend Fire Department, Deschutes County Rural Fire Protection District #2, Bend City Planning, and Deschutes National Forest. Bend became the pilot community for the FireFree program.

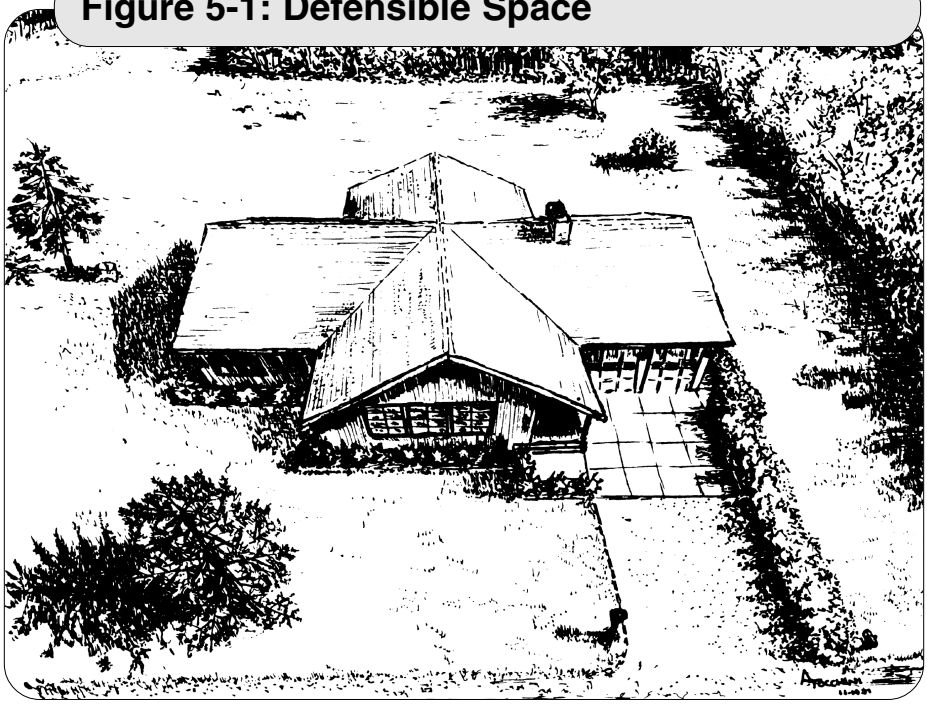
5.1.2 Implementation

Bend's fuel break ordinance is a regulatory tool for creating "defensible space" or an area around a structure free from flammable vegetation (refer to figure 5-1). The objectives of the ordinance often are met through the non-regulatory FireFree program. Bend holds annual community clean-up weekends, during which residents can dispose of yard debris free of charge at local facilities. Hauling the debris has been done at no cost to the property owner, as well. These kinds of local, private partnerships help sustain the FireFree program at an effective level. The 1999 designation of Deschutes County as a FEMA Project Impact community increases the effort to utilize all levels of government and numerous business interests to support and increase the use of the FireFree program.

TRG Key

Refer to Appendix C: Land Use Tools for more information on Planned Unit Developments.

Figure 5-1: Defensible Space



Source: *Northwest Interagency Fire Prevention Group. Fire Safety Considerations for Developments in Forested Areas. Salem, Ore.: Oregon Department of Forestry (1997) p. 15.*

Wildfire Key

Refer to Section 6 of this guide for more Project Impact information.

5.1.3 Ordinance Language: Flammable Vegetation Fuel Breaks, City of Bend

The City of Bend Code addresses risk reduction of interface wildfire by requiring property owners to remove flammable vegetation surrounding structures and other objects susceptible to fire. The four main items of Bend Code Section 5.345 (Flammable Vegetation Fuel Breaks) read as follows:

1) It shall be the responsibility of every property owner and occupier of property within the City of Bend to reduce the fire hazard created by flammable weeds, grass, vines, brush and other combustible vegetation on their property by complying with the requirements of this ordinance.
2) Every property owner and occupier of property shall establish fuel breaks (also known as firebreaks) on their property in the following manner:
   a) A fuel break shall be created by removing or cutting all of the flammable weeds, grass, vines, brush, and other combustible vegetation within the fuel break as close to the ground as is reasonably practicable given the nature of the terrain and property.
   b) The fuel break shall be a minimum of ten feet in width or depth, or three times the height of the tallest vegetation adjacent to the fuel break, if this would be more than ten feet.
   c) The fuel breaks shall be located along the boundaries of the property; and also around any structures, power poles,

Mike Byers "Planner's Perspective"

Bend has experienced several small lighting caused fires in the past, but it was the human caused 1990 Awbrey Hall fire that brought the reality of wildfire to Bend. Policy changes to require fire flows tests and second emergency evacuation routes out of subdivisions – both critical concerns during the Awbrey Hall fire – were made following the fire. The rapid growth during the early 1990s kept the Bend planning and engineering staff busy with current planning issues, and unfortunately better wildfire planning slipped into the "to do" file.

The 1996 Skeleton fire, just southeast of Bend in an area of junipers and brush, made it clear that the risk of wildfire is present throughout Central Oregon. Since the development patterns in the urban area and rural subdivisions are already established, the city staff and rural fire department worked on ways to mitigate damage and protect the public from future wildfires. In addition to the very successful FireFree! education program, changes to the city subdivision codes were drafted to require multiple roads in and out of new development to provide safe evacuation of residents and access by emergency equipment. Other changes to street widths, block length, design standards, and pedestrian access ways were made to ensure rapid response to fires and protection of the public. These mitigation measures also considered planning design and livability issues like "skinny streets", connectivity, streetscape, and tree preservation. Exceptions to street width, length and design standards can be granted upon a determination by the planning and fire departments that public safety can be maintained.

The variety of both voluntary and regulatory measures taken in Bend after both the Awbrey Hall and Skeleton fires will help reduce the risk of wildfire hazards and damage to the community.

Mike Byers - Bend Long Range Planning

vehicles, trees or other improvements on the property that would be vulnerable to a fire hazard created by flammable weeds, grass, vines, brush and other combustible vegetation.

d) The purpose of the fuel breaks shall be to protect the property from the spread of fire from other properties; as well as confining any fire on the property by preventing its spread to other properties. In addition to the fuel breaks described above, the Fire Chief or Fire Chief representative may also permit smaller properties to comply with the purpose of this ordinance by cutting all of the flammable weeds, grass, vines, brush and other combustible vegetation on those properties to a prescribed height that will create a defensible fire space and accomplish the purpose of this ordinance.

3) The requirements of this ordinance shall be interpreted and applied consistently with the Uniform Fire Code in effect within the City of Bend.

4) A violation of this ordinance by any person, firm or corporation shall be a Class B Civil Infraction. In addition, any person, firm or corporation not complying with the provisions of this ordinance shall be subject to the abatement procedures provided in Bend Code Section 5.400 – 5.425.

Tip Box

Defensible Space

Creation of "defensible space" may meet with opposition from property owners who do not want to denude their landscape. Yet, non-flammable vegetation (preferably native to the area) can be planted in defensible space. A compilation of fire performance ratings for residential landscape plants can be accessed at: **http://www.prefire.ucfpl.ucop.edu/vegetati.htm**

Cooperation between planners and the fire protection community is key for reducing risk to development in wildfire-prone areas. Bend accomplishes this through interaction that occurs between the city's planning department and fire department. When conflicts of interest arise between development proposals and fire protection, there may be a meeting of planning department staff, fire department personnel, developers and engineers. Representatives from the fire department occasionally participate in public planning hearings, and planning department representatives attend fire department demonstrations. A year's worth of cooperation between the planning and fire departments facilitated the first of the following items in Bend's subdivision code.

Bend's Subdivision Code:

Design Standards

To help find common ground between developers' desires and fire department needs, Article VI (Design Standards and Improvements) of the subdivision code addresses exceptions to street standards. The exceptions are allowed only after the fire department reviews the proposed design. This review assures that the design will not restrict or prevent emergency vehicle access or create an unsafe situation for adjacent buildings or properties. Street standard exceptions may be granted if they allow for approved fire department access within 150 feet of all exterior portions of structures, do not require emergency vehicles to back-up more than 150 feet, or if there are increased fire protection measures inside structures (a fire sprinkler system for example).

Tip Box

Bend's Ordinance

Bend's ordinance includes a clear purpose statement and clear, objective performance standards. Also, the ordinance tells property owners exactly what is expected of them and exactly what the penalty is if they don't comply.

Water Availability

For any land division, information needs to be provided on the fire hydrant location and sizes of water mains.

Land Division

Safety from fire, flood, and other natural hazards needs to be considered in the review of a land division proposal. Placement of available utilities and adequate provision of public facilities and services must also be considered. The general provision on fire hazards applies to all land divisions not just subdivisions.

Block Length

Maximum residential block length is 600 feet to help ensure connectivity and multiple access routes in and out.

5.2 Regulatory Approaches to Wildfire in Ashland, Oregon

Ashland, after a detailed survey of wildfire hazard areas, has addressed the wildfire hazard through regulatory measures in specific hazard locations.

5.2.1 Background

Along with Deschutes County, Jackson County is a pilot area for ORS 477, interface mapping. This southwestern portion of the state experienced severe losses during the 1987 fire season. Ashland is situated in an area of high wildfire risk encompassing most of Jackson County.

The city of Ashland has mapped wildfire hazard areas within its Urban Growth Boundary, providing a strong fact base for wildfire hazard planning. This was done through a site-specific survey performed by Ashland's fire department in cooperation with the Oregon Department of Forestry, using United States Forest Service fuel models. Ashland has 1,100 acres categorized as wildfire hazard areas.[35] Some key criteria include connectivity of fuel, roofing materials, density of vegetation, and slope.

5.2.2 Wildfire Policy

Increased development pressure in Ashland led to a policy change in interface wildfire mitigation. Originally adopted in the early 1980s, the physical constraints chapter of Ashland's land use code (which deals with multiple hazard-related land development constraints) addressed development of wildfire hazard areas on a site-specific basis. In 1994, a change was made to include regulation at the subdivision level, as well (the original version of the code is included as an element of the updated version). The end result has been to create a lower level of risk for development in wildfire areas by addressing a broader level of development.

5.2.3 Implementation

Implementation of Ashland's code is similar to that of Colorado's Jefferson County Overlay District profiled in Section 4. Ashland has defined areas of wildfire hazard as a result of the mapping process described above. Within these mapped areas the city can apply effective regulation, because it has the factual base to support that regulation. The implementation procedure is highlighted within the second version of the code listed below.

Ashland illustrates a key requirement for community implementing measures with its clear and objective standards. Property owners

know exactly what size fuel break they need to install (A) and how to maintain it (B). Also included are clear building code requirements. As part of Ashland's implementing measure, the subdivision code includes a provision for a fire prevention and control plan, again stressing the need for cooperation between the planning department and fire/emergency management agencies.

Ashland's planning department can be contacted at Community Development; 20 East Main; Ashland, OR; 97520. Phone: (541) 488-5305.

Ashland Municipal Code (Original Version)
Chapter 18.62 Physical Constraints, Section 18.62.110, Development Standards for Class E Lands (wildfire hazard areas)

A) A 30-ft. shaded fuel break shall be installed and maintained around each dwelling unit or structure. Such fuel break shall be increased by 5 ft. for each 10% increase in slope over 10%.
B) A shaded fuel break is defined as an area that is free of dead or dying vegetation, and has native, fast-burning species sufficiently thinned so that there is no interlocking canopy of this type of vegetation. Where necessary for erosion control or aesthetic purposes, the fuel break may be planted in slow-burning species. Fuel breaks do not involve stripping the ground of all native vegetation.
C) No structure shall be constructed or re-roofed with wooden shingles, shakes or other combustible roofing material, as defined in the City's building code.
D) Fuel breaks in areas that are also Class C (constraints due to erosion hazards) lands shall be included in the erosion control measures outlined in Section 18.62.090.

Ashland Municipal Code (Updated Version)
Chapter 18.62 Physical and Environmental Constraints, Section 18.62.090, Development Standards for Wildfire Lands

Complete code language can be accessed at **http://www.ashland.or.us/MunicipalCode**.

Requirements for Subdivisions, Performance Standards Developments, or Partitions:

- A Fire Prevention and Control Plan shall be required with the submission of any application for an outline plan approval of a Performance Standards Development, preliminary plat of a subdivision, or application to partition land which contains areas designated as Wildfire Hazard areas.
- Criterion for Approval. The hearing authority shall approve the Fire Prevention and Control Plan when, in addition to the findings required by this chapter, the additional finding is made that the wildfire hazards present on the property have been reduced to a reasonable degree, balanced with the need to preserve and/or plant a sufficient number of trees and plants for erosion prevention, wildlife habitat, and aesthetics.

- The Fire Prevention and Control Plan shall be implemented during the public improvements required of a subdivision or Performance Standards Development, and shall be considered part of the subdivider's obligations for land development. The Plan shall be implemented prior to the issuance of any building permit for structures to be located on lots created by partitions and for subdivisions or Performance Standards developments not requiring public improvements. The Fire Chief, or designee, shall inspect and approve the implementation of the Fire Prevention and Control Plan, and the Plan shall not be considered fully implemented until the Fire Chief has given written notice to the Staff Advisor that the Plan was completed as approved by the hearing authority.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Your comprehensive plan should be coordinated with and reflect other comprehensive plan, plan policies and implementing measures of other communities within your region. Natural hazards do not respect community boundaries, making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plans, your community should ask the following questions in developing plan policies and implementing measures for wildfire hazards:

- ❒ What policy measures would assist your community in planning for wildfire hazards?
- ❒ Are there communities that face similar wildfire threats that have developed ordinances or non-regulatory programs that could be adopted by your community?
- ❒ Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park, and transportation districts)?

Section 6:
Where Can Your Community Find Resources to Plan for Wildfire Hazards?

This section is a resource directory including contacts, documents, and internet resources to assist planners, local governments and citizens in obtaining further information on wildfire hazards.

6.1 State Agency Resources

Oregon Department of Forestry (ODF)

ODF's Fire Prevention Unit is involved in interface wildfire mitigation, providing information about Oregon's Wildfire Hazard Zones (refer to Section 4 of this Guide). ODF has mapping relevant to wildfire hazard mitigation (refer to Internet Resources below). ODF's Graphics Department can produce mapping at the local level, but data availability may limit the usefulness of this resource.

Contact: Fire Prevention Unit
Address: 2600 State Street
Salem, OR 97310
Phone : (503) 945-7440
Fax: (503) 945-7454
Website: http://www.odf.state.or.us
Contact: Graphics Department
Address: 2600 State Street, Salem, OR 97310
Phone: (503) 945-7200

Oregon Department of Consumer and Business Services

The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards. Information about wildfire related building codes is found through this department.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW
P.O. Box 14470, Salem, OR 97309
Phone : (503) 373-4133
Fax: (503) 378-2322
Website: http://www.cbs.state.or.us/external/bcd

Sidebar

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Office of the State Fire Marshal (OSFM)

The Prevention Unit of Oregon's Office of the State Fire Marshal includes 19 Deputy State Fire Marshals located in various regions. The responsibilities of these deputies include public education for local fire districts and inspection of businesses, public assemblies, schools, daycare centers, and adult foster homes.

Contact: Prevention Unit
Address: 4760 Portland Rd. NW
Salem OR 97305-1760
Phone : (503) 378-3473
Fax: (503) 373-1825
Email: oregon.sfm@state.or.us
Website: http://www.sfm.state.or.us

6.2 Federal Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA Region 10 serves the northwestern states of Alaska, Idaho, Oregon and Washington. The Federal Regional Center (FRC) for Region 10 is located in Bothell, Washington. FEMA is an agency of the federal government whose purpose is to reduce risks, strengthen support systems, and help people and their communities prepare for and cope with disasters regardless of the cause. FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response and recovery."

Contact: Federal Regional Center, Region 10
Address: 130-228th St. SW
Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: www.fema.gov

National Fire Protection Association (NFPA)

NFPA is the principal federal agency involved in the National Wildland/Urban Interface Fire Protection Initiative. NFPA has information on the initiative's programs and documents. Other members of the initiative include: the National Association of State Foresters, the U.S. Department of Agriculture Forest Service, the U.S. Department of the Interior (including Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, and National Park Service), and the United States Fire Administration.

Contact: Public Fire Protection Division
Address: 1 Batterymarch Park, P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000
Website: http://www.nfpa.org

Back Forward

6.3 Recommended Wildfire Publications

The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should use in planning for wildfire hazards. Secondary documents may not be as essential as primary documents or as readily accessible, yet they still provide useful information to communities. Technical documents are those that focus on a particular specialized aspect of wildfire hazard mitigation.

Primary Resources

These documents represent the principal resources communities can use to better plan for the wildfire hazard. They are key tools for reducing the risks associated with wildfire-prone areas.

National Fire Protection Association Standard 299: Protection of Life and Property from Wildfire. National Wildland/Urban Interface Fire Protection Program. (1991). Washington, D.C.: National Fire Protection Association.

This document, developed by the NFPA Forest and Rural Fire Protection Committee, provides criteria for fire agencies, land use planners, architects, developers, and local governments to use in the development of areas that may be threatened by wildfire. The document is further profiled in Section 4 of this Guide.

To obtain this resource: National Fire Protection Association Publications (**http://www.nfpa.org** or 800 344-3555), Firewise (**http://www.firewise.org**)

An International Collection of Wildland-Urban Interface Resource Materials (Information Report NOR-X-344). Hirsch, K., Pinedo, M., & Greenlee, J. (1996). Edmonton, Alberta: Canadian Forest Service.

A comprehensive bibliography of interface wildfire materials. Over 2,000 resources are included, grouped under the categories of general and technical reports, newspaper articles, and public education materials. The citation format allows the reader to obtain most items through a library or directly from the publisher. The bibliography is available in hard copy or diskette at no cost. It is also available in downloadable PDF form.

To obtain this resource: Canadian Forest Service- Northwest Region, Northern Forestry Centre (780 435-7210), I-Zone Series (**http://www.prefire.ucfpl.ucop.edu/uwibib.htm**)

Wildland/Urban Interface Fire Hazard Assessment Methodology. National Wildland/Urban Interface Fire Protection Program. (1998). Washington, D.C.: Author.

This detailed 17-page pamphlet addresses the generic methodology listed in Section 4 of this Guide. Included in the back cover are 17 profiles of quality hazard assessment resources. Copies are limited, and bulk orders are not recommended.

To obtain this resource: Firewise (**www.firewise.org)**, NFPA Public Fire Protection Division (617) 984-7486

Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. National Wildland/Urban Interface Fire Protection Program. (1998). Washington, D.C.: Author.

A pamphlet providing three case studies of interface wildfire areas (Shenandoah Co., VA; Prescott, AZ; Orange Co., CA) with reviews of local interface wildfire programs. Includes general information on the process of developing a strong program. Also of value is information on rating systems and wildfire ordinances. Copies are limited, and bulk orders are not recommended.

To obtain this resource: Firewise (**www.firewise.org**) NFPA Public Fire Protection Division (617) 984-7486

Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[36]

Benton, Deschutes, and Tillamook counties, and Multnomah County with the City of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the Office of Emergency Management in Salem.[37] For more information about Project Impact visit **http://www.fema.gov** on the World Wide Web (**http://www.fema.gov/impact/impact00.htm**), or contact the Oregon Office of Emergency Management.

Secondary Resources

These documents provide additional information and tools for reducing the risks associated with wildfire-prone areas.

IFCI Urban/Wildland Interface Code. International Fire Code Institute. (1996). Whittier, CA.

California's I-Zone: Wildland/Urban Fire Prevention and Mitigation. Slaughter, R. (Ed.). (1996). Sacramento, CA: Governor's Office of Emergency Services.

Wildland/Urban Interface Fire Policy Action Report. Western Governor's Association. (1996). Denver, CO.

Wildfire Strikes Home (2nd Edition). National Wildland/Urban Interface Fire Protection Program. (1991). Washington, D.C..

The Wildland/Urban Fire Hazard. Insurance Services Office, Inc. (1997). New York, NY.

Questions and Answers about Wildfire Hazard Zones. Oregon Department of Forestry. (1996). Salem, OR.

Disaster in the Making: Awbrey Hall Fire (brochure). Oregon Department of Forestry. (1991). Salem, OR.

Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities. Burby, R. (1998). Washington, D.C.: Joseph Henry Press.

Protecting Life and Property from Wildfire: An Introduction to Designing Zoning and Building Standards for Local Officials. Great Lakes Forest Fire Compact. (1996). Sault Ste. Marie, Ontario.

The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildfire Ecosystems. Weise, D. (1995). Albany, CA: Pacific Southwest Research Station.

The East Bay Hills Fire Oakland-Berkeley, California. Routley, J. (1991). Washington, D.C.: United States Fire Administration.

Wildfire Hazard Management in the Urban/Wildland Interface in Southern Oregon. Curran, C. (1978). Ashland, OR: Southern Oregon State College.

Sidebar

Similar to Oregon's catastrophic flooding in 1996, California's 1993 wildfire events resulted in a presidential declaration of emergency triggering FEMA's Hazard Mitigation Grant Program. One ensuing mitigation project created an online guide (The I-Zone Series) containing downloadable interface wildfire publications. This Internet resource can be used to supplement the listed document resources.

Technical Resources

The document listed here focuses on the technical aspects of wildfire hazard mitigation. It may require interpretation by a technical specialist.

Planning for Water Supply and Distribution in the Wildland/Urban Interface. National Wildland/Urban Interface Fire Protection Program. (1994). Washington, D.C.

6.4 Internet Resources

Urban/Wildland Interface Fire: The I-Zone Series

http://www.prefire.ucfpl.ucop.edu/izone.htm

This is a comprehensive Web site with extensive information on all aspects of interface wildfire. The I-Zone series is an online "strategic resource planning guide" featuring downloadable publications, a homeowner's guide, a hazard assessment report, and more. Downloadable publications are found under: **"**Relevant Reports on the Urban/Wildland Interface".

Firewise

http://www.firewise.org/

Firewise maintains a Web site designed for people who live, vacation, or own structures in wildfire-prone areas, but it also can be of use to local planners and decision-makers. It offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive site allows users to ask questions of fire-protection experts and to register and receive further information as it becomes available.

Colorado State Forest Service (CSFS)- Interface Fire

http://www.colostate.edu/Depts/CSFS/fire/interface.html

The interface section of CSFS's Web site contains valuable links to Colorado mitigation strategies involving planning departments. Also included is the Wildfire Hazard Mitigation and Response Plan evaluation tool (refer to Section 4 of this Guide) and summaries of state fire hazard mitigation grant projects.

FireFree Program

http://www.ci.bend.or.us/firedept/firefree.htm or http://www.FireFree.org

A site sponsored by SAFECO Insurance Corporation, the Bend Fire Department, and Deschutes County Rural Fire Protection District Number Two. It includes a home rating questionnaire for interface wildfire mitigation and a list of prevention tips for homeowners.

Oregon Department of Forestry (ODF), Protection from Fire and Geographic Information System (GIS)

www.odf.state.or.us/FIREPROT.HTM and www.odf.state.or.us/gis/gisatlas.html

The Protection from Fire section of the ODF site includes Oregon specific fire protection resources. Wildfire condition reports can be accessed here. The GIS section of the site includes state maps of the following: slope, fire weather zones, precipitation, forest protection districts, potential natural vegetation, GAP vegetation, Northwest Oregon fire history, Southwest Oregon vegetation, lightning frequency, major watersheds, and general land ownership.

Fire Safety and Prevention: Wildfire Report

http://www.ci.medford.or.us/fire/urbanwild.html

This site provides an overview of interface wildfire including prevention strategies for both homeowners and fire departments.

Fire Policy in the Wildland/Urban Interface (Western Governor's Association)

http://www.westgov.org/wga/policy/98013.htm and http://www.westgov.org/wga/publicat/feb.wpd

A profile of a 1998 interface wildfire policy resolution including policy statements and management directives adopted by the Western Governor's Association. Also available through the Association's site is an online version of the Wildland/Urban Interface Fire Policy Action Report. The report broadly addresses what needs to be accomplished to mitigate interface wildfire in the Western United States.

Risk Mitigation of Wildfire Hazards at the Wildland/Urban Interface of Northwest Arkansas

http://www.cast.uark.edu/~mike/thesis.html

This site is a thesis on interface fire mitigation. It includes a detailed overview of the wildfire hazard mapping process for an Arkansas Forestry Commission Fire Protection District.

Wildfire Hazard Maps of the Eastside Sierra Nevada

http://www.npr.unr.edu/fire

This site is an outline of the wildfire hazard mapping process completed by the University of Nevada- Reno's Department of Environmental and Resource Science. The project was aided by a multiple partnership of non-governmental organizations, academic institutions, and both state and federal government.

The Wildland/Urban Fire Hazard (Executive Summary)

http://www.iso.com/docs/stud009.htm

An executive summary of the Insurance Services Office, Inc. report on interface wildfire. Intended for use by regulators, legislators, the general public, and insurance company personnel, the report offers an overview of interface wildfire and presents the insurance industry's role in hazard mitigation.

Great Lakes Forest Fire Compact

http://www.glffc.com/fire_prevention.htm

The fire prevention section of the Compact's Web site provides a downloadable version of their pamphlet Protecting Life and Property from Wildfire: An Introduction to Designing Zoning and Building Standards for Local Officials and a printable homeowner's evaluation questionnaire. The pamphlet draws on NFPA Standard 299, listed above as a primary resource.

Wildland/Urban Interface Fire Mitigation

http://www.ak-prepared.com/plans/mitigation.fire.htm

A list of actions homeowners can take to make their dwellings less susceptible to interface wildfire. The State of Alaska Division of Emergency Services maintains this site.

National Interagency Fire Center (NIFC)

http://www.nifc.gov

The National Interagency Fire Center employs wildland fire experts in the fields of fire ecology, fire behavior, technology, aviation, and weather. Working together with state and local agencies, NIFC's role is to serve as a focal point for wildland fire information and technology. The site provides National Weather Service fire weather forecasts, information about cooperating agencies, and other information about NIFC projects.

Fire Globe

http://www.uni-freiburg.de/fireglobe

Fire Globe is a resource providing links on multiple aspects of wildfire. The site evolved from a need for global information and a monitoring system that national and international agencies involved in land use planning, disaster management, or other fire-related tasks could use in planning and decision-making.

Canadian Forest Service's Fire Management Network

http://www.nofc.forestry.ca/fire/

The mission of the Canadian Forest Service's Fire Management Network is to "increase understanding and ability to manage wildland fires within the context of sustainable development of Canada's forests." The site offers network information; a publications list; a glossary of fire acronyms; and information about the Canadian Forest Fire Danger Rating System, Forest Fire Weather Index System, and Forest Fire Behavior Prediction System.

California Fire Safe Council

http://www.firesafecouncil.org

The main goal of the council is to preserve California's natural and manmade resources by mobilizing all Californians to make their homes, neighborhoods, and communities fire safe. The site provides a model for creating fire safe councils in California.

Interface Fire

http://www.interfacefire.com

A dedicated fire official's effort to stimulate fire protection. Interface Fire acts as a news source with links to recently published articles.

Alaska Fire and Safety Net

http://www.alaskafire.net

One of the main goals of Alaska Fire and Safety Net is wildfire prevention. The site provides a link to the organization's Firewise program, including tips on interface wildfire mitigation.

Wildfire Assessment System

http://www.fs.fed.us/land/wfas

Utilizing the National Fire Danger Rating System (NFDRS), this site is maintained by the United States Department of Agriculture- Forest Service. It gives daily forecasts, and it contains graphic information on national conditions for wildfire. National maps for fuel and fire danger are available at this site.

Federal Emergency Management Agency (FEMA) Wildfire Publications

http://www.fema.gov/MIT/wfpubs.htm and http://www.fema.gov/library/wildlanf.htm

FEMA offers a short list of wildfire publications available for order through the Internet. It also provides "fact sheets" (including preparedness and mitigation tips) concerning most natural hazards. The collection includes a wildland fire fact sheet.

Federal Wildland Fire Policy, Wildland/Urban Interface Protection

http://www.fs.fed.us/land/wdfire7c.htm

This is a report describing federal policy and interface fire. Areas of needed improvement are identified and addressed through recommended goals and actions.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce wildfire risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical assistance provided by agencies to assist your community in planning for the wildfire hazard?
- ❒ What documents or resources does your community need to find to further understanding of the wildfire hazard and begin the process of assessing community risk from wildfire hazard?

Wildfire Endnotes:

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[7] National Wildland/Urban Interface Fire Protection Program. (1998). Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. Washington, D.C..

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[11] (ibid.)

[12] (ibid.)

[13] (ibid.)

[14] (ibid.)

[15] (ibid.)

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[30] Ecology and participation in landscape-based planning within the Pacific Northwest. Johnson, B. (1999). Policy Studies Journal, 27(3), 502-530.

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[36] Federal Emergency Management Agency http://www.fema.gov (April 2000)

[37] OEM Murray, Joseph. Personal Interview. 9 Feb 2000.

PLANNING FOR NATURAL HAZARDS:
Seismic TRG

July 2000

Oregon Department of Land Conservation & Development
635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

Community Planning Workshop
Community Service Center
1209 University of Oregon
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Section 1:
Introduction to the Seismic Technical Resource Guide

Seismic hazards pose a significant threat in Oregon. The purpose of this guide is to help planners, local decision-makers, and community leaders reduce risk to life and property from seismic hazards. The guide is designed to help your local government address seismic hazard issues through effective comprehensive plan inventories, policies and implementing measures.

1.1 The Threat of Seismic Hazards to Oregon Communities

Seismic events have occurred since the formation of the earth and posed little threat to life and property until earthquakes began affecting developed areas.[1] Seismic events were once thought to pose little danger to Oregon communities. However, recent earthquakes and scientific evidence suggest that the risk is much higher than previously thought. Earthquakes combined with considerable publicity have increased seismic awareness in the state. Seismic hazards pose a real and serious threat to many communities in Oregon, requiring local governments, planners, and engineers to consider their community's safety. Currently, no reliable scientific means exist to predict earthquakes. Therefore, identifying seismic-prone locations, adopting strong policies and implementing measures and utilizing other mitigation techniques are essential to reducing risk from seismic hazards in your community.

Tip Box

Organization of Natural Hazards Technical Resource Guide:

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goals 2,7,17 and 18, a resource directory and a land use tools matrix for hazard mitigation.

1.2 How to use the Seismic Technical Resource Guide

The Seismic Technical Resource Guide provides information to help communities in Oregon plan for seismic hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about seismic hazards.

Section 2:
Is Your Community Threatened by Seismic Hazards?

Section 2 presents an overview of the causes and characteristics of earthquakes, and provides information to assist communities in seismic hazard identification.

Section 3:
What are the Laws in Oregon for Seismic Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for seismic hazards.

Section 4:
How can Your Community Reduce Risk from Seismic Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from seismic hazards.

Section 5:
How are Oregon Communities Addressing Seismic Hazards?

Section 5 examines how several communities are implementing programs to reduce risk from seismic hazards. These examples illustrate plan policies, and implementing measures for seismic hazards.

Section 6:
Where can Your Community find Resources to Plan for Seismic Hazards?

Section 6 is a resource directory listing contacts, programs, and documents that planners, local governments and citizens can use to get more information on seismic hazards.

Section 2:
Is Your Community Threatened by Seismic Hazards?

Identifying hazard areas is a key step in developing effective plan policies and implementing measures to reduce loss of life and property damage. This section will assist your community in determining how seismic hazards may affect current and future development. An overview of the causes and characteristics of seismic hazards is included, along with information on identifying seismic hazards in your community.

2.1 What are the Specific Hazards Associated with Earthquakes?

Ground shaking, ground shaking amplification, liquefaction, landslides, tsunamis, and surface faulting are the specific hazards associated with an earthquake. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake. Information on the different types of earthquake hazards and mapping of high hazard areas are available from the Oregon Department of Geology and Mineral Industries (see Section 6 for contact information).

Tip Box

Goal 2

Oregon Statewide Planning Goal 2 requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

Sidebar

Glossary of terms:

This guide uses a number of technical terms in describing seismic hazards. Definitions of some of the terms are as follows:

- *Faults* – breaks in the earth's crust along which movement has taken place. Faults are found deep within the earth or on the surface (San Andreas Fault).
- *Ground shaking* – seismic waves felt on the earth's surface. Primary cause of damage during an earthquake.
- *Ground shaking amplification* – increase in ground shaking (and damages caused by earthquake) due to soil types that cause seismic waves to "amplify" and increase in strength.
- *Liquefaction* – occurs when ground shaking causes granular soils (e.g., sand, gravel and silt) to turn from a solid material into a liquid material. Soils lose strength and can no longer support the weight of buildings.
- *Magnitude*- the measure of the earthquake's size; the amount of energy released by an earthquake.
- *Subduction zone/Cascadia subduction zone* – Subduction describes the motion of one plate being pushed under another plate. In Oregon, there is high potential for a subduction zone earthquake due to the relationship between the Juan de Fuca plate and the North American plate. The area where the two plates are moving is known as the "Cascadia subduction zone."

2.1.1 Ground Shaking

Ground shaking is the motion or seismic waves felt on the earth's surface caused by an earthquake. Ground shaking is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault that is slipping, and distance from the epicenter (where the earthquake originates). Ground shaking can be amplified, that is intensified, or de-amplified by the near-surface soils and can also cause secondary hazards such as liquefaction and landslides. Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock. *Building construction and design play a vital role in the survival of a structure during earthquakes.* Wood structures tend to withstand earthquakes better than structures made of brick or un-reinforced masonry buildings.[2]

Ground shaking hazard maps, such as Department of Geology and Mineral Industries' (DOGAMI) Earthquake Hazard Maps for Oregon depict the ground shaking levels expected at three occurrence frequencies – every 500, every 1,000 and every 2,500 years. The maps indicate the general ground shaking level that a community needs to prepare for based on the three scenarios. *DOGAMI's maps are some of the most important sources of information for your community in evaluating seismic hazards.*[3]

2.1.2 Ground Shaking Amplification

Soils and soft sedimentary rocks near the surface can modify ground shaking caused by an earthquake. This modification may be increased amplification or decreased strength of shaking and may change the frequency of the shaking. How much amplification occurs is determined by the thickness of the geologic materials and their physical properties. Ground motion amplification will exacerbate the risk for buildings and structures built on soft and unconsolidated soils. Information on the potential for ground motion amplifaction is critical for evaluating your community's seismic hazards.

2.1.3 Surface Faulting

Faults are planes or surfaces in earth materials along which failure occurs. Materials on opposite sides of faults move relative to one another in response to the accumulation of stress.[4] Faults can be found deep within the earth or on the earth's surface. Earthquakes occurring from faults slipping deep within the earth usually only create ground shaking. Surface faults, such as the San Andreas in California, create ground shaking and ground displacement. With surface faults, avoidance is the most effective strategy because little can be done to prevent ground displacement. Collecting information about the faults, implementing mitigation and response strategies and understanding the risks your community faces is the best protection.[5]

2.1.4 Earthquake-Induced Landslides

Earthquake-induced landslides are secondary hazards that occur from ground shaking. These landslides can destroy roads, buildings, utilities and critical facilities necessary to recovery efforts after an earthquake. Many Oregon communities are built in environments with high potential for earthquake-induced landslide hazards. The potential for these types of landslides is greatest in areas with steep slopes.

TRG Key

Information regarding landslides and identification of landslide prone areas can be found in Section 2 of the Landslide Technical Resource Guide.

2.1.5 Liquefaction

Liquefaction occurs when ground shaking causes granular soils to turn from a solid state into a liquid state. This causes soils to lose their strength and their ability to support weight. When the ground can no longer support buildings and structures, buildings and their occupants are at risk.[6] When evaluating your community for seismic hazards, it is important to collect information on liquefiable soils for future planning, mitigation and response.

2.1.6 Tsunamis

Tsunamis are secondary hazards that are created from earthquakes under the ocean and cause flooding and damage to coastal communities. A tsunami, often incorrectly referred to as a "tidal wave," is a series of gravity-induced waves that can travel great distances from the earthquake's source and impact coastal areas.[8]

Definition Box

Granular soils are more likely to experience liquefaction during an earthquake. They are mainly comprised of gravel, sand, or silt. When combined with shallow groundwater, liquefaction potential increases in the event of an earthquake.[7]

Tsunamis pose a real threat to the Oregon coast in the event of a subduction zone earthquake. A tsunami is a series of waves rather than one large wave. Tsunamis, produced by *distant* subduction zone earthquakes, will arrive in several hours giving residents enough time to evacuate to higher ground. However, the initial tsunami produced by a *local* subduction zone earthquake will arrive within 5 to 30 minutes. The time of arrival depends on location. Southern coastal areas will have less time to evacuate than northern coastal areas. The waves will continue to arrive over an 8 to 10 hour period and it is important to stay away from low-lying areas until the official all clear is given.

After a Cascadia subduction earthquake (see glossary), there will be little time for evacuation. Residents should understand that local tsunami warning systems might not give sufficient notice of the impending danger. The warnings could sound at approximately the same time as the initial tsunami wave is inundating the coastline. Because a tsunami travels so quickly, it is important that coastal residents recognize shaking from a subduction zone earthquake as a "natural warning system" that signals the probable arrival of a major tsunami. Residents should immediately seek higher ground when ground shaking has occurred.[9]

To prevent and minimize damage from a tsunami, local officials should acquire tsunami inundation zone maps from DOGAMI. These maps show low-lying areas that could be affected during a tsunami. Communities are required by the State Building Code to ensure that critical facilities are not located in tsunami inundation zones. Information from the tsunami inundation zone maps can also be used to establish development-free zones if the community desires to regulate land use in these areas.[10]

2.1.7 Volcanoes

Volcanic activity can trigger earthquakes, just as earthquakes can trigger volcanic events. Volcanic-activated earthquakes are triggered as magma moves upward through the earth's crust. The magnitude and impact of a seismic event associated with a volcanic eruption is similar to that of an earthquake resulting from a crustal fault deformation. Additional information on volcanic eruptions and their relationships to seismic events can be found at the United States Geological Survey's Web page- **http://vulcan.wr.usgs.gov/home.html**.

2.2 What are the Types of Earthquakes in Oregon?

Based on historical records and geologic investigations, three types of earthquakes occur in Oregon: (1) shallow crustal fault; (2) deep intraplate; and (3) subduction zone earthquakes.

2.2.1 Earthquakes Occurring on Crustal Faults

When crustal faults slip, they can produce earthquakes of magnitudes up to 6.0 or greater. Although most crustal fault earthquakes are smaller than 4.0 and generally create little or no damage, some of them can cause extensive damage that tends to be localized in the vicinity of the area of slippage. Many areas, such as Portland, have crustal faults that could produce earthquakes with a magnitude greater than 6.0. The crustal earthquakes also pose high risks to Willamette Valley communities.

2.2.2 Deep Intraplate Earthquakes

Deep intraplate earthquakes occur at depths between 30 to 100 kilometers below the earth's surface. These earthquakes occur in the subducting oceanic crust and can be up to 7.5 in magnitude.

2.2.3 Subduction Zone Earthquakes

Subduction is a term that describes the motion of one plate being pushed under another, less dense plate. *Subduction zone earthquakes pose the most significant threat to Oregon's coastal residents*. Known as great thrust earthquakes, they occur at shallow depths below the ocean floor at the boundary between the two plates in the subduction zone. These earthquakes can be generated off the coast of Oregon along the sloping boundary between the descending Juan de Fuca plate and the North American plate. This area — known as the Cascadia subduction zone — could produce an earthquake of a magnitude 8.0 to 9.0, or greater. Earthquakes of this magnitude occur once every

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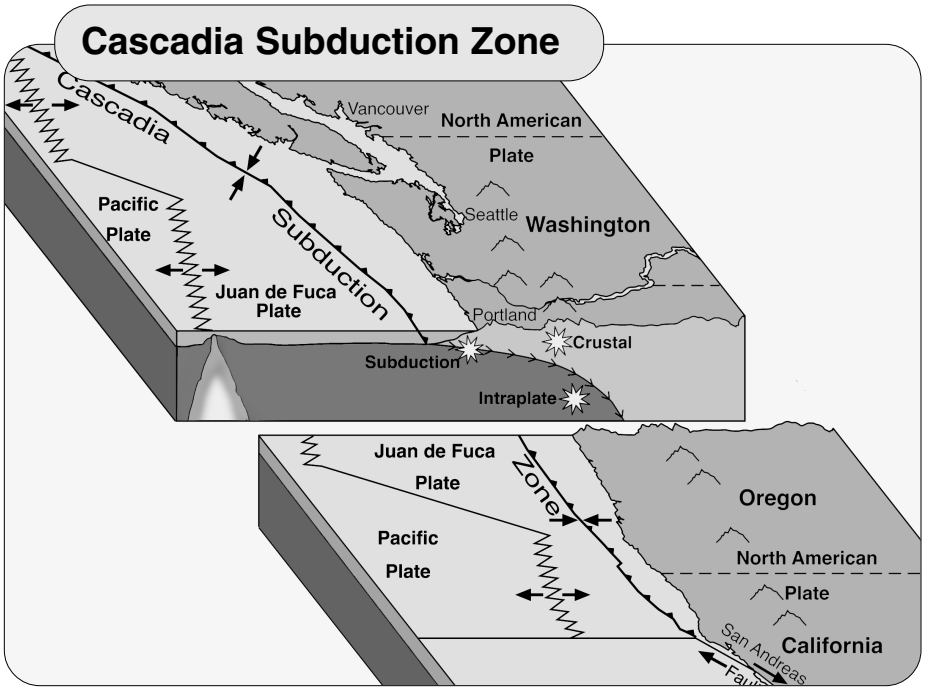
500 to 600 years, with some gaps between events as little as 200 years and as large as 1000 years. The last major earthquake of this magnitude occurred in late January, 1700. An earthquake of this size would cause enormous damage to the coast and large portions of Western Oregon. In many areas, especially on the coast, liquefaction and landslides could damage buildings and their foundations, destroy bridges and cause massive loss of life. Shaking from a great subduction zone earthquake could last for as long as 5 minutes.

Although the Cascadia subduction zone is located off the Oregon and Washington coast, the amount of energy released in this type of earthquake would be catastrophic to the entire Northwest region, and would likely cause damage in Seattle and Portland. Disaster response would be severely limited with communities throughout Western Oregon and Washington seriously damaged.[11]



Source: *Shoreland Solutions. Chronic Coastal Natural Hazards Model Overlay Zone. Salem, Ore.: Oregon Department of Land Conservation and Development (1998) Technical Guide-3.*

2.3 What is the Effect of Earthquakes in Developed Areas?

During an earthquake, serious damage may be caused by the displacement of faults and ground shaking. Damage created by earthquakes can be reduced through mitigation and preparation. Communities can identify seismic hazards by using maps produced by DOGAMI or by working with other geologists to conduct their own evaluations. Communities should enact local policies and ordinances to minimize damages and prepare communities for seismic events. Knowledge of seismic hazards in specific areas prior to development can potentially prevent property destruction. Buildings that were not built to any seismic standard often can be retrofitted and strengthened to help withstand earthquakes. [12]

Seismic Key

More information on reducing risk from seismic hazards can be found in Section 4 of this guide.

2.4 How can Your Community Identify Seismic-Prone Locations?

DOGAMI has released earthquake hazard maps for many communities in Western and Southern Oregon. These maps combine the effects of ground shaking amplification, liquefaction and earthquake-induced landslides to show the earthquake hazards relative to the local geologic conditions. All maps and CD-ROMs are available for purchase through Nature of the Northwest Information Center (see Section 6 of this guide for contact information). Communities may need additional technical assistance in interpreting the maps.

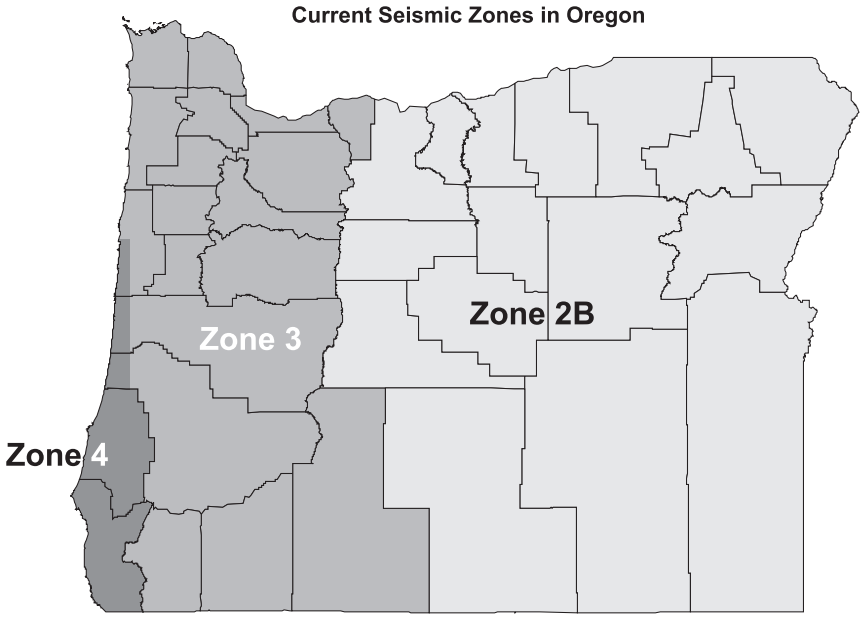
Creating multiple overlays that identify seismic risk areas on a map can help planners, policy makers, building code officials, and engineers understand which areas should have minimal development. Incorporating soil liquefaction potential, fault locations, tsunami run-up areas in coastal areas, past earthquake occurrences, groundwater level, and predicted ground response onto a single map will allow local decision makers to recognize potential threats before development projects are started.

Seismic Key

For more information on Oregon State Building Codes see Section 3.

Until recently, earthquakes were thought to pose little risk to the residents of Oregon. This perception has changed dramatically with recent earthquake events and information provided by geological and soil science researchers. In response to this growing awareness, the *Oregon Building Codes Division* revised construction standards for new buildings to make them resistant to seismic events. The State Building Codes reflect three seismic zones. An increase in zone number reflects increased seismic activity.

Cascadia Subduction Zone



Sidebar

Earthquake Zones in Oregon

- Zone 2 – Almost all counties east of the crest of the Cascades.
- Zone 3 – Most counties west of the crest of the Cascades (includes the Willamette Valley and the Portland Metro area).
- Zone 4 – All of Curry and Coos Counties and a thin band from Douglas County to just north of Newport in Lincoln County.

Source: *Shoreland Solutions. Chronic Coastal Natural Hazards Model Overlay Zone. Salem, Ore.: Oregon Department of Land Conservation and Development (1998) Technical Guide-3.*

Zones are based on predicted ground motion and potential risk from large earthquakes within 50 years. New structures must be built to standards capable of resisting the forces caused by ground shaking applicable to the various seismic zones. For example, a structure in Zone 4 must be 33 percent stronger or more seismically resistant than a structure built in Zone 3. Oregon's coastal areas are subject to significant subduction-type seismic activity. The northern coast is currently Zone 3; however, based on new scientific data, consideration is being given to upgrading it to Zone 4.[14]

Sidebar

Earthquake Maps:

The Oregon Department of Geology and Mineral Industries (DOGAMI), in partnership with other State agencies and Federal agencies, has undertaken a rigorous program in Oregon to identify seismic hazards, including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. Seismic hazard maps have been published and are available for many communities in Oregon through DOGAMI. Refer to Section 6 of this guide for DOGAMI contact information.[13] As of June 2000, the following seismic hazard maps are available from DOGAMI:

Earthquake Maps

- Earthquake scenario and probabilistic ground shaking map for *Portland Hills (Multnomah, Washington and Clackamas Counties) 1999;* (map # IMS-16)
- Relative Earthquake Hazard Map – *Eugene-Springfield metro area – 1999; (map #*IMS 14*)*
- Earthquake Hazard Maps – *Coastal Oregon including Astoria-Warrenton, Brookings, Coquille, Florence-Dunes City, Lincoln City, Newport, Reedsport-Winchester Bay, Seaside-Gearhart-Cannon Beach and Tillamook – 1999;* (map # IMS 10)
- Earthquake Hazard Maps – *Ashland, Cottage Grove, Grants Pass, Sutherlin-Oakland and Roseburg – 1999;* (map # IMS 9)
- Earthquake Hazard Maps – *Canby-Aurora, Lebanon, Sweet Home, Woodburn-Hubbard, Silverton-Mt. Angel and Stayton-Sublimity-Aumsville – 1999;* (map # IMS – 8)
- Earthquake Hazard Maps – *St. Helens- Columbia City-Scappoose, Sandy, Hood River, McMinnville-Dayton-Lafayette, Newberg-Dundee, Sheridan-Willamina, and Monmouth-Independence – 2000;* (map # IMS-7)
- Relative Earthquake Hazard Map of the Portland Metro Region – *Clackamas, Washington and Multnomah Counties – 1997*
- Earthquake Hazards – *Salem (Polk and Marion Counties – 1996;* (map # GMS 105)
- Earthquake Hazards for Oregon – *1996;* (map # GMS 100)

Tsunami Maps

- Tsunami Hazard Map – *Warrenton area – Clatsop County – 1999;* (map # IMS 12)
- Tsunami Hazard Map – *Astoria area – Clatsop County – 1999;* (map # IMS 11)
- Tsunami Hazard Map – *Seaside-Gearhart – Clatsop County – 1997;* (map # IMS 3)
- Tsunami Hazard Map – *Yaquina Bay – Lincoln County – 1997;* (map # IMS 2)

Tsunami Hazard Map – *Siletz Bay – Lincoln County – 1995;* (map # GMS 99)

The Department of Geology and Mineral Industries maps are available from *The Nature of the Northwest Information Center* (503) 872-2750. Publications can also be ordered on line from **http://www.naturenw.org**. Descriptions of the maps are provided on the website. There is a small charge for these maps.

2.5 Summary: Identifying Seismic Hazards in Oregon

- ❑ Earthquakes produce a variety of hazards which can affect Oregon communities.
- ❑ Numerous hazard maps are available for seismic hazard identification in Oregon.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Chapter 2: Elements of a Comprehensive Plan provides information on three phases of hazard assessment: hazard identification, vulnerability assessment and risk analysis. The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment will examine identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following questions in determining whether or not its comprehensive plan has adequately inventoried seismic hazards:

- ❒ Are there seismic hazards in your community?
- ❒ Does your comprehensive plan hazard inventory describe seismic hazards in terms of the geographical extent, the severity and the frequency of occurrence?
- ❒ Has your community conducted a community-wide vulnerability assessment?

Section 3:
What are Laws in Oregon for Seismic Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with "known" natural hazards. This section of the Seismic Guide presents laws that Oregon communities are required to address.

3.1 Oregon Laws Related to Seismic Hazards

3.1.1 Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning requirement that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states that, "Developments subject to damage, or that could result in loss of life, shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards..."

TRG Key

Information on Goal 7 can be found in Appendix A of the Natural Hazards Technical Resource Guide.

3.1.2 State Building Codes

The Oregon State Building Codes Division adopts statewide standards for building construction that are administered by the state, cities and counties throughout Oregon. The codes apply to new construction and to the alteration of, or addition to, existing structures. The One and Two Family Dwelling Code and the Structural Specialty Code (both included in the State Building Code) contain maps identifying the various seismic zones for Oregon, as described in Section 2 of this guide. The Structural Specialty Code is based on the 1997 edition of the Uniform Building Code published by the International Conference of Building Officials and amended by the state of Oregon. The Uniform Building Code contains specific regulations for development within seismic zones.[15]

Within these standards are six levels of design and engineering specifications that are applied to areas according to the expected degree of ground motion and site conditions that a given area could experience during an earthquake (ORS 455.447). The Structural Code requires a site-specific seismic hazard report for projects including essential facilities such as hospitals, fire and police stations, emergency response facilities, and special occupancy structures, such as large schools and prisons.

The seismic hazard report required by the Structural Code for essential facilities and special occupancy structures must take into consideration factors such as the seismic zone, soil characteristics including amplification and liquefaction potential, any known faults, and potential landslides. The findings of the seismic hazard report must be considered in the design of the building. The Dwelling Code simply incorporates prescriptive requirements for foundation reinforcement and framing connections based on the applicable seismic zone for the area. The cost of these requirements is rarely more than a small percentage of the overall cost for a new building.[16]

The requirements for existing buildings vary depending on the type and size of the alteration and whether there is a change in the use of the building to house a more hazardous use. Oregon State Building Codes recognize the difficulty of meeting new construction standards in existing buildings and allow some exception to the general seismic standards. Upgrading existing buildings to resist earthquake forces is more expensive than meeting code requirements for new construction. State code only requires seismic upgrades when there is significant structural alteration to the building or where there is a change in use that puts building occupants and the community at a greater risk. Your local building official is responsible for enforcing these codes.[17] Although there is no statewide building code for substandard structures, local communities have the option of adopting one to mitigate hazards in existing buildings. The state has adopted regulations to abate buildings damaged by an earthquake in Oregon Administrative Rules (OAR) 918-470. Oregon Revised Statutes (ORS) 455.020 and 455.390-400 also allow municipalities to create local programs to require seismic retrofitting of existing buildings within their communities. The building codes do not regulate public utilities and facilities constructed in public right-of-ways, such as bridges that are regulated by the Department of Transportation.

3.1.3 State Legislation

During the last ten years, the legislature has passed a number of laws that address the risk of earthquakes and encourage earthquake preparedness.

1991 Legislation:

The legislature passed Senate Bill 96 in 1991. This law requires site-specific seismic hazard investigations before the construction of essential facilities, hazardous facilities, major structures, and special-occupancy structures (e.g., hospitals, schools, utilities and public works, police and fire stations). These requirements are adopted into the State Building Code. The law also provides for the installation of strong-motion sensors in selected major buildings and mandates that school officials in all public schools lead students and staff in earthquake drills. (See Oregon Revised Statutes 455.447 and 336.071)[18]

1995 Legislation:

Fourteen earthquake-related bills were introduced during the 1995 session. Several passed, including a new requirement for earthquake education and tsunami drills to be conducted in public schools (ORS 336.071), a requirement for essential and special-occupancy structures to be built outside of tsunami inundation zones (ORS 455.446), provisions for the inspection and entrance of buildings damaged by earthquakes (ORS 455.448) and specific provisions for the abatement of buildings damaged by earthquakes. Senate Bill 1057 created a task force to evaluate the risks impacting existing buildings and make recommendations to the 1997 legislature.

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1997 Legislation:

The Seismic Rehabilitation Task Force created in 1995 (see above) submitted House Bill 2139. The bill proposed an inventory over a period of six years to determine the type of construction and the degree of safety of each building in the state, excluding one- and two-family homes and other specific buildings. The bill also proposed that the time frame for retrofitting buildings identified as vulnerable to earthquake damage be: (1) within 15 years for unreinforced masonry (URM) buildings with parapets, signs, and other appendages, except for cornices and nonstructural cladding, that may constitute a falling hazard during an earthquake; (2) within 30 years for the remainder of the URM buildings; and (3) within 70 years for all other unsafe buildings. This upgrading process was to have been encouraged by tax credits, property tax abatements and public education. House Bill 2139 was not passed, because of the fiscal impact and community priorities. However, it proposed good strategies that local communities may want to consider (see reference to local rehabilitation programs in the State Building Code subsection above).[19]

1999 Legislation:

Although the legislature considered several proposals on seismic safety, no new laws were adopted during the 1999 session.

3.1.4 Oregon Seismic Safety Policy Advisory Commission (OSSPAC) - ORS 401.337 to 401.353

OSSPAC is a state advisory commission created in February 1990 through an executive order from Governor Neil Goldschmidt. It is made up of 18 members with interests in earthquake safety including: Oregon Emergency Management, State Building Codes, and the Departments of Geology and Mineral Industries, Land Conservation and Development, and Transportation; two representatives from the Oregon state legislature; one local government representative; one member from education; three from the general public; and six members from affected industries, such as homebuilders and banking industries. The purpose is to reduce exposure to Oregon's earthquake hazards by: (1) developing and influencing policy at the federal, state and local levels; (2) facilitating improved public understanding and encouraging identification of earthquake risk; and (3) supporting research and special studies, appropriate mitigation and response and recovery.

The group has proposed legislative concepts to the State legislature on improving seismic safety in Oregon. They are currently preparing a document entitled "Oregon at Risk" discussing seismic hazards in the state. For information on OSSPAC, contact Oregon Emergency Management at 503-378-2911.

Tip Box

Preparation of Site Specific Hazard Reports

In 1996, the State of Oregon Boards of Geologists and Engineering Examiners prepared guidelines to assist in preparing site specific hazard reports for essential facilities, major structures and special occupancy structures as provided in Oregon Revised Statute (ORS) 455.447. A complete listing of all report elements is included in Section 2905 of the Oregon Structural Speciality Code.

3.2 Summary: Laws for Seismic Hazards

- ❒ Oregon Statewide Planning Goal 7: Areas Subject to Natural Hazards
- ❒ Oregon State Building Codes
- ❒ State Legislation
- ❒ Oregon Seismic Safety Policy Advisory Commission (OSSPAC)

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Statewide Planning Goal 2 requires that comprehensive plan policies be supported by a sound factual base. Section 3 of the Seismic Technical Resource Guide describes laws that communities are required to address in comprehensive plans.

Your community should ask the following questions after identifying seismic hazards in your area:

- ❒ Does your community's comprehensive plan contain an inventory of seismic hazards, a vulnerability assessment and policies addressing seismic hazards?
- ❒ Has your community's comprehensive plan been updated to reflect the latest information on seismic hazards in your community?
- ❒ Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in seismic hazard areas?

Section 4:
How can Your Community Reduce Risk from Seismic Hazards?

Seismic Key

Section 2 of this document provides information that can assist your community in identifying seismic hazards.

Avoiding development in hazard areas is the most effective way to reduce risk. There are, however, many areas in Oregon where some degree of hazard is unavoidable. Communities in vulnerable areas should manage and reduce their risk from seismic hazards if the risk cannot be completely eliminated.

Section 4 describes methods to evaluate site-specific development and other implementing measures to reduce risk from seismic hazards. Implementing measures are the ordinances and programs used to carry out decisions made in the comprehensive plan. They include zoning ordinances, and other land use regulations which directly regulate land use activities.

4.1 How can Your Community Plan for Seismic Hazards?

It is possible to plan, at least to some degree, for seismic hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in seismic areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

To successfully plan for a seismic hazard, your community should consider the following steps:

- ✓ **Identify the hazard**
  Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.
- ✓ **Avoid the hazard**
  Restrict development in hazard-prone areas. For areas with high density development and potential for severe property damage or loss of life, this option should be taken. This strategy works better for some seismic hazards like surface faulting, tsunamis, and liquefaction, than for other, less localized seismic events.
- ✓ **Evaluate site-specific development**
  Communities are required to follow building codes and should enact policies and measures to review site-specific development in seismic-prone areas.
- ✓ **Implement regulatory strategies through land use planning**
  Minimizing development in hazard areas through low density and regulated development can reduce risk of property damage and loss of life. This section provides information on specific land use planning and zoning measures.

Tip Box

The Three Levels of Hazard Assessment

1. Hazard Identification
2. Vulnerability Assessment
3. Risk Analysis

If your community identifies landslide hazards through a hazard identification process or a vulnerability assessment, you should adopt a process to review individual development permits in those landslide-prone areas. For further description of the three levels of hazard assessment, refer to Chapter 2: Elements of a Comprehensive Plan.

✓ **Implement non-regulatory measures**

Additional mitigation strategies and non-regulatory measures can further reduce risk from seismic hazards. *This section provides information on non-regulatory strategies in the home and business environment.*

4.2 How can Development Requests in Seismic-Prone Areas be Evaluated?

Conducting a site-specific evaluation prior to construction helps engineers design buildings to avoid or mitigate the possible effects of a seismic event. For example, if proposed construction occurs in sandy soils located in an area where seismic activity poses a threat, options include relocating the building, placing supports deep into the ground until they rest on a more stable soil or bedrock, or designing a foundation with a seismic base isolation system. Seeking technical assistance from engineering geologists or geotechnical engineers is highly recommended.

4.3 What Land Use Tools and Building Codes can be Used in Planning for Seismic Hazards?

Examples of land use techniques and other regulatory strategies that can be implemented include:

4.3.1 Identify the Hazard

Mapping areas that may pose seismic threats to the community is a potential regulatory requirement. The maps of seismic-prone areas should be incorporated into the local hazard inventory.

4.3.2 Zoning Ordinances

Zoning ordinances can address seismic hazards by restricting or prohibiting development in seismically active areas. This can be accomplished by creating hazard overlay zones to restrict development. The development of overlay zones is accomplished by mapping hazard areas within the community. Mapping is then coupled with supplemental standards that would contain setback regulations; clearing, excavation, and grading restrictions; and requirements for seismic evaluation of the site.

Other techniques include designating seismic hazard areas for open spaces such as parks or greenways or for low density uses. A tradeoff allowing already existing parks not in seismic hazard areas to be developed could potentially occur. Refusing new construction of “essential facilities” in seismic hazard areas such as tsunami inundation zones and over active fault systems will help ensure emergency services and lifelines remain open during a seismic event. Essential facilities are defined as hospitals and other medical facilities, fire and police stations, emergency-preparedness shelters, standby power generating facilities, and any structures required for emergency response. These services are essential to communities in case of an emergency and will need to be operating in the event of an earthquake disaster. Moving these types of facilities away from seismic hazards also will potentially steer private development and lifelines such as utilities and roadways away from high-risk areas.

Seismic Key

For more information on identifying seismic hazards, refer to section 2 of this Chapter.

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4.3.3 Seismic Hazard Area Ordinances

Communities can adopt sensitive area ordinances that require an analysis of projects proposed to be located within designated seismic hazard areas. The resulting reports should address the nature of the hazard, and discuss what steps should be taken to minimize damage from earthquakes and the secondary impacts such as landslides.

4.3.4 Adopting an Ordinance for Mitigating Dangerous Buildings

Adopting an ordinance for retrofitting buildings at risk from seismic hazards allows local communities to focus on individual buildings that may be structurally vulnerable or unsound. A Hazardous Building Abatement ordinance, usually based on the ICBO Code for Abatement of Dangerous Buildings, allows the building official or local enforcement officer to require property owners to abate hazardous conditions. The property owner is required to bring a particular building classified as hazardous or substandard, closer to compliance with the current building code, or face demolition or condemnation of that building. The owner is liable for repairs or demolition costs.

Seismic Key

Refer to Section 5 for more information on Portland and seismic hazards.

4.3.5 Creating a Local Rehabilitation Program for Existing Buildings

Creating a local rehabilitation program for existing buildings by incorporating FEMA regulations in combination with a dangerous building code for retrofitting buildings to withstand earthquakes can be accomplished through ordinances. (Refer to *FEMA Standard 237*: *Seismic Rehabilitation of Buildings – Phase I, Issues Identification and Resolution* and related FEMA publications). Seismic Rehabilitation Programs are authorized by Oregon statute in ORS 455.020 and 455.390-400. In order to implement such a program, an inventory of existing buildings including such information as their occupancy, age, construction type, general condition and configuration is needed. An inventory is necessary to evaluate whether the buildings should be rehabilitated and strengthened. Unreinforced masonry buildings, structures containing hazardous materials and essential facilities such as hospitals, fire and police stations and water treatment plants, are buildings that should be considered for upgrade depending on their condition. Incentive programs and fundraising are options for smaller communities needing to accomplish retrofitting projects. California has used this type of program extensively and the city of Portland has also adopted a local program based on these standards.

4.3.6 Adoption of Local Development Standards

Adoption of local development standards for installation and construction of utility services and roads, or “adequate public facilities”, is critical to local communities. Such facilities are essential to emergency response and must be able to function following a seismic event. Public water mains are “looped” in order to provide fire or domestic service if part of a water line is broken by a slide or ground movement. Sometimes it is

possible to design multiple routes for gravity sewer lines or back-up power if sewer lines are on lift (pump) stations. Standards for street and bridge construction and installation of utilities help to ensure these facilities resist damage. The Oregon Department of Transportation and American Public Works Association are developing and publishing a joint set of construction standards.

4.4 What are Additional Methods to Reduce Risk from Seismic Hazards?

Mitigation through the use of non-regulatory, voluntary strategies allows communities to gain cooperation, educate the public and provide solutions to ensure safety in the event of an earthquake.

4.4.1 Public Education and Outreach[20]

Public education and outreach can be inexpensive and provide information that results in safer households, work places and other public areas. Some outreach materials include: informational brochures about community seismic risks and mitigation techniques, public forums, newspaper articles, training classes and television advertisements.

Examples of non-structural improvements to homes and businesses that could be included in public education and outreach materials are:

- Anchor bookcases and filing cabinets to nearby walls.
- Install latches on cabinet doors and drawers to prevent contents from spilling.
- Move heavier items down to lower shelves and put ledge barriers on the end of shelves.
- Attach computers, televisions and appliances to desks or countertops.
- Apply safety film to windows.
- Secure water heaters to a nearby wall to prevent fire damage.
- Install a main gas shut-off device and ensure the location of the shut-off switch is known.
- Attach the home or structure to a foundation to prevent the structure from sliding. If the building has a perimeter foundation then the sill plate must be bolted to the foundation. If there are support wood studs running from the foundation to the first floor then checks should be made by professionals to ensure adequate bracing exists.
- Secure masonry chimneys to the framing of the roof to prevent them from collapsing. Have a professional inspect the chimney after it has been secured.

4.4.2 Incentive Programs

Incentive programs include a variety of benefits to building owners or developers that help to offset the cost of mitigation. The following incentives can be established through ordinance, policy or cooperative agreements:

- *Density bonuses* that shift development away from a hazardous site, but do not penalize the developer by reducing number of units.
- *Tax credits* to reduce a property owner's tax liabilities. Using conservation easements for tax break incentives on land that is deemed seismically hazardous is a viable way to use the tax credit system. This option allows a community to maintain open spaces while restricting development in hazard areas.
- *Property tax incentives or deferrals* can be authorized by ordinance to offset the costs of voluntary rehabilitation of existing buildings.
- *Real estate disclosures* provide homebuyers with incentives to take action pertaining to seismic hazards. Knowledge of a potentially hazardous area ensures that the homebuyer is more aware of existing dangers and encourages the purchase of earthquake insurance, upgrading the existing structure or not moving into the hazardous area at all.
- *Property Acquisition or purchase of development rights* places management responsibilities for hazard areas into the hands of local officials. Once the land is purchased, it may be managed to protect public safety.
- *Increased funding of public infrastructure programs* can help to upgrade lifeline infrastructure.
- *Phasing retrofitting projects* over a set time frame allows upgrades as more money becomes available.

Seismic Key

More detailed examinations of community seismic hazard mitigation measures for Portland and Klamath Falls, Oregon are included in Section 5 of this guide.

4.5 What are Examples of Seismic Mitigation Activities?

4.5.1 Corvallis, Oregon

The City of Corvallis has adopted a local grading and excavation ordinance based on Appendix Chapter 33 of the 1994 Uniform Building Code (UBC). Section 3309.7 states, "The building official may require a geotechnical investigation in accordance with Sections 1804.2 and 1804.5 (of the UBC) when, during the course of an investigation the report shall address the potential for liquefaction when all of the following conditions are discovered:

1. Shallow ground water, 50 feet (15,240mm) or less.
2. Unconsolidated sandy alluvium.
3. Seismic Zones 3 and 4."[21]

Corvallis has adopted this local standard to make it clear that they will require a geotechnical study of soil conditions where liquefaction soils may exist.

Tip Box

The 1998 Oregon Structural Speciality Code contains similar provisions for local adoption in Appendix Chapter 38.

4.5.2 Seattle, Washington

In 1990 the city hired seismic and design analysts to determine the seismic resistance of city-owned buildings. Fire and police stations were given top priority and those deemed unsafe have been retrofitted to meet structural requirements in the event of an earthquake.[22]

4.5.3 East Bay Municipal Utility District (EBMUD), California

The EBMUD provides water to over 1.2 million people in the San Francisco area. One of the most active faults in California bisects the service district. In 1994, the EBMUD started a ten-year, $189 million capital improvement program that would secure facilities and water for fire prevention, and restore water to customers within 10 days of a catastrophic earthquake.[23]

4.5.4 Berkeley, California

In 1992, Berkeley started its Hazard Mitigation Bond Program with the passage of two general obligation bond measures and the establishment of municipal residential upgrade incentive programs. Berkeley upgraded every major public building and installed secondary water supply systems to protect the water system in the event of an earthquake. The city provided incentives to non-profit agencies and property owners by giving a waiver on all permit fees for seismic upgrades, a 1.5% transfer tax rebate on upgrade costs, funding for low-income homes, and mitigation courses for tenants and landlords. Berkeley is currently looking at funding options with local banks involving low-interest loans for homeowners under the federal Community Reinvestment Act.[24]

4.5.5 Monroe, Washington and Tigard, Oregon

Children in elementary schools are involved in programs that teach safe practices in the event of an earthquake. School children in both locations practice earthquake drills and learn what precautions to take in the event of an earthquake. FEMA has a similar program for children called “Quake Ready.” Oregon schools are required to practice earthquake drills along with their regular fire drills.[25]

4.5.6 Summary of Community Programs

These programs, ideas and community examples are just a few that are currently in place nationally. In general, most activities related to reducing seismic hazards have been associated with building codes, public education and fiscal incentives to retrofit existing structures. There will be greater opportunities to use traditional land use planning tools as communities have better information on seismic hazards and better inventories of structures that are at risk. Every community should develop their own strategies consistent with local conditions and community support. Public education and outreach are essential in establishing successful seismic mitigation programs.

4.6 Summary: Reducing Your Community's Risk from Seismic Hazards

- ❒ *Avoid the hazard* if possible, since risk reduction techniques can be very expensive or may not be feasible in areas prone to seismic hazards.
- ❒ *Reduce the level of risk* in hazard-prone areas by minimizing development, reducing density, or implementing mitigation measures if developing in hazard-prone locations is unavoidable.
- ❒ *Evaluate development* in seismic-prone locations. Evaluation can happen through local government regulations and by understanding the geology of the area. Technical assistance from state agencies such as DOGAMI can assist in hazard mapping and assessment.
- ❒ *Consider non-regulatory strategies* such as retrofitting existing houses and businesses, and dedication of land for open space to reduce risk from seismic hazards.
- ❒ *Provide public outreach* and information sessions for residents and potential residents living in seismic-prone terrain regarding the hazards and steps residents can take to protect themselves.
- ❒ *Research mitigation strategies* used by other communities located in seismic-prone areas.

TRG Key

Refer to the Comprehensive Plan Evaluation Guide Chapter 2 for more information on developing inventories and a listing of critical facilities.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your local government should ask the following questions in assessing the adequacy of your comprehensive plan in addressing the level of seismic hazard:

- ❒ Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to natural hazards?
- ❒ Has your community implemented a process for evaluating site-specific development?
- ❒ Does your community have an approach to reduce risk from seismic hazards through a combination of regulatory and non-regulatory measures?
- ❒ Do the implementing measures carry out your comprehensive plan's policies related to seismic hazards in your community?

Sidebar

The report produced by the herein mentioned Portland study is entitled *Earthquake Risk Analysis, Volumes 1 & 2*. This report can be obtained through publishers Goettel & Horner Inc, 2725 Donner Way, Sacramento,CA 95818 (916)451-4160

Section 5: How are Oregon Communities Addressing Seismic Hazards?

Section 5 describes how two Oregon communities are addressing seismic hazards.

5.1 Innovative Approaches to Seismic Retrofits in Portland, Oregon

Background

In 1993, revisions to the Uniform Building Code and the upgrade of seismic zones in Oregon caused Portland to identify many of its buildings as potentially dangerous. To minimize the impact on building owners and the real estate market, the city did not require these buildings to be immediately retrofitted. The city instead targeted owners who were requesting building permits. The city concentrated on improving unreinforced masonry buildings (URMs), whose seismic design load is considerably weaker than that of other buildings. The city formed a seismic task force comprised of building owners, banks, engineers, and architects. Portland first obtained an inventory of buildings within the Portland Metro area. They partnered with Portland State University (at a cost of $12 per building) to conduct inspections of buildings to identify those at risk from seismic hazards.

Portland also funded a study concerning the level of risk the city faces and the potential cost of rehabilitating the buildings in their community. The report from this study discusses the following topics: (1) a review of Portland's earthquake hazards from known faults or fault zones; (2) an assessment of the life safety risks associated with some classes of buildings when subjected to the range of future earthquakes that can affect Portland; (3) an analysis of the benefits associated with life safety seismic retrofits of vulnerable existing buildings compared to the typical costs of such retrofits; and (4) conclusions regarding the types, locations and uses of buildings that would be good candidates for seismic retrofit. Out of these discussions, Chapter 24.85 from Title 24 of Portland's City Code was formulated.

Title 24 Building Regulations

Chapter 24.85 addresses seismic-specific upgrades to existing buildings, design standards, building additions and alterations, and the phasing of improvements. It applies to building permits seeking to change the occupancy, add square footage, or otherwise alter the building. There must be a seismic evaluation performed if structural work is planned for any building built prior to 1974.

Portland Title 24 Outline – Building Regulations

Chapter 24.85 – Interim Seismic Design Requirements for Existing Buildings

Added by Ordinance No. 168627 passed March 22, 1995.

- General Provisions
- Seismic Definitions

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- Design Standards
- Change of Occupancy (list of relative hazards and occupancy classifications)
- Building Additions
- Building Alterations

For information or the actual building regulations contact the City of Portland: City Information and Referral; City Hall; 1221 SW 4th Ave.; Portland, OR 97204. The code is also available online at **http://ordlink.com/codes/portland/index.htm**.

Funding retrofitting projects can be costly and a burden to many property owners. To offset these costs, Portland has developed some creative ideas to fund these upgrading projects. Upgrades can be phased in over a maximum ten-year period from the start of the project to its completion. Phasing allows the property owner to upgrade over a period of time without having to fund the entire project in one large payment. Tax incentives can be awarded to those willing to upgrade a structure to meet seismic regulations.

Communities can use Portland's work in seismic regulations as a model in developing their own building regulations.

Tip Box

To find information on California rehabilitation, contact the Governor's Office of Emergency Services to obtain "*Bay Area Regional Earthquake Preparedness Project, Seismic Retrofit Incentive Programs, A Handbook for Local Governments*" dated fall 1992, document number P92001BAR. The Office can be reached via Association of Bay Area Governments, PO Box 2050, Oakland, CA 94604-2050, (510) 464-7900.

5.2 Reducing Seismic Risk in Klamath Falls, Oregon

Background

Klamath Falls is located in the south-central part of Oregon, just north of the Oregon-California border. The city is situated in an earthquake prone area between the High Cascades volcanic regime and the Basin and Range system of faulting. Klamath Falls has experienced minor earthquakes since the 1950's. On September 20, 1993, earthquakes hit 16 to 20 miles west-northwest of Klamath Falls. At 8:15 pm, a foreshock earthquake (a smaller earthquake preceding larger events) of magnitude 3.9 struck. Two main shocks registered at magnitudes of 5.9 and 6.0. The earthquakes were felt over a 300 by 200 mile radius and caused extensive damage in Klamath Falls resulting in the deaths of two people.

Public facilities sustained damages of over $1.6 million, while 940 residences suffered at least minor damages involving cracked walls, broken windows, collapsed chimneys, and damaged plumbing. Businesses reported damages exceeding $2 million, while other non-residential structures estimated damages around $260,000.

Two miles north of Klamath Falls, The Oregon Institute of Technology (OIT) experienced non-structural damage, including toppled bookcases and filing cabinets, and collapsed storage shelves. Most of the structural damage was limited to buildings with brick walls.[26]

Funding Seismic Risk Reduction

After the earthquakes, FEMA hosted a series of informational workshops on earthquake mitigation and preparation. The Physical Plant Director at the OIT attended the workshops and found ways to obtain grants from FEMA to help repair non-structural damage. He

obtained a $10,000 grant from FEMA, which OIT used to anchor bookcases and furniture over five feet tall to the walls. OIT allocated remaining funds to initiate other non-structural improvements on OIT's campus.[27]

OIT no longer builds with brick and continues to anchor new shelves and furniture. Construction is now completed with steel frames and insulated, Styrofoam stucco walls and panels that will not collapse. Stresses from earthquakes are concentrated to the reinforced corners of buildings.

Implementing Measures

As a result of the destructive 1993 earthquake mentioned above, Klamath Falls adopted a dangerous building ordinance. At the time of this guide's production, the city is considering three additions to their ordinance based on what Portland has done. Contact City of Klamath Falls at (541) 883-5316 for more information on the ordinance and these additions.

5.3 Summary: Oregon Communities Addressing Seismic Hazards

Portland is using a Variety of Tools to Address Seismic Hazards Including:

- Analysis of Portland's seismic risks;
- Updating building code provisions to address modifications to existing structures and the requirements for seismic retrofitting;
- Phase-in period for retrofit requirements providing building owners with time to fund the project; and
- Incentives to help offset retrofit costs including tax credits.

In Klamath Falls:

- Oregon Institute of Technology sought funding to help pay for retrofitting. Mitigation measures were put into place including: anchoring bookshelves, changing building practices to reflect the seismic hazard and no longer builds with brick.
- A dangerous building ordinance was adopted after 1993 earthquake damage.

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Your comprehensive plan should be coordinated with and reflect other comprehensive plans, plan policies and implementing measures of other communities within your region. Natural hazards do not respect community boundaries making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plan, your community should ask the following questions in developing plan policies and implementing measures for seismic hazards:

- ❒ What policy measures would assist your community in planning for the seismic hazard?
- ❒ Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park, and transportation districts)?
- ❒ Are there communities that face similar seismic threats that have developed ordinances or non-regulatory programs that could be adopted by your community?

SideBar

The Governor's Interagency Hazard Mitigation Team (GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Section 6:
Where can Your Community find Resources to Plan for Seismic Hazards?

This section is a resource directory including contacts, documents, and internet resources to assist planners, local governments and citizens in obtaining further information on seismic hazards.

6.1 State Agency Resources

Oregon Department of Geology and Mineral Industries (DOGAMI)

The mission of the Department of Geology and Mineral Industries is to serve a broad public by providing a cost-effective source of geologic information for Oregonians and to use that information in partnership to reduce the future loss of life and property due to potentially devastating earthquakes, tsunami, landslides, floods, and other geologic hazards. The Department has mapped earthquake hazards in most of western Oregon.

Contacts: Deputy State Geologist, Seismic Hazards Team Leader,
Tsunami and Coastal Hazards Team Leader
Address: 800 NE Oregon St., Suite 965, Portland, Oregon 97232
Phone: 503-731-4100
Fax: 503-731-4066
Website: http://sarvis.dogami.state.or.us/homepage/

The Nature of the Northwest Information Center

The Nature of the Northwest Information Center is operated jointly by the Oregon Department of Geology and Mineral Industries and the USDA Forest Service. It offers selections of maps and publications from state, federal and private agencies. DOGAMI's earthquake hazard maps can be ordered from this site.

Address: Suite 177, 800 NE Oregon Street # 5, Portland, Oregon 97232
Phone: (503) 872-2750
Fax: (503) 731-4066
Hours: 9 am to 5 pm Monday through Friday
E-mail: Nature.of.NW@state.or.us

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Oregon Department of Consumer & Business Services - Building Codes Division

The Building Codes Division (BCD) sets statewide standards for design, construction and alteration of buildings that include resistance to seismic forces. BCD is active on several earthquake committees and funds construction related continuing-education programs. BCD registers persons qualified to inspect buildings as safe or unsafe to occupy following an earthquake and works with OEM to assign inspection teams where they are needed.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW, P.O. Box 14470
Salem, Oregon 97309-0404
Phone: (503) 378-4133
Fax: (503) 378-2322
Website: **http://www.cbs.state.or.us/external/bcd**

Oregon State Police (OSP)-Office of Emergency Management (OEM)

The purpose of OEM is to execute the Governor's responsibilities to maintain an emergency services system as prescribed in Oregon Revised Statutes Chapter 401 by planning, preparing and providing for the prevention, mitigation and management of emergencies or disasters that present a threat to the lives and property of citizens of and visitors to the State of Oregon. OEM coordinates the initial response to an earthquake including on-site inspectors providing damage assessment. OEM also holds a statewide emergency response exercise pertaining to a possible Cascadia subduction zone earthquake, however the last one was in 1994 and the next one is not scheduled until 2002.

Contact: Earthquake and Tsunami Program Coordinator
Address: 595 Cottage St. NE, Salem, Oregon 97301
Phone: (503) 378-2911
Fax: (503) 588-1378
Website: **http://www.osp.state.or.us/oem/**

6.2 Federal and Regional Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA is heavily involved with seismic risks in Oregon and has aided in several projects in Portland and Klamath Falls. The Federal Emergency Management Agency (FEMA) is an independent agency of the federal government, reporting to the President. FEMA's purpose is to reduce loss of life and property and protect the nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response and recovery. FEMA provides disaster relief funds following a natural hazard and works most closely with Oregon Emergency Management (OEM).

Contact: Public Affairs Officer
Address: Federal Emergency Management Agency, Federal Regional Center
130 228th Street, St., Bothell, WA 98021-9796
Phone: 425-487-4610
Fax: 425-487-4690

U.S. Geological Survey (USGS)

The USGS is an active seismic research organization that also provides funding for research. (For an example of such research, see *Recommended Seismic Publications* below).

Contact: USGS, National Earthquake Information Center
Address: Box 25046; DFC, MS 967; Denver, Colorado 80225
Phone: 303-273-8500
Fax: 303-273-8450

Building Seismic Safety Council (BSSC)

The Building Seismic Safety Council (BSSC) established by the National Institute of Building Sciences (NIBS), deals with the complex regulatory, technical, social, and economic issues and develops and promotes building earthquake risk mitigation regulatory provisions for the nation.

Address: 1090 Vermont Avenue, NW, Suite 700, Washington, DC 20005-4905
Phone: (202) 289-7800
Fax: (202) 289-109
Website: **http://www.bssconline.org/**

Western States Seismic Policy Council (WSSPC)

The WSSPC is a regional organization that includes representatives of the earthquake programs of thirteen states (Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), three U.S. territories (American Samoa, Commonwealth of the Northern Mariana Islands and Guam) one Canadian Province, and one Canadian Territory (Yukon). The primary aims of the organization have been: to improve public understanding of seismic risk; to improve earthquake preparedness; and, to provide a cooperative forum to enhance transfer of mitigation technologies at the local, state, interstate, and national levels.

The mission of the Council is to provide a forum to advance earthquake hazard reduction programs throughout the western region and to develop, recommend, and present seismic policies and programs through information exchange, research, and education.

Contact: WSSPC, Executive Director
Address: 121 Second Street, 4th Floor; San Francisco, CA 94105
Phone: (415) 974-6435
Fax: (415) 974-1747
Email: wsspc@wsspc.org
Website: **http://www.wsspc.org**

National Tsunami Hazard Mitigation Program (NTHMP)

The National Tsunami Hazard Mitigation Program is a state/federal partnership created to reduce the impacts of tsunamis to U.S. coastal states by coordinating the state efforts of Alaska, California, Hawaii, Oregon, and Washington with federal activities of the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency(FEMA), and the United States Geological Survey (USGS). The three main areas of focus are hazard assessment, warning guidance, and mitigation

Contact: NTHMP, Chair
Address: NOAA/PMEL; 7600 Sand Point Way; Seattle WA 98115
Phone: (206) 526-6800
Fax: (206) 526-6815
Website: h**ttp://www.pmel.noaa.gov/tsunami-hazard**

Cascadia Region Earthquake Workgroup (CREW)

The Cascadia Region Earthquake Workgroup provides information on regional earthquake hazards, facts and mitigation strategies for the home and business office. The Cascadia Region Earthquake Workgroup (CREW) is a coalition of private and public representatives working together to improve the ability of Cascadia Region communities to reduce the effects of earthquake events. Members are from Oregon, Washington, California and British Columbia. Goals are to:

- Promote efforts to reduce the loss of life and property.
- Conduct education efforts to motivate key decision makers to reduce risks associated with earthquakes.
- Foster productive linkages between scientists, critical infrastructure providers, businesses and governmental agencies in order to improve the viability of communities after an earthquake event.

Contact: CREW, Executive Director
Address: 1330A S. 2nd Street, #105; Mount Vernon, WA 98273
Phone: (360) 336-5494
Fax: (360) 336-2837
Website: **http://www.crew.org**

6.3 Recommended Seismic Publications

The following list groups documents into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should have in its resource library. Secondary documents are not as essential as primary documents and may not be readily accessible, yet they still provide useful information to communities. Technical documents are those that focus on a particular specialized aspect of seismic hazard mitigation.

Primary Resources

These documents represent the principal resources communities can use to better plan for a seismic hazard. They are key tools for reducing the risks associated with seismic-prone areas.

Environmental, Groundwater and Engineering Geology: Applications for Oregon – Earthquake Risks and Mitigation in Oregon Yumei Wang, (1998) Oregon Department of Geology and Mineral Industries, Star Publishing.

This paper deals with earthquake risks in Oregon, what is being done today and what policies and programs are in action to help prevent loss and damage from seismic events. This article also gives a good list of organizations that are doing work in this field within the state. This article is somewhat technical but provides vital information to communities around the state.

To obtain this document: It may be difficult to obtain this document as it is part of a larger book edited by Scott Burns of Portland State University. Try contacting DOGAMI at 503-731-4100 or the Nature of the Northwest Information Center at 503-731-4444.

Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners, Wolfe, Myer R. et. al., (1986) University of Colorado, Institute of Behavioral Science, National Science Foundation.

This handbook provides techniques that planners and others can utilize to help mitigate for seismic hazards. It provides information on the effects of earthquakes, sources on risk assessment and effects of earthquakes on the built environment. The handbook also gives examples on application and implementation of planning techniques to be used by local communities.

To obtain this document: Contact the University of Colorado's Natural Hazards Research and Applications Information Center at (303) 492-6818.

Strategic Design and Applications of Earthquake Hazard and Risk Characterizations, Dr. John Beaulieu, DOGAMI

This document provides the reader with concise information on strategies for local earthquake hazards zoning and for risk determinations and loss estimations within a community. It also informs the reader of strategies to use for zonation mapping, risk assessments and loss estimation in developing local policy.

To obtain this document: Contact DOGAMI at 503-731-4100.FEMA Standards. An existing inventory giving required upgrades and building stock. To obtain these standards: Call 1-800-480-2520

Planning for Natural Hazards: Reviewing your Comprehensive Plan

Coordination and consistency is essential to implementing plan policies that reduce seismic risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- ❒ Have you made use of technical information and assistance provided by agencies to assist your community in planning for seismic hazards?
- ❒ What documents or technical assistance does your community need to find to further understanding of seismic hazards and begin the process of assessing community risk from seismic hazards?

Sidebar

Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.[28]

Benton, Deschutes, and Tillamook counties, and Multnomah County with the city of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the Oregon State Police: Office of Emergency Management in Salem.[29] For more information about Project Impact visit http://www.fema.gov on the World Wide Web (http://www.fema.gov/impact/impact00.htm), or contact the Oregon State Police: OEM.

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Secondary Resources

These documents provide additional information and tools for reducing the risks associated with seismic-prone areas.

Earthquakes, Bolt, Bruce A., University of California, Berkeley, W.H. Freeman and Company, (1995) New York.

Using Earthquake Hazard Maps: A Guide for Local Governments In the Portland Metropolitan Region, Spangle Associates, (1998) Urban Planning and Research, Portola Valley, California, October.

The Great Earthquake Experiment, Mileti, Dennis, (1993) Westview Press.

Putting Down Roots in Earthquake Country, (1995) USGS.

Evaluation of Earthquake Hazard Maps for the Portland Metropolitan Region, Spangle Associates, (1999) June.

Risk Reduction Strategies for Geologic Hazards – A Reference Manual for Oregon, John Beaulieu & Dennis Olmstead (1999) DOGAMI.

Earthquake Case Study: Loma Prieta in Santa Cruz and Watsonville, California, Chapter 12, *Planning for Post-Disaster Recovery and* Reconstruction, Charles Eadie.

Earthquake Policies Make Insurers Tremble, Joseph Treaster, New York Times, 1/9/00.

Earthquakes, Kaye M. Shedlock, U.S. Dept. of the Interior & USGS.

Planning for Earthquakes, Berke, Philip and Beatley, Timothy, (1992) Johns Hopkins University Press, Baltimore.

Reducing Seismic Hazards of Existing Buildings: A Status Report Ghosh, S.K., (March-April 2000) PCI Journal, (Pages 106-109).

USGS Response to an Urban Earthquake, Northridge '94, Prepared by USGS for FEMA (1996) Open-File Report 96-263.

Special Paper 29, DOGAMI.

Living with Earthquakes in the Pacific Northwest, Yeats, Robert (1998) OSU Press.

Technical Resources

The documents listed here focus on the technical aspects of seismic hazard mitigation. They may require interpretation by a technical specialist.

Shaping the Earth - Tectonics of Continents & Oceans, Moores, Eldridge M., University of California at Davis, W.H. Freeman and Company, (1990) New York.

The Behavior of the Earth, Allegre, Claude, (1988) Harvard University Press.

A Method for Producing Digital Probabilistic Seismic Landslide Hazard Maps: An Example from the Los Angeles, California, Area, Jibson, Randall W., et. al., (1998) U.S. Department of the Interior and USGS, Open File Report 98-113.

The Geology of Earthquakes, Yeats, Sieh, Allen (1997) Oxford University Press.

6.4 Internet Resources

Federal Emergency Management Agency

http://www.fema.gov/pte/prep.htm

The Federal Emergency Management Agency (FEMA) Preparedness, Training, and Exercises Directorate provides “fact sheets” - including preparedness tips - concerning most natural and technological hazards. This website is the primary source for questions and to find out what is being done throughout the country in hazard mitigation. Go to this website before going to any others. The collection includes:

http://www.fema.gov/library/quakef.htm - “Fact Sheet: Earthquakes”

http://www.fema.gov/library/tsunamif.htm - “Fact Sheet: Tsunamis”

EQNet

http://www.eqnet.org

EQNet is a collaborative effort of many of the institutions providing earthquake information in the U.S. It is a free, one-stop source for locating Internet information related to earthquake hazards mitigation.

The U.S. Geological Survey

http://quake.wr.usgs.gov or http://socal.wr.usgs.gov

The U.S. Geological Survey's Western Region Earthquake Hazards Information home page is an excellent place to begin any search for seismic information. It includes pages on the latest seismic events, earthquake hazard preparedness, and all other aspects of earthquakes. It also has an entire section devoted to the 1906 San Francisco earthquake and an extensive and notated list of other Web quake sites.

The Western Region's Pasadena Office Southern California Earthquake Information Page, at the second URL above, offers real-time earthquake data of the region, as well as information about past, present, and future quakes. It also provides USGS papers, reports, and other products concerning the 1994 Northridge, California quake, as well as maps, links, and a raft of other useful information about earthquakes.

http://geohazards.cr.usgs.gov

The USGS Central Region Geologic Hazards Page covers earthquakes, landslides, and geomagnetism. The earthquake section (http://geohazards.cr.usgs.gov/eq) offers numerous products related to the USGS national seismic hazard-mapping program. For example, users can look up the seismic hazard in any part of the continental U.S. by zip code, and the section also includes a custom-mapping feature, through which the user can specify latitude and longitude bounds and produce customized hazard maps of the selected area. Additionally, large versions (24"x36") of the national and western U.S. seismic hazard maps can be ordered using forms available from the Web site.

http://www.neic.cr.usgs.gov

The USGS's National Earthquake Information Center Web site comprises pages and pages, maps and maps of seismicity information from around the world. It offers general information about the center and its services, current quake information, general quake information, and access to other earthquake information sources. In addition, users can now search the National Earthquake Information Services (NEIS) historical database to identify historical seismic events (2100 B.C. to the present) for any location, using several user-defined parameters.

The Central United States Earthquake Consortium (CUSEC)

http://www.cusec@cusec.org

The CUSEC is comprised of the following public-private sector partners. Five core organizations: CUSEC State Geologists, Institute for Business and Home Safety (IBHS), the Mid-America Earthquake Center (MAE), FEMA, and USGS. Nine additional partners include the Federal Department of Transportation, Federal Highway Administration (FHWA), Association of Contingency Planners (ACP), Disaster Recovery Business Alliance (DRBA), Extreme Information Infrastructure (XII), Institute of Gas Technology (IGT), American Society of Civil Engineers (ASCE) and USGS Mid-Continent Mapping Center (MCMC).

NISEE

http://www.eerc.berkeley.edu/library/websites.html

The NISEE Web site provides a nice “Yahoo-like” guide to other Internet sources of earthquake information. This page, updated regularly, links to about 200 multidisciplinary earthquake engineering and engineering-related sites by subject, and includes a search engine as well as category listings. The main categories are: Seismology and Geophysics; Geotechnical Engineering; Structural Engineering; and Policy, Planning and Economics; and each of these categories then includes four or more subcategories. Sites providing educational resources (on-line library databases, etc.) are clearly marked with a special icon.

MAE Center

http://mae.ce.uiuc.edu/

The MAE Center is one of three national earthquake engineering research centers established by the National Science Foundation and its partner institutions. The MAE Center consists of a consortium of seven core institutions, and is funded by NSF and each core university as well as through joint collaborative projects with industry and other organizations. Center projects fall under four general types: 1) research, 2) implementation of research results, 3) education and 4) outreach. The center’s Web site offers more information about the organization, its goals and intended products, each of its core programs - coordinated research, essential facilities, transportation networks, hazards evaluation, outreach, and education - as well as recent news from the center.

The Southern California Earthquake Center

http://www.scec.org

The Southern California Earthquake Center (SCEC) is a Science and Technology Center of the National Science Foundation that brings scientists together for joint research to reduce vulnerability to earthquake hazards in Southern California. The formal mission of the center is to promote earthquake hazard reduction by estimating when and where future damaging earthquakes will occur, calculating the expected ground motion, and disseminating that information to the public. The SCEC Home Page contains background information about SCEC, links to its many member academic institutions, and pages of information on the Southern California earthquake hazard. Both the SCEC newsletter and SCEC publications list are available from this site, which also, includes an Earthquake Hazard Analysis Map (**http://scec.gps.caltech.edu/PhaseII.html**) - a map of probable future Southern California earthquakes, as well as abundant seismic data available from the SCEC Seismic Data Center (**http://www.scecdc.scec.org**).

Natural Hazards Center

http://www.colorado.edu/hazards/sites/sites.html

The Natural Hazards Center contains more information on websites pertaining to seismic hazards. This site provides other internet links that will complement the specific websites mentioned above.

Seismic Endnotes:

[1] Wolfe, Myer, et al. Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners, Special Publication 14, Natural Hazards Research and Applications Information Center.

[2] (ibid.)

[3] Zhenming Wang, Personal Interview, May 23, 2000.

[4] Nichols, D.R. and J.M. Buchanan-Banks, Seismic Hazard and Land-Use Planning, Geological Survey Circular #690, Reston, Virginia: U.S. Geological Survey, 1974.

[5] Wolfe, Myer, et al. Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners, Special Publication 14, Natural Hazards Research and Applications Information Center.

[6] (ibid.)

[7] Olmstead, Dennis, Personal Interview, April 27, 2000.

[8] Wolfe, Myer, et al. Land Use Planning for Earthquake Hazard Mitigation: A Handbook for Planners, Special Publication 14, Natural Hazards Research and Applications Information Center.

[9] The National Tsunami Hazard Mitigation Program, May 3, 2000, http://www.pmel.noaa.gov/tsunami-hazard/.

[10] Burns, Scott, Personal Interview, February 17, 2000.

[11] Catlin, Rich, Personal Interview, March 6, 2000.

[12] Darienzo, Mark, Personal Interview, February 8, 2000.

[13] Olmstead, Dennis, Personal Interview, April 27, 2000.

[14] Oregon Building Codes Division

[15] Collins, Peggy, Personal Interview, May 15, 2000.

[16] United States Geologic Survey, Geologic Division, Earthquake Information: reducing Hazards, http://quake.wr.usgs.gov, October 19, 1999.

[17] Collins, Peggy, Personal Interview, February 24, 2000.

[18] (ibid.)

[19] Wang, Yumei, Environmental, Groundwater and Engineering Geology: Applications for Oregon – Earthquake Risks and Mitigation in Oregon, Oregon Department of Geology and Mineral Industries, Star Publishing, 1998.

[20] Protect Your Home Against Earthquake Damage, Institute for Business and Home Safety, 175 Federal Street, Suite 500, Boston, MA. 02110-2222, August, 1999.

[21] 1994 Uniform Building Code.

[22] Federal Emergency Management Agency, Mitigation, http://www.fema.gov.

[23] (ibid.)

[24] (ibid.)

[25] (ibid.)

[26] Estes, Elliot, Personal Interview, April 2, 2000.

[27] (ibid.)

[28] Federal Emergency Management Agency, http://www.fema.gov.

[29] OEM Murray, Joseph. Personal Interview. 9 Feb 2000.

PLANNING FOR NATURAL HAZARDS:

Appendix A: Goals 2, 7, 17, & 18

July 2000

Oregon Departmentof Land Conservation & Development

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Oregon's Statewide Planning Goals & Guidelines

GOAL 2: LAND USE PLANNING

OAR 660-015-0000(2)

PART I -- PLANNING
To establish a land use planning process and policy framework as a basis for all decision and actions related to use of land and to assure an adequate factual base for such decisions and actions.

City, county, state and federal agency and special district plans and actions related to land use shall be consistent with the comprehensive plans of cities and counties and regional plans adopted under ORS Chapter 268.

All land use plans shall include identification of issues and problems, inventories and other factual information for each applicable statewide planning goal, evaluation of alternative courses of action and ultimate policy choices, taking into consideration social, economic, energy and environmental needs. The required information shall be contained in the plan document or in supporting documents. The plans, supporting documents and implementation ordinances shall be filed in a public office or other place easily accessible to the public. The plans shall be the basis for specific implementation measures. These measures shall be consistent with and adequate to carry out the plans. Each plan and related implementation measure shall be coordinated with the plans of affected governmental units.

All land-use plans and implementation ordinances shall be adopted by the governing body after public hearing and shall be reviewed and, as needed, revised on a periodic cycle to take into account changing public policies and circumstances, in accord with a schedule set forth in the plan. Opportunities shall be provided for review and comment by citizens and affected governmental units during preparation, review and revision of plans and implementation ordinances.

Affected Governmental Units -- are those local governments, state and federal agencies and special districts which have programs, land ownerships, or responsibilities within the area included in the plan.

Comprehensive Plan -- as defined in ORS 197.015(5).

Coordinated -- as defined in ORS 197.015(5). Note: It is included in the definition of comprehensive plan.

Implementation Measures -- are the means used to carry out the plan. These are of two general types: (1) management implementation measures such as ordinances, regulations or project plans, and (2) site or area specific implementation measures such as permits and grants for construction, construction of public facilities or provision of services.

Plans -- as used here encompass all plans which guide land-use decisions, including both comprehensive and single-purpose plans of cities, counties, state and federal agencies and special districts.

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PART II -- EXCEPTIONS

A local government may adopt an exception to a goal when:

(a) The land subject to the exception is physically developed to the extent that it is no longer available for uses allowed by the applicable goal;

(b) The land subject to the exception is irrevocably committed to uses not allowed by the applicable goal because existing adjacent uses and other relevant factors make uses allowed by the applicable goal impracticable; or

(c) The following standards are met:

(1) Reasons justify why the state policy embodied in the applicable goals should not apply;

(2) Areas which do not require a new exception cannot reasonably accommodate the use;

(3) The long-term environmental, economic, social and energy consequences resulting from the use of the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site; and

(4) The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.

Compatible, as used in subparagraph (4) is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

A local government approving or denying a proposed exception shall set forth findings of fact and a statement of reasons which demonstrate that the standards for an exception have or have not been met.

Each notice of a public hearing on a proposed exception shall specifically note that a goal exception is proposed and shall summarize the issues in an understandable manner.

Upon review of a decision approving or denying an exception:

(a) The commission shall be bound by any finding of fact for which there is substantial evidence in the record of the local government proceedings resulting in approval or denial of the exception;

(b) The commission shall determine whether the local government's findings and reasons demonstrate that the standards for an exception have or have not been met; and

(c) The commission shall adopt a clear statement of reasons which sets forth the basis for the determination that the standards for an exception have or have not been met.

Exception means a comprehensive plan provision, including an amendment to an acknowledged comprehensive plan, that;

(a) Is applicable to specific properties or situations and does not establish a planning or zoning policy of general applicability;

(b) Does not comply with some or all goal requirements applicable to the subject properties or situations; and

(c) Complies with standards for an exception.

PART III -- USE OF GUIDELINES

Governmental units shall review the guidelines set forth for the goals and either utilize the guidelines or develop alternative means that will achieve the

goals. All land-use plans shall state how the guidelines or alternative means utilized achieve the goals.

Guidelines -- are suggested directions that would aid local governments in activating the mandated goals. They are intended to be instructive, directional and positive, not limiting local government to a single course of action when some other course would achieve the same result. Above all, guidelines are not intended to be a grant of power to the state to carry out zoning from the state level under the guise of guidelines. (Guidelines or the alternative means selected by governmental bodies will be part of the Land Conservation and Development Commission's process of evaluating plans for compliance with goals.)

GUIDELINES

A. PREPARATION OF PLANS AND IMPLEMENTATION MEASURES

Preparation of plans and implementation measures should be based on a series of broad phases, proceeding from the very general identification of problems and issues to the specific provisions for dealing with these issues and for interrelating the various elements of the plan. During each phase opportunities should be provided for review and comment by citizens and affected governmental units.

The various implementation measures which will be used to carry out the plan should be considered during each of the planning phases.

The number of phases needed will vary with the complexity and size of the area, number of people involved, other governmental units to be consulted, and availability of the necessary information.

Sufficient time should be allotted for:

(1) collection of the necessary factual information

(2) gradual refinement of the problems and issues and the alternative solutions and strategies for development

(3) incorporation of citizen needs and desires and development of broad citizen support

(4) identification and resolution of possible conflicts with plans of affected governmental units.

B. REGIONAL, STATE AND FEDERAL PLAN CONFORMANCE

It is expected that regional, state and federal agency plans will conform to the comprehensive plans of cities and counties. Cities and counties are expected to take into account the regional, state and national needs. Regional, state and federal agencies are expected to make their needs known during the preparation and revision of city and county comprehensive plans. During the preparation of their plans, federal, state and regional agencies are expected to create opportunities for review and comment by cities and counties. In the event existing plans are in conflict or an agreement cannot be reached during the plan preparation process, then the Land Conservation and Development Commission expects the affected government units to take steps to resolve the issues. If an agreement cannot be reached, the appeals procedures in ORS Chapter 197 may be used.

C. PLAN CONTENT

1. Factual Basis for the Plan

Inventories and other forms of data are needed as the basis for the policies and other decisions set forth in the plan. This factual base should include data on the following as they relate to the goals and other provisions of the plan:

(a) Natural resources, their capabilities and limitations

(b) Man-made structures and utilities, their location and condition

(c) Population and economic characteristics of the area

(d) Roles and responsibilities of governmental units.

2. Elements of the Plan

The following elements should be included in the plan:

(a) Applicable statewide planning goals

(b) Any critical geographic area designated by the Legislature

(c) Elements that address any special needs or desires of the people in the area

(d) Time periods of the plan, reflecting the anticipated situation at appropriate future intervals.

All of the elements should fit together and relate to one another to form a consistent whole at all times.

D. FILING OF PLANS

City and county plans should be filed, but not recorded, in the Office of the County Recorder. Copies of all plans should be available to the public and to affected governmental units.

E. MAJOR REVISIONS AND MINOR CHANGES IN THE PLAN AND IMPLEMENTATION MEASURES

The citizens in the area and any affected governmental unit should be given an opportunity to review and comment prior to any changes in the plan and implementation ordinances. There should be at least 30 days notice of the public hearing on the proposed change.

1. Major Revisions

Major revisions include land use changes that have widespread and significant impact beyond the immediate area, such as quantitative changes producing large volumes of traffic; a qualitative change in the character of the land use itself, such as conversion of residential to industrial use; or a spatial change that affects large areas or many different ownerships.

The plan and implementation measures should be revised when public needs and desires change and when development occurs at a different rate than contemplated by the plan. Areas experiencing rapid growth and development should provide for a frequent review so needed revisions can be made to keep the plan up to date; however, major revisions should not be made more frequently than every two years, if at all possible.

2. Minor Changes

Minor changes, i.e., those which do not have significant effect beyond the immediate area of the change, should be based on special studies or other information which will serve as the factual basis to support the change. The public need and justification for the particular change should be established. Minor changes should not be made more frequently than once a year, if at all possible.

F. IMPLEMENTATION MEASURES

The following types of measure should be considered for carrying out plans:

1. Management Implementation Measures

(a) Ordinances controlling the use and construction on the land, such as building codes, sign ordinances, subdivision and zoning ordinances. ORS Chapter 197 requires that the provisions of the zoning and subdivision ordinances conform to the comprehensive plan.

(b) Plans for public facilities that are more specific than those included in the comprehensive plan. They show the size, location, and capacity serving each property but are not as detailed as construction drawings.

(c) Capital improvement budgets which set out the projects to be constructed during the budget period.

(d) State and federal regulations affecting land use.

(e) Annexations, consolidations, mergers and other reorganization measures.

2. Site and Area Specific implementation Measures

(a) Building permits, septic tank permits, driveway permits, etc; the review of subdivisions and land partitioning applications; the changing of zones and granting of conditional uses, etc.

(b) The construction of public facilities (schools, roads, water lines, etc.).

(c) The provision of land-related public services such as fire and police.

(d) The awarding of state and federal grants to local governments to provide these facilities and services.

(e) Leasing of public lands.

G. USE OF GUIDELINES FOR THE STATEWIDE PLANNING GOALS

Guidelines for most statewide planning goals are found in two sections-planning and implementation. Planning guidelines relate primarily to the process of developing plans that incorporate the provisions of the goals. Implementation guidelines should relate primarily to the process of carrying out the goals once they have been incorporated into the plans. Techniques to carry out the goals and plans should be considered during the preparation of the plan.

Oregon's State-Wide Planning Goals and Guidelines

GOAL 7: AREAS SUBJECT TO NATURAL DISASTERS AND HAZARDS

OAR 660-015-0000(7)

To protect life and property from natural disasters and hazards.

Developments subject to damage or that could result in loss of life shall not be planned nor located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disaster and hazards.

Areas of Natural Disasters and Hazards -- are areas that are subject to natural events that are known to result in death or endanger the works of man, such as stream flooding, ocean flooding, ground water, erosion and deposition, landslides, earthquakes, weak foundation soils and other hazards unique to local or regional areas.

GUIDELINES

A. PLANNING

1. Areas subject to natural hazards should be evaluated as to the degree of hazard present. Proposed developments should be keyed to the degree of hazard and to the limitations on use imposed by such hazard in the planning areas.

2. In planning for floodplain areas, uses that will not require protection through dams, dikes and levies should be preferred over uses that will require such protection.

3. Low density and open space uses that are least subject to loss of life or property damage such as open storage, forestry, agriculture and recreation should be preferred in floodplains, especially the floodway portion. The floodway portion should be given special attention to avoid development that is likely to cause an impediment to the flow of floodwaters.

4. Plans taking into account known areas of natural disasters and hazards should consider as a major determinant, the carrying capacity of the air, land and water resources of the planning area. The land conservation and development actions provided for by such plans should not exceed the carrying capacity of such resources.

5. Planning for known areas of natural disasters and hazards should include an evaluation of the beneficial impact on natural resources and the environment from letting such events naturally reoccur.

B. IMPLEMENTATION

1. Cities and counties not already eligible should qualify for inclusion in the National Flood Insurance Program, provided under the National Flood Insurance Act of 1968 (Public Law 90-448). The Act requires that development in flood-prone areas be appropriate to the probability of flood damage, and the danger to human life. The Flood Disaster Protection Act of 1973 (P.L. 93-

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Oregon's Statewide Planning Goals & Guidelines

GOAL 17: COASTAL SHORELANDS

OAR 660-015-0010(2)
(Please Note: Amended 08/05/99)

To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and

To reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

Programs to achieve these objectives shall be developed by local, state, and federal agencies having jurisdiction over coastal shorelands.

Land use plans, implementing actions and permit reviews shall include consideration of the critical relationships between coastal shorelands and resources of coastal waters, and of the geologic and hydrologic hazards associated with coastal shorelands. Local, state and federal agencies shall within the limit of their authorities maintain the diverse environmental, economic, and social values of coastal shorelands and water quality in coastal waters. Within those limits, they shall also minimize man-induced sedimentation in estuaries, near shore ocean waters, and coastal lakes.

General priorities for the overall use of coastal shorelands (from highest to lowest) shall be to:

1. Promote uses which maintain the integrity of estuaries and coastal waters;
2. Provide for water-dependent uses;
3. Provide for water-related uses;
4. Provide for nondependent, nonrelated uses which retain flexibility of future use and do not prematurely or inalterably commit shorelands to more intensive uses;
5. Provide for development, including nondependent, nonrelated uses, in urban areas compatible with existing or committed uses;
6. Permit nondependent, nonrelated uses which cause a permanent or long-term change in the features of coastal shorelands only upon a demonstration of public need.

INVENTORY REQUIREMENTS

Inventories shall be conducted to provide information necessary for identifying coastal shorelands and designating uses and policies. These inventories shall provide information on the nature, location, and extent of geologic and hydrologic hazards and shoreland values, including fish and wildlife habitat, water-dependent uses,

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economic resources, recreational uses, and aesthetics in sufficient detail to establish a sound basis for land and water use management.

The inventory requirements shall be applied within an area known as a coastal shorelands planning area. This planning area is not an area within which development or use is prohibited. It is an area for inventory, study, and initial planning for development and use to meet the Coastal Shorelands Goal.

The planning area shall be defined by the following:

1. All lands west of the Oregon Coast Highway as described in ORS 366.235, except that:

(a) In Tillamook County, only the lands west of a line formed by connecting the western boundaries of the following described roadways: Brooten Road (County Road 887) northerly from its junction with the Oregon Coast Highway to Pacific City, McPhillips Drive (County Road 915) northerly from Pacific City to its junction with Sandlake Road (County Road 871), Sandlake-Cape Lookout Road, (County Road 871) northerly to its junction with Cape Lookout Park, Netarts Bay Drive (County Road 665) northerly from its junction with the Sandlake-Cape Lookout Road (County Road 871) to its junction at Netarts with State Highway 131, and northerly along State Highway 131 to its junction with the Oregon Coast Highway near Tillamook.

(b) In Coos County, only the lands west of a line formed by connecting the western boundaries of the following described roadways: Oregon State 240, Cape Arago Secondary (FAS 263) southerly from its junction with the Oregon Coast Highway to Charleston; Seven Devils Road (County Road 33) southerly from its junction with Oregon State 240 (FAS 263) to its junction with the Oregon Coast Highway, near Bandon; and

2. All lands within an area defined by a line measured horizontally

(a) 1000 feet from the shoreline of estuaries; and

(b) 500 feet from the shoreline of coastal lakes.

COMPREHENSIVE PLAN REQUIREMENTS

Based upon inventories, comprehensive plans for coastal areas adjacent to the ocean, estuaries, or coastal lakes shall:

1. Identify coastal shorelands;

2. Establish policies and uses of coastal shorelands in accordance with standards set forth below:

Identification of Coastal Shorelands

Lands contiguous with the ocean, estuaries, and coastal lakes shall be identified as coastal shorelands. The extent of shorelands shall include at least:

1. Areas subject to ocean flooding and lands within 100 feet of the ocean shore or within 50 feet of an estuary or a coastal lake;

2. Adjacent areas of geologic instability where the geologic instability is related to or will impact a coastal water body;

3. Natural or man-made riparian resources, especially vegetation necessary to stabilize the shoreline and to maintain water quality and temperature necessary for the maintenance of fish habitat and spawning areas;

4. Areas of significant shoreland and wetland biological habitats whose habitat quality is primarily derived from or related to the association with coastal water areas;

5. Areas necessary for water-dependent and water-related uses, including areas of recreational importance which utilize coastal water or riparian resources, areas appropriate for navigation and port facilities, dredge material disposal and mitigation sites, and areas having characteristics suitable for aquaculture;

6. Areas of exceptional aesthetic or scenic quality, where the quality is primarily derived from or related to the association with coastal water areas; and

7. Coastal headlands.

Coastal Shoreland Uses

1. Major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources inventoried in the Identification Section, shall be protected. Uses in these areas shall be consistent with protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting, wild crops, and low intensity water-dependent recreation.

2. Water-Dependent Shorelands.

Location. Shorelands in the following areas that are suitable for water-dependent uses shall be protected for water-dependent recreational, commercial, and industrial uses:

(a) urban or urbanizable areas;

(b) rural areas built upon or irrevocably committed to non-resource use; and

(c) any unincorporated community subject to OAR Chapter 660, Division 022 (Unincorporated Communities).

Minimum Acreage. Within each estuary, the minimum amount of shorelands to be protected shall be equivalent to the following combination of factors as they may exist:

(a) Acreage of estuarine shorelands that are currently being used for water-dependent uses; and

(b) Acreage of estuarine shorelands that at any time were used for water-dependent uses and still possess structures or facilities that provide or provided water-dependent uses with access to the adjacent coastal water body. Examples of such facilities or structures that provide water-dependent access would be wharves, piers, docks, mooring piling, boat ramps, water intake or discharge structures, or navigational aids.

Suitability. Any shoreland area within the estuary may be designated to provide the minimum amount of protected shorelands. However, any such designated shoreland area shall be suitable for water dependent uses. At a minimum, such water-dependent shoreland areas shall possess, or be capable of possessing, structures or facilities that provide water-dependent uses with physical access to the adjacent coastal water body. Such designations shall comply with applicable Statewide Planning Goals.

Permissible Nonwater-Dependent Uses. Other uses which may be permitted in these areas are temporary uses which involve minimal capital investment and no permanent structures, or a use in conjunction with and incidental and subordinate to a water-dependent use.

Applicability. Local cities and counties are not mandated by this requirement to make changes to their acknowledged local comprehensive plans or land use regulations for existing water-dependent shorelands. However, if a local government chooses to revise

the boundary of or allowed uses of a designated water-dependent shoreland site, then this requirement shall apply.

3. Local governments shall determine whether there are any existing, developed commercial/industrial waterfront areas which are suitable for redevelopment which are not designated as especially suited for water-dependent uses. Plans shall be prepared for these areas which allow for a mix of water-dependent, water-related, and water oriented nondependent uses and shall provide for public access to the shoreline.

4. Shorelands in rural areas other than those built upon or irrevocably committed to nonresource use and those designated in (1) above shall be used as appropriate for:

(a) farm uses as provided in ORS Chapter 215;

(b) propagation and harvesting of forest products consistent with the Oregon Forest Practices Act;

(c) private and public water-dependent recreation developments;

(d) aquaculture;

(e) water-dependent commercial and industrial uses, water-related uses and other uses only upon a finding by the county that such uses satisfy a need which cannot be accommodated on uplands or in urban and urbanizable areas or in rural areas built upon or irrevocably committed to non-resource use.

IMPLEMENTATION REQUIREMENTS

1. The Oregon Department of Forestry shall recognize the unique and special values provided by coastal shorelands when developing standards and policies to regulate uses of forest lands within coastal shorelands. With other state and federal agencies, the Department of Forestry shall develop forest management practices and policies including, where necessary, amendments to the FPA rules and programs which protect and maintain the special shoreland values and forest uses especially for natural shorelands and riparian vegetation.

2. Local government, with assistance from state and federal agencies, shall identify coastal shoreland areas which may be used to fulfill the mitigation requirement of the Estuarine Resources Goal. These areas shall be protected from new uses and activities which would prevent their ultimate restoration or addition to the estuarine ecosystem.

3. Coastal shorelands identified under the Estuarine Resources Goal for dredged material disposal shall be protected from new uses and activities which would prevent their ultimate use for dredged material disposal.

4. Because of the importance of the vegetative fringe adjacent to coastal waters to water quality, fish and wildlife habitat, recreational use and aesthetic resources, riparian vegetation shall be maintained; and where appropriate , restored and enhanced, consistent with water-dependent uses.

5. Land-use management practices and non-structural solutions to problems or erosion and flooding shall be preferred to structural solutions. Where shown to be necessary, water and erosion control structures, such as jetties, bulkheads, seawalls, and similar protective structures; and fill, whether located in the waterways or on shorelands above ordinary high water mark, shall be designed to minimize adverse impacts on water currents, erosion, and accretion patterns.

6. Local government in coordination with the Parks and Recreation Division shall develop and implement a program to provide increased public access. Existing public ownerships, rights of way, and similar public easements in coastal shorelands which provide access to or along coastal waters shall be retained or replaced if sold, exchanged or transferred. Rights of way may be vacated to permit redevelopment of shoreland areas provided public access across the affected site is retained.

GUIDELINES FOR GOAL 17

The requirements of the Coastal Shorelands Goal should be addressed with the same consideration applied to previously adopted goals and guidelines. The planning process described in the Land Use Planning Goal (Goal 2), including the exceptions provisions described in Goal 2, applies to coastal shoreland areas and implementation of the Coastal Shorelands Goal.

Because of the strong relation of estuarine shorelands to adjacent estuaries, the inventory and planning requirements for estuaries and estuarine shorelands should also be fully coordinated. Coastal shoreland inventories and planning should also be fully coordinated with those required in other statewide planning goals, supplementing them where necessary. Of special importance are the plan requirements of the Goals for Agricultural Lands; Forest Lands; Open Spaces, Scenic and Historic Areas and Natural Resources; Air, Water, and Land Resources Quality; Areas Subject to Natural Disasters and Hazards; Recreational Needs; and Economy of the State.

A. INVENTORIES

In coastal shoreland areas the following inventory needs should be reviewed. The level of detail of information needed will differ depending on the development or alteration proposed and the degree of conflict over the potential designation.

1. Hazard areas, including at least:

(a) Areas the use of which may result in significant hydraulic alteration of other lands or water bodies;

(b) Areas of geological instability in, or adjacent to shorelines; and

(c) The 100-Year Floodplain.

2. Existing land uses and ownership patterns, economic resources, development needs, public facilities, topography, hydrography, and similar information affecting shorelands;

3. Areas of aesthetic and scenic importance;

4. Coastal shoreland and wetland biological habitats which are dependent upon the adjacent water body, plus other coastal shoreland and adjacent aquatic areas of biological importance (feeding grounds, nesting sites, areas of high productivity, etc.) natural areas and fish and wildlife habitats;

5. Areas of recreational importance;

6. Areas of vegetative cover which are riparian in nature or which function to maintain water quality and to stabilize the shoreline;

7. Sedimentation sources;

8. Areas of present public access and recreational use;

9. The location of archaeological and historical sites; and

10. Coastal headlands.

B. FLOODPLAIN

In the development of comprehensive plans, the management of uses and development in floodplain areas should be expanded beyond the minimal considerations necessary to comply with the National Flood Insurance Program and the requirements of the Flood Disaster Protection Act of 1973. Communities may wish to distinguish between the floodway and floodfringe in developing coastal shoreland plans; development in the floodway should be more strictly controlled. Government projects in coastal shorelands should be examined for their impact on flooding, potential flood damage, and effect on growth patterns in the floodplain. Nonwater-dependent emergency service structures (such as hospitals, police, and fire stations) should not be constructed in the floodplain. Although they may be flood-proofed, access and egress may be prevented during a flood emergency.

C. OPEN SPACE, NATURAL AREAS AND AESTHETIC RESOURCES, AND RECREATION

Coastal shorelands provide many areas of unique or exceptional value and benefit for open space, natural areas, and aesthetic and recreational use. The requirements of the Goals for Open Spaces, Scenic and Historic Areas, and Natural Resources (Goal 5) and Recreational Needs (Goal 8) should be carefully coordinated with the coastal shoreland planning effort. The plan should provide for appropriate public access to and recreational use of coastal waters. Public access through and the use of private property shall require the consent of the owner and is a trespass unless appropriate easements and access have been acquired in accordance with law.

D. DEVELOPMENT NEEDS

In coordination with planning for the Estuarine Resources Goal, coastal shoreland plans should designate appropriate sites for water-dependent activities, and for dredged material disposal.

Historic, unique, and scenic waterfront communities should be maintained and enhanced, allowing for nonwater-dependent uses as appropriate in keeping with such communities.

E. TRANSPORTATION

The requirements of the Transportation Goal should be closely coordinated with the Coastal Shorelands Goal. Coastal transportation systems frequently utilize shoreland areas and may significantly affect the resources and values of coastal shorelands and adjacent waters; they should allow appropriate access to coastal shorelands and adjacent waters, and be planned in full recognition of the protection needs for the special resources and benefits which shorelands provide.

F. EXAMPLES OF INCIDENTAL USES

Examples of uses that are in conjunction with and incidental to a water-dependent use include a restaurant on the second floor of an existing seafood processing plant and a retail sales room as part of a seafood processing plant. Generally, to be in conjunction with and incidental to a water dependent use, a nonwater-dependent use must be constructed at the same time or after the water-dependent use of the site is

established and be carried out together with the water-dependent use. Incidental means that the size of nonwater-dependent use is small in relation to the water-dependent operation and that it does not interfere with conduct of the water-dependent use.

Oregon's Statewide Planning Goals & Guidelines

GOAL 18: BEACHES AND DUNES

OAR 660-015-0010(3)

To conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of coastal beach and dune areas; and

To reduce the hazard to human life and property from natural or man-induced actions associated with these areas.

Coastal comprehensive plans and implementing actions shall provide for diverse and appropriate use of beach and dune areas consistent with their ecological, recreational, aesthetic, water resource, and economic values, and consistent with the natural limitations of beaches, dunes, and dune vegetation for development.

INVENTORY REQUIREMENTS

Inventories shall be conducted to provide information necessary for identifying and designating beach and dune uses and policies. Inventories shall describe the stability, movement, groundwater resource, hazards and values of the beach and dune areas in sufficient detail to establish a sound basis for planning and management. For beach and dune areas adjacent to coastal waters, inventories shall also address the inventory requirements of the Coastal Shorelands Goal.

COMPREHENSIVE PLAN REQUIREMENTS

Based upon the inventory, comprehensive plans for coastal areas shall:

1. Identify beach and dune areas; and

2. Establish policies and uses for these areas consistent with the provisions of this goal.

IDENTIFICATION OF BEACHES AND DUNES

Coastal areas subject to this goal shall include beaches, active dune forms, recently stabilized dune forms, older stabilized dune forms and interdune forms.

USES

Uses shall be based on the capabilities and limitations of beach and dune areas to sustain different levels of use or development, and the need to protect areas of critical environmental concern, areas having scenic, scientific, or biological importance, and significant wildlife habitat as identified through application of Goals 5 and 17.

IMPLEMENTATION REQUIREMENTS

1. Local governments and state and federal agencies shall base decisions on plans, ordinances and land use actions in beach and dune areas, other than older stabilized dunes, on specific findings that shall include at least:

(a) The type of use proposed and the adverse effects it might have on the site and adjacent areas;

(b) Temporary and permanent stabilization programs and the planned

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maintenance of new and existing vegetation;

(c) Methods for protecting the surrounding area from any adverse effects of the development; and

(d) Hazards to life, public and private property, and the natural environment which may be caused by the proposed use.

2. Local governments and state and federal agencies shall prohibit residential developments and commercial and industrial buildings on beaches, active foredunes, on other foredunes which are conditionally stable and that are subject to ocean undercutting or wave overtopping, and on interdune areas (deflation plains) that are subject to ocean flooding. Other development in these areas shall be permitted only if the findings required in (1) above are presented and it is demonstrated that the proposed development:

(a) Is adequately protected from any geologic hazards, wind erosion, undercutting, ocean flooding and storm waves; or is of minimal value; and

(b) Is designed to minimize adverse environmental effects.

3. Local governments and state and federal agencies shall regulate actions in beach and dune areas to minimize the resulting erosion. Such actions include, but are not limited to, the destruction of desirable vegetation (including inadvertent destruction by moisture loss or root damage), the exposure of stable and conditionally stable areas to erosion, and construction of shore structures which modify current or wave patterns leading to beach erosion.

4. Local, state and federal plans, implementing actions and permit reviews shall protect the groundwater from drawdown which would lead to loss of stabilizing vegetation, loss of water quality, or intrusion of salt water into water supplies. Building permits for single family dwellings are exempt from this requirement if appropriate findings are provided in the comprehensive plan or at the time of subdivision approval.

5. Permits for beachfront protective structures shall be issued only where development existed on January 1, 1977. Local comprehensive plans shall identify areas where development existed on January 1, 1977. For the purposes of this requirement and Implementation Requirement 7 "development" means houses, commercial and industrial buildings, and vacant subdivision lots which are physically improved through construction of streets and provision of utilities to the lot and includes areas where an exception to (2) above has been approved. The criteria for review of all shore and beachfront protective structures shall provide that:

(a) visual impacts are minimized;

(b) necessary access to the beach is maintained;

(c) negative impacts on adjacent property are minimized; and

(d) long-term or recurring costs to the public are avoided.

6. Foredunes shall be breached only to replenish sand supply in interdune areas, or on a temporary basis in an emergency (e.g., fire control, cleaning up oil spills, draining farm lands, and alleviating flood hazards), and only if the breaching and restoration

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after breaching is consistent with sound principles of conservation.

7. Grading or sand movement necessary to maintain views or to prevent sand inundation may be allowed for structures in foredune areas only if the area is committed to development or is within an acknowledged urban growth boundary and only as part of an overall plan for managing foredune grading. A foredune grading plan shall include the following elements based on consideration of factors affecting the stability of the shoreline to be managed including sources of sand, ocean flooding, and patterns of accretion and erosion (including wind erosion), and effects of beachfront protective structures and jetties. The plan shall:

(a) Cover an entire beach and foredune area subject to an accretion problem, including adjacent areas potentially affected by changes in flooding, erosion, or accretion as a result of dune grading;

(b) Specify minimum dune height and width requirements to be maintained for protection from flooding and erosion. The minimum height for flood protection is 4 feet above the 100 year flood elevation;

(c) Identify and set priorities for low and narrow dune areas which need to be built up;

(d) Prescribe standards for redistribution of sand and temporary and permanent stabilization measures including the timing of these activities; and

(e) Prohibit removal of sand from the beach-foredune system.

The Commission shall, by January 1, 1987, evaluate plans and actions which implement this requirement and determine whether or not they have interfered with maintaining the integrity of beach and dune areas and minimize flooding and erosion problems. If the Commission determines that these measures have interfered it shall initiate Goal amendment proceedings to revise or repeal these requirements.

GUIDELINES FOR GOAL 18

The requirements of the Beaches and Dunes Goal should be addressed with the same consideration applied to previously adopted goals and guidelines. The planning process described in the Land Use Planning Goal (Goal 2), including the exceptions provisions described in Goal 2, applies to beaches and dune areas and implementation of the Beaches and Dunes Goal.

Beaches and dunes, especially interdune areas (deflation plains) provide many unique or exceptional resources which should be addressed in the inventories and planning requirements of other goals, especially the Goals for Open Space, Scenic and Historic Areas and Natural Resources; and Recreational Needs. Habitat provided by these areas for coastal and migratory species is of special importance.

A. INVENTORIES

Local government should begin the beach and dune inventory with a review of Beaches and Dunes of the Oregon Coast, USDA Soil Conservation Service and OCCDC, March 1975, and determine what additional information is necessary to identify and describe:

1. The geologic nature and stability of the beach and dune landforms;

2. Patterns of erosion, accretion, and migration;

3. Storm and ocean flood hazards;

4. Existing and projected use, development and economic activity on the beach and dune landforms; and

5. Areas of significant biological importance.

B. EXAMPLES OF MINIMAL DEVELOPMENT

Examples of development activity which are of minimal value and suitable for development of conditionally stable dunes and deflation plains include beach and dune boardwalks, fences which do not affect sand erosion or migration, and temporary open-sided shelters.

C. EVALUATING BEACH AND DUNE PLANS AND ACTIONS

Local government should adopt strict controls for carrying out the Implementation Requirements of this goal. The controls could include:

1. Requirement of a site investigation report financed by the developer;

2. Posting of performance bonds to assure that adverse effects can be corrected; and

3. Requirement of re-establishing vegetation within a specific time.

D. SAND BY-PASS

In developing structures that might excessively reduce the sand supply or interrupt the longshore transport or littoral drift, the developer should investigate, and where possible, provide methods of sand by-pass.

E. PUBLIC ACCESS

Where appropriate, local government should require new developments to dedicate easements for public access to public beaches, dunes and associated waters. Access into or through dune areas, particularly conditionally stable dunes and dune complexes, should be controlled or designed to maintain the stability of the area, protect scenic values and avoid fire hazards.

F. DUNE STABILIZATION

Dune stabilization programs should be allowed only when in conformance with the comprehensive plan, and only after assessment of their potential impact.

G. OFF-ROAD VEHICLES

Appropriate levels of government should designate specific areas for the recreational use of off-road vehicles (ORVs). This use should be restricted to limit damage to natural resources and avoid conflict with other activities, including other recreational use.

H. FOREDUNE GRADING PLANS

Plans which allow foredune grading should be based on clear consideration of the fragility and ever-changing nature of the foredune and its importance for protection from flooding and erosion. Foredune grading needs to be planned for on an area-wide basis because the geologic processes of flooding, erosion, sand movement, wind patterns, and littoral drift affect entire stretches of shoreline. Dune grading cannot be carried out effectively on a lot-by-lot basis because of these areawide processes and the off-site effects of changes to the dunes.

Plans should also address in detail the findings specified in

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Implementation Requirement (1) of this Goal with special emphasis placed on the following:

- Identification of appropriate measures for stabilization of graded areas and areas of deposition, including use of fire-resistant vegetation;
- Avoiding or minimizing grading or deposition which could adversely affect surrounding properties by changing wind, ocean erosion, or flooding patterns;
- Identifying appropriate sites for public and emergency access to the beach.

economic resources, recreational uses, and aesthetics in sufficient detail to establish a sound basis for land and water use management.

The inventory requirements shall be applied within an area known as a coastal shorelands planning area. This planning area is not an area within which development or use is prohibited. It is an area for inventory, study, and initial planning for development and use to meet the Coastal Shorelands Goal.

The planning area shall be defined by the following:

1. All lands west of the Oregon Coast Highway as described in ORS 366.235, except that:

(a) In Tillamook County, only the lands west of a line formed by connecting the western boundaries of the following described roadways: Brooten Road (County Road 887) northerly from its junction with the Oregon Coast Highway to Pacific City, McPhillips Drive (County Road 915) northerly from Pacific City to its junction with Sandlake Road (County Road 871), Sandlake-Cape Lookout Road, (County Road 871) northerly to its junction with Cape Lookout Park, Netarts Bay Drive (County Road 665) northerly from its junction with the Sandlake-Cape Lookout Road (County Road 871) to its junction at Netarts with State Highway 131, and northerly along State Highway 131 to its junction with the Oregon Coast Highway near Tillamook.

(b) In Coos County, only the lands west of a line formed by connecting the western boundaries of the following described roadways: Oregon State 240, Cape Arago Secondary (FAS 263) southerly from its junction with the Oregon Coast Highway to Charleston; Seven Devils Road (County Road 33) southerly from its junction with Oregon State 240 (FAS 263) to its junction with the Oregon Coast Highway, near Bandon; and

2. All lands within an area defined by a line measured horizontally

(a) 1000 feet from the shoreline of estuaries; and

(b) 500 feet from the shoreline of coastal lakes.

COMPREHENSIVE PLAN REQUIREMENTS

Based upon inventories, comprehensive plans for coastal areas adjacent to the ocean, estuaries, or coastal lakes shall:

1. Identify coastal shorelands;

2. Establish policies and uses of coastal shorelands in accordance with standards set forth below:

Identification of Coastal Shorelands

Lands contiguous with the ocean, estuaries, and coastal lakes shall be identified as coastal shorelands. The extent of shorelands shall include at least:

1. Areas subject to ocean flooding and lands within 100 feet of the ocean shore or within 50 feet of an estuary or a coastal lake;

2. Adjacent areas of geologic instability where the geologic instability is related to or will impact a coastal water body;

3. Natural or man-made riparian resources, especially vegetation necessary to stabilize the shoreline and to maintain water quality and temperature necessary for the maintenance of fish habitat and spawning areas;

4. Areas of significant shoreland and wetland biological habitats whose habitat quality is primarily derived from or related to the association with coastal water areas;

5. Areas necessary for water-dependent and water-related uses, including areas of recreational importance which utilize coastal water or riparian resources, areas appropriate for navigation and port facilities, dredge material disposal and mitigation sites, and areas having characteristics suitable for aquaculture;

6. Areas of exceptional aesthetic or scenic quality, where the quality is primarily derived from or related to the association with coastal water areas; and

7. Coastal headlands.

Coastal Shoreland Uses

1. Major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources inventoried in the Identification Section, shall be protected. Uses in these areas shall be consistent with protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting, wild crops, and low intensity water-dependent recreation.

2. Water-Dependent Shorelands.

Location. Shorelands in the following areas that are suitable for water-dependent uses shall be protected for water-dependent recreational, commercial, and industrial uses:

(a) urban or urbanizable areas;

(b) rural areas built upon or irrevocably committed to non-resource use; and

(c) any unincorporated community subject to OAR Chapter 660, Division 022 (Unincorporated Communities).

Minimum Acreage. Within each estuary, the minimum amount of shorelands to be protected shall be equivalent to the following combination of factors as they may exist:

(a) Acreage of estuarine shorelands that are currently being used for water-dependent uses; and

(b) Acreage of estuarine shorelands that at any time were used for water-dependent uses and still possess structures or facilities that provide or provided water-dependent uses with access to the adjacent coastal water body. Examples of such facilities or structures that provide water-dependent access would be wharves, piers, docks, mooring piling, boat ramps, water intake or discharge structures, or navigational aids.

Suitability. Any shoreland area within the estuary may be designated to provide the minimum amount of protected shorelands. However, any such designated shoreland area shall be suitable for water dependent uses. At a minimum, such water-dependent shoreland areas shall possess, or be capable of possessing, structures or facilities that provide water-dependent uses with physical access to the adjacent coastal water body. Such designations shall comply with applicable Statewide Planning Goals.

Permissible Nonwater-Dependent Uses. Other uses which may be permitted in these areas are temporary uses which involve minimal capital investment and no permanent structures, or a use in conjunction with and incidental and subordinate to a water-dependent use.

Applicability. Local cities and counties are not mandated by this requirement to make changes to their acknowledged local comprehensive plans or land use regulations for existing water-dependent shorelands. However, if a local government chooses to revise

the boundary of or allowed uses of a designated water-dependent shoreland site, then this requirement shall apply.

3. Local governments shall determine whether there are any existing, developed commercial/industrial waterfront areas which are suitable for redevelopment which are not designated as especially suited for water-dependent uses. Plans shall be prepared for these areas which allow for a mix of water-dependent, water-related, and water oriented nondependent uses and shall provide for public access to the shoreline.

4. Shorelands in rural areas other than those built upon or irrevocably committed to nonresource use and those designated in (1) above shall be used as appropriate for:

(a) farm uses as provided in ORS Chapter 215;

(b) propagation and harvesting of forest products consistent with the Oregon Forest Practices Act;

(c) private and public water-dependent recreation developments;

(d) aquaculture;

(e) water-dependent commercial and industrial uses, water-related uses and other uses only upon a finding by the county that such uses satisfy a need which cannot be accommodated on uplands or in urban and urbanizable areas or in rural areas built upon or irrevocably committed to non-resource use.

IMPLEMENTATION REQUIREMENTS

1. The Oregon Department of Forestry shall recognize the unique and special values provided by coastal shorelands when developing standards and policies to regulate uses of forest lands within coastal shorelands. With other state and federal agencies, the Department of Forestry shall develop forest management practices and policies including, where necessary, amendments to the FPA rules and programs which protect and maintain the special shoreland values and forest uses especially for natural shorelands and riparian vegetation.

2. Local government, with assistance from state and federal agencies, shall identify coastal shoreland areas which may be used to fulfill the mitigation requirement of the Estuarine Resources Goal. These areas shall be protected from new uses and activities which would prevent their ultimate restoration or addition to the estuarine ecosystem.

3. Coastal shorelands identified under the Estuarine Resources Goal for dredged material disposal shall be protected from new uses and activities which would prevent their ultimate use for dredged material disposal.

4. Because of the importance of the vegetative fringe adjacent to coastal waters to water quality, fish and wildlife habitat, recreational use and aesthetic resources, riparian vegetation shall be maintained; and where appropriate , restored and enhanced, consistent with water-dependent uses.

5. Land-use management practices and non-structural solutions to problems or erosion and flooding shall be preferred to structural solutions. Where shown to be necessary, water and erosion control structures, such as jetties, bulkheads, seawalls, and similar protective structures; and fill, whether located in the waterways or on shorelands above ordinary high water mark, shall be designed to minimize adverse impacts on water currents, erosion, and accretion patterns.

6. Local government in coordination with the Parks and Recreation Division shall develop and implement a program to provide increased public access. Existing public ownerships, rights of way, and similar public easements in coastal shorelands which provide access to or along coastal waters shall be retained or replaced if sold, exchanged or transferred. Rights of way may be vacated to permit redevelopment of shoreland areas provided public access across the affected site is retained.

GUIDELINES FOR GOAL 17

The requirements of the Coastal Shorelands Goal should be addressed with the same consideration applied to previously adopted goals and guidelines. The planning process described in the Land Use Planning Goal (Goal 2), including the exceptions provisions described in Goal 2, applies to coastal shoreland areas and implementation of the Coastal Shorelands Goal.

Because of the strong relation of estuarine shorelands to adjacent estuaries, the inventory and planning requirements for estuaries and estuarine shorelands should also be fully coordinated. Coastal shoreland inventories and planning should also be fully coordinated with those required in other statewide planning goals, supplementing them where necessary. Of special importance are the plan requirements of the Goals for Agricultural Lands; Forest Lands; Open Spaces, Scenic and Historic Areas and Natural Resources; Air, Water, and Land Resources Quality; Areas Subject to Natural Disasters and Hazards; Recreational Needs; and Economy of the State.

A. INVENTORIES

In coastal shoreland areas the following inventory needs should be reviewed. The level of detail of information needed will differ depending on the development or alteration proposed and the degree of conflict over the potential designation.

1. Hazard areas, including at least:

(a) Areas the use of which may result in significant hydraulic alteration of other lands or water bodies;

(b) Areas of geological instability in, or adjacent to shorelines; and

(c) The 100-Year Floodplain.

2. Existing land uses and ownership patterns, economic resources, development needs, public facilities, topography, hydrography, and similar information affecting shorelands;

3. Areas of aesthetic and scenic importance;

4. Coastal shoreland and wetland biological habitats which are dependent upon the adjacent water body, plus other coastal shoreland and adjacent aquatic areas of biological importance (feeding grounds, nesting sites, areas of high productivity, etc.) natural areas and fish and wildlife habitats;

5. Areas of recreational importance;

6. Areas of vegetative cover which are riparian in nature or which function to maintain water quality and to stabilize the shoreline;

7. Sedimentation sources;

8. Areas of present public access and recreational use;

9. The location of archaeological and historical sites; and

10. Coastal headlands.

B. FLOODPLAIN

In the development of comprehensive plans, the management of uses and development in floodplain areas should be expanded beyond the minimal considerations necessary to comply with the National Flood Insurance Program and the requirements of the Flood Disaster Protection Act of 1973. Communities may wish to distinguish between the floodway and floodfringe in developing coastal shoreland plans; development in the floodway should be more strictly controlled. Government projects in coastal shorelands should be examined for their impact on flooding, potential flood damage, and effect on growth patterns in the floodplain. Nonwater-dependent emergency service structures (such as hospitals, police, and fire stations) should not be constructed in the floodplain. Although they may be flood-proofed, access and egress may be prevented during a flood emergency.

C. OPEN SPACE, NATURAL AREAS AND AESTHETIC RESOURCES, AND RECREATION

Coastal shorelands provide many areas of unique or exceptional value and benefit for open space, natural areas, and aesthetic and recreational use. The requirements of the Goals for Open Spaces, Scenic and Historic Areas, and Natural Resources (Goal 5) and Recreational Needs (Goal 8) should be carefully coordinated with the coastal shoreland planning effort. The plan should provide for appropriate public access to and recreational use of coastal waters. Public access through and the use of private property shall require the consent of the owner and is a trespass unless appropriate easements and access have been acquired in accordance with law.

D. DEVELOPMENT NEEDS

In coordination with planning for the Estuarine Resources Goal, coastal shoreland plans should designate appropriate sites for water-dependent activities, and for dredged material disposal.

Historic, unique, and scenic waterfront communities should be maintained and enhanced, allowing for nonwater-dependent uses as appropriate in keeping with such communities.

E. TRANSPORTATION

The requirements of the Transportation Goal should be closely coordinated with the Coastal Shorelands Goal. Coastal transportation systems frequently utilize shoreland areas and may significantly affect the resources and values of coastal shorelands and adjacent waters; they should allow appropriate access to coastal shorelands and adjacent waters, and be planned in full recognition of the protection needs for the special resources and benefits which shorelands provide.

F. EXAMPLES OF INCIDENTAL USES

Examples of uses that are in conjunction with and incidental to a water-dependent use include a restaurant on the second floor of an existing seafood processing plant and a retail sales room as part of a seafood processing plant. Generally, to be in conjunction with and incidental to a water dependent use, a nonwater-dependent use must be constructed at the same time or after the water-dependent use of the site is

established and be carried out together with the water-dependent use. Incidental means that the size of nonwater-dependent use is small in relation to the water-dependent operation and that it does not interfere with conduct of the water-dependent use.

234) and other pertinent federal and state programs should be considered. The United States Department of Housing and Urban Development should identify all flood and mud-slide prone cities and counties in Oregon, and priority should be given to the completion of flood rate maps for such areas.

2. When locating developments in areas of known natural hazards, the density or intensity of the development should be limited by the degree of the natural hazard.

3. When regulatory programs and engineering projects are being considered, the impacts of each should be considered.

4. Natural hazards that could result from new developments, such as runoff from paving projects and soil slippage due to weak foundation soils, should be considered, evaluated and provided for.

PLANNING FOR NATURAL HAZARDS:

Appendix B: Contacts

July 2000

Oregon Departmentof Land Conservation & Development

635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

Community Planning Workshop

Community Service Center
1209 University of Oregon
Eugene, OR 97403
541-346-3889

Special Acknowledgements to:

The text for this appendix was collected by the Community Planning Workshop research team.

INTRODUCTION

Appendix B contains contact listings for a variety of state agencies. Possible funding sources for hazard risk reduction are included.

DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT

Land Use Programs

Contact: Oregon Department of Land Conservation and Development

Address: 635 Capitol Street NE, Suite 150, Salem, OR 97301

Phone: (503) 373-0050 (voice) or (503) 378-6033 (fax)

Funds: The Department of Land Conservation and Development makes grants available to local governments to help them with periodic review and also provides grants for general technical assistance on land use planning issues. Periodic review grants are available to help local governments carry out work tasks which the local government and DLCD determine are the most worthwhile to be accomplished in periodic review. Technical assistance grants can be used to help local governments improve their comprehensive plans and land use regulations.

Eligibility: Applications for technical assistance and periodic review grants may be submitted by individual cities or counties, by one or more cities and a county jointly, or by a council of governments (COG) on behalf of one or more of its member governments. Additional funding is likely to be approved during the next legislative session. Grant funds may also be available through DLCD's Regional Problem Solving grants, funds for Columbia Gorge National Scenic Area counties, Dispute Resolution and Coastal Management.

OREGON DEPARTMENT OF CONSUMER AND BUSINESS SERVICES

Building Codes Division (BCD)

Contact: Building Codes Division

Address: 1535 Edgewater Street NW, P.O. Box 14470 Salem, OR 97309

Phone: (503) 373-1258

Funds: 1% surcharge on all building permits goes to training sessions for building inspection.

Eligibility: Contractors, engineers, draftsmen of private organizations

OREGON EMERGENCY MANAGEMENT

Hazard Mitigation Grant Program

Contact: Oregon Office of Emergency Management

Address: 595 Cottage Street NE, Salem, OR 97301

Phone: (503) 378-2911 ext. 227

Funds: Available after a presidential disaster declaration.

Eligibility: State and local governments, certain private non-profit organizations or institutions that serve a public function, tribes or authorized tribal organizations.

Flood Mitigation Assistance

Contact: Oregon Office of Emergency Management

Address: 595 Cottage Street NE, Salem, OR 97301

Phone: (503) 378-2911 ext. 227

Funds: Annual limited funding for planning grants and project/technical assistance grants.

Eligibility: Local governments, special districts or councils of government, cetain private non-profit organizations. Individuals, businesses and other related organizations cannot apply directly for grant assistance but can be represented by and eligible applicant.

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

Geologic Information Program

Contact: Oregon Department of Geology and Mineral Industries

Address: 800 NE Oregon Street, Suite 965, Portland, OR 97232

Phone: (503) 731-4100 (voice) or (503) 731-4066 (fax)

Funds: Technical assistance to local governments

Eligibility: Local, state, and federal agencies, industry, landowners, private sector groups.

OREGON DEPARTMENT OF FORESTRY

Fire Protection Program

Contact: Oregon Department of Forestry

Address: 2600 State Street, Salem, OR 97310

Phone: (503) 945-7200 (voice) or (503) 945-7212 (fax)

Funds: Technical assistance to local governments in regulating forest land

Eligibility: Local, state and federal lands

OREGON WATERSHED ENHANCEMENT BOARD

Wetlands Reserve Program

Contact: Oregon Watershed Enhancement Board

Address: 255 Capitol Street NE, Salem, Oregon 97310

Phone: (503) 378-3589 (voice) or (503) 378-3225 (fax)

Funds: Available every two years; prefer projects tht approach natural resources management from a whole-watershed perspective.

Eligibility: Oregon Watershed Councils and Soil and Water Conservation Districts may apply for funds to do watershed enhancement projects.

OREGON DEPARTMENT OF TRANSPORTATION

Transportation Programs

Contact: Oregon Department of Transportation

Address: 355 Capitol Street NE, Salem OR 97301-3871

Phone: (888) 275-6368

Funds: N/A

Eligibility: N/A

OREGON PARKS AND RECREATION DEPARTMENT

State Park Protection Programs

Contact: Oregon Department of Parks and Recreation

Address: 1115 Commercial Street NE, Suite 1 Salem 97301-1002

Phone: (503) 378-6447

Funds: N/A

Eligibility: N/A

PLANNING FOR NATURAL HAZARDS:

Appendix C: Tools

July 2000

Oregon Departmentof Land Conservation & Development

635 Capitol Street NE, Suite 150
Salem, OR 97301
503-373-0050

Community Planning Workshop

Community Service Center
1209 University of Oregon
Eugene, OR 97403
541-346-3889

Special Acknowledgements to:

This appendix of the Natural Hazards Technical Resource Guide utilizes information from a table included in Raymond Burby's book Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities. The table, entitled *A Qualitative Assessment of the Effectiveness of Land Use Management Tools for Hazard Mitigation* was developed by Robert Olshansky and Jack Kartez and based on a conference of the authors involved with Burby's text. This table has been supplemented with information from Tools and Techniques for Mitigating the Effects of Natural Hazards, a North Carolina Division of Emergency Management document.

INTRODUCTION

This appendix describes various tools and techniques that can help communities reduce risk from natural hazards. A brief examination of the effectiveness and limitations for each tool is included.

Land Use Management Tools	Description	Effectiveness	Limitations
Plans			
Comprehensive Land Use Plans adopted by all Oregon cities and counties and acknowledged by DLCD.	In Oregon, local comprehensive plans comply with Statewide Planning Goals including Goal 7 – natural hazards.	Local governments are specifically required to address hazards in the context of community's overall land use plan.	Natural hazards element is only one piece of the comprehensive plan. Have historically been overshadowed by other issues (e.g., transportation and housing).
Hazard mitigation plans As of June 2000, approximately 30 Oregon communities have adopted hazard mitigation plans. Many of these are specific to flood hazards.	Specifies actions a community will take to reduce its hazard vulnerability. Assesses community's financial, legal and technical ability to mitigate hazards.	Allows for a substantial amount of decision-making to occur prior to a disaster event. Recommendations can be incorporated into a comprehensive plan and land use ordinances.	Limited funding for mitigation planning. Need to build local support for planning effort.
Public facility plans In Oregon, State-wide Planning Goal 11 requires communities to plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.	In Oregon, this refers to a plan for the sewer, water, and transportation facilities needed to serve a city with a population greater than 2,500. Less specific than a capital improvements program.	Can discourage or reduce the intensity of development in hazard areas. Local governments should consider natural hazards in public facilities planning although not specifically required by Goal 11.	Does not alter the basic spatial pattern of private development in hazard areas. Goal 11 does not specifically require consideration of natural hazards in public facilities planning.

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Land Use Management Tools	Description	Effectiveness	Limitations
Building Standards			
Special building standards Oregon has a state building code administered by the state and local jurisdictions.	A set of regulations that govern the construction of buildings and other structures. Building codes may also apply to major repairs and renovations.	Elevating structures in floodplains to prevent building damages is widely used because of the National Flood Insurance Program. Landslide and wildfire standards can help reduce structure damage. Seismic codes can effectively save lives and reduce (but not prevent) chances of building collapse.	Applicable primarily to new development.
Development Regulations			
Zoning ordinances	The designation of allowable uses for a particular area.	Can limit exposure of new development in hazard areas and protect natural values and functions not yet degraded by development.	Cannot mitigate losses to existing development and infrastructure. Requires information identifying geographic extent of hazard. If a community's boundaries are all within high risk areas, zoning may be ineffective. (e.g., zoning may be ineffective for certain seismic hazards)
Overlay zones Many Oregon jurisdictions employ these for floods and steep slopes.	A special zone that is applied "over" or in addition to a base zone. Limit/apply additional regulation to underlying uses.	Allow communities to isolate and protect certain areas or to devise regulations that apply in specific situations.	Requires detailed information on the spatial extent and nature of the hazard to support effective regulation.

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Land Use Management Tools	Description	Effectiveness	Limitations
Development Regulations continued			
Bonus and incentive zoning	The practice of allowing developers to exceed limitations imposed by current regulations, such as building height, floor area or density, in return for special concessions. An example could be a developer granting an open space easement in flood prone area in exchange for increased density outside the of hazard area.	Communities can offer bonuses, in the form of increased densities or floor space, to developers who avoid building in hazard-prone areas or who integrate mitigation into design.	Generally limited to metropolitan areas where land is scarcer and the market benefit to the developer is more tangible. May face legal challenges if there is not a clear connection between the concession and the government purpose.
Performance or impact zoning	Sets standards for the allowable effects or impacts of new development.	Allows local governments to set standards such as minimum protections for natural resources (e.g., wetlands protection, stormwater control and traffic access standards).	Performance standards may be difficult to write and administer. Requires time and expertise.
Planned Unit Developments (PUDs), average density, and cluster development	Regulation under which design is a matter of negotiation. The average density of the site remains at or near the allowable limit.	Allows flexible design of developments that are constructed as a unit. Can help shift density away from hazard prone areas.	PUDs must have areas of lower hazard risk available for development.
Subdivision ordinances	Local ordinances that regulate the conversion of undivided land into building lots for residential or other purposes.	The key tool in land use planning where damage can be reduced by design and density limitance. Moves structures, streets and utilities to safest area of site.	Subdivision regulation is not well tied to hazard mitigation objectives in many areas.

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Land Use Management Tools	Description	Effectiveness	Limitations
Environmental Management			
Wetlands protection Wetlands provide habitat, water quality benefits and flood storage	Wetlands serve many environmental purposes in addition to flood mitigation. Other programs are in place to prohibit dredging and placement of fill in wetlands.	Prevents development in wetlands that protect areas for flood storage and preserve other environmental benefits. Wetlands regulations and funds to protect wetlands may also be used to support floodplain management activities.	Evidence from the 1993 Midwest floods found that wetland restoration is effective for small and medium floods, but usefulness in mitigating floods diminished as the size of the flood increased.
Stormwater management New development generally results in an increase in impervious surface, impairing the ability of land to absorb water and increasing the volume of peak flow runoff.	Structural and non-structural measures to control run-off. Structural solutions include detention and retention ponds to store water, and filter strips. Non structural projects include maintaining existing stormwater systems and limiting impervious surfaces.	Measures reduce flooding, erosion and water quality problems. New permit requirements for smaller cities will encourage adoption of stormwater management tools.	Most effective for new development. Hard to retrofit existing stormwater systems to provide better water storage.
Public Facilities Policies			
Capital improvements program (CIP) Used in conjunction with other land use planning measures to ensure that development is not stimulated in hazard prone areas.	A multi-year plan describing how some or all of a community's capital improvements are to be developed. Contains detailed information on technical items (e.g., pipe capacity, for example) and information on projected costs and financing methods.	Can be useful in steering development away from hazard areas by limiting availability of necessary services. Can promote funding for services in lower hazard areas.	Many cities and counties do not have such programs.

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Land Use Management Tools	Description	Effectiveness	Limitations
Land and Property Acquisition			
Acquisition of land in high hazard areas.	Local jurisdiction acquires land for permanent open space or low-intensity use (e.g., recreation) in hazard prone areas.	Maintaining hazard areas as open space truly minimizes risks from hazards. Multiple objectives are possible (e.g., recreation, flood mitigation, alternative transportation corridors, and neighborhood redevelopment).	Acquisition is usually expensive. Must coordinate acquisition with overall land use plan. The challenge is avoiding "checker-board" acquisition of property. Must target specific, high hazard areas.
Structural buy-outs	Obtain buildings damaged by natural hazards.	Can be a key component in the relocation of existing hazard area development to new site(s).	Effectiveness depends on what happens to acquired structures and subsequent rebuilding on- and off-site. Most effective if group of structures can be acquired in same area. Expensive, with very high demands for commitment and coordination.
Relocation of existing hazard area development to new site(s)	The removal and relocation of structures to areas with reduced hazard risk.	Removes risk to residents in the hazard area if limits are placed on the property thus precluding redevelopment.	Same limitations for structural buy-outs noted above. In addition, relocations require large investment in new site, with no assurances that former residents will move to relocated development. Timing is a problem because buyouts and relocation are not necessarily at the same time.
Acquisition of development rights or easements	Obtain a right to use property for a specific purpose.	Potentially very effective if funds are available and adequate authority (such as eminent domain) can be employed to target key sites. Property owner still allowed to use site for recreation, agriculture and other activities that minimize risk to people and structures.	Have not been frequently used for hazard mitigation in Oregon.

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Land Use Management Tools	Description	Effectiveness	Limitations
Land and Property Acquisition			
Transfer of development rights (TDR) away from hazard areas to safer locations.	Development rights are separated from the land in an area where a community wishes to limit development. Development rights are then permitted to be sold for use in an area desirable for high-density development.	Potentially very effective if there are suitable receiving areas for transferred rights and the program is mandatory, not voluntary.	This is a complex tool for hazard mitigation aims alone. Costs of developing and administering TDR or purchase of development rights programs are significant.
Taxation and Fiscal Policies			
Preferential (reduced) taxation	Taxation is linked with open space or reduced land use intensity of lands in hazard areas.	Important as a possible incentive for easements and other partial-fee transactions to limit development in hazard areas.	Has not been used for mitigation aims. Completely ineffective as a stand-alone tool. Requires state enabling legislation or extension of existing farmland and open-space laws for mitigation purposes.
Impact taxes or special assessments	Taxes or assessments to fund the added public costs of hazard area development.	Can shift costs of future public losses due to developing in hazardous locations back onto the developers and owners. Possible disincentive to vulnerable development.	Has not been used for mitigation, although many other public costs of development are now collected from new development.

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Land Use Management Tools	Description	Effectiveness	Limitations
Information Dissemination			
Public information programs	Educational programs for increasing natural hazard mitigation.	Better-informed citizens and consumers can create a political constituency for hazard mitigation when they know about the location and magnitude of hazards.	Generally, programs have a mixed record in building local political commitment for hazard mitigation. Targeted programs providing specialized information have been more effective (e.g., DOGAMI landslide brochure).
Construction practice seminars or builder/ developer mitigation	Educational programs aimed specifically at builders and developers.	Essential aspect of effective use of specialized codes and building standards. Can contribute to success of an overall multi-tool mitigation strategy.	It is a challenge to ensure that training is available for all local/ state building code officials and that information provided is consistent.
Hazard disclosure	A requirement for disclosing hazard risk in real estate transactions.	Better-informed real estate purchasers should create pressure for limiting some of the worst cases of new development in known hazard locations.	Disclosure typically is perfunctory and is provided too late in the transaction to affect the purchase decision.

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