Preparing for a Cascadia Subduction Zone Tsunami: A Land Use Guide for Oregon Coastal Communities

Prepared by
The Department of
Land Conservation
and Development

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Important Notice

The Land Use Guide provides coastal communities examples of comprehensive plan language and development code provisions that can serve to help communities reduce their risk to tsunami hazards. These examples are intended to provide general guidance allowing communities to tailor land use policies and regulations appropriate to their individual circumstances. In developing the Guide, every effort has been made to provide examples which conform to Oregon land use law. However, as always when developing land use regulations or other related legislation for local adoption, local governments should consult with their legal counsel to ensure that such regulations comply with applicable state and local requirements.

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CHAPTER 1:
Introduction

TSUNAMI!

Chapter 1: Introduction

The Oregon coast is well known for its spectacular scenery and natural resources. However, because the coast lies at the interface between land and the Pacific Ocean, it also is a zone of great instability and vulnerability. Over time, we are gaining a greater awareness of our coast's geologic hazards and its risks to people and property there.

Tip: These boxes provide wayfinding to narrative in the text and offer other guidance.

Coastal Oregon is not only vulnerable to chronic coastal hazards such as coast erosion from winter storms and sea level rise, but it is also subject to potential catastrophic hazards such as a Cascadia earthquake and tsunami. It is for this local catastrophic tsunami event that this Land Use Guide has been developed. These types of powerful and devastating earthquakes of magnitude 9+ can be generated at the Cascadia Subduction Zone where the eastward- moving Juan de Fuca tectonic plate dives under the westward-moving North American plate just off the Oregon coast. These large earthquakes will occur under the ocean just offshore of our coast and can cause destructive tsunamis that can strike the coast 15 to 20 minutes after the earthquake. It is likely that in most Oregon coast communities, the only warning will be the earthquake itself.

The geologic record shows that the largest Cascadia Subduction Zone earthquakes and accompanying tsunamis occur about every 500 years, plus or minus 200 years. The last such earthquake occurred over 300 years ago. This means that we are in the time window where a destructive Cascadia earthquake and tsunami could occur and the probability of that occurrence will continue to increase over time. Smaller, but still destructive Cascadia earthquakes and tsunamis occur in southern Oregon between the largest events, so overall frequency of these earthquakes south of Cape Blanco is about double the frequency in northern Oregon.

Tip: For a catastrophic tsunami, the only warning will likely be the earthquake itself. No one should wait for a warning siren or other notice to evacuate. In most cases, there will be no operable sirens or other evacuate warnings.

The most recent Cascadia earthquake struck at around 9 pm on the evening of January 26th, 1700. The next great earthquake and catastrophic tsunami along the Cascadia Subduction Zone could occur on a mid-July morning when tens of thousands of Oregonians and visitors are enjoying coastal beaches and towns. No one can predict the next time the Cascadia fault will rupture; hence, we need to prepare now. Land use planning that addresses tsunami risk is one tool that can help with that preparation. This Land Use Guide provides options which can be tailored to a specific community's needs to help increase its resilience to a potentially catastrophic tsunami event.

1.1 Scope of the Land Use Guide

The goal of this Land Use Guide is to help local coastal communities become more resilient to a catastrophic tsunami event through community land use options and strategies. The guide is focused on a local tsunami event as these events will likely be far more destructive to an entire community and much harder to prepare for. Generally, in preparing for a local event a community should also be well prepared for a distant event. The guide is focused on land use planning approaches to reduce tsunami hazard risk, and is not intended to address the full range of efforts needed for overall disaster preparedness. Adequately preparing for a catastrophic event, such as a Cascadia earthquake and tsunami, requires a comprehensive community effort and must include preparation in many areas including education, outreach, individuals and family, emergency services, evacuation, economic, and land use. This guide can be used to develop land use strategies and options as one part of a community's comprehensive preparedness effort.

Tip: Communities should consider their own strategies.

During a Cascadia Subduction Zone event, an earthquake and tsunami will occur in tandem. However, as noted, the primary focus of this guide is on the tsunami impacts of a Cascadia event, as land use options and strategies can be more directly applied to the locational hazards associated with tsunami. Although building code requirements address specific construction standards related to a seismic event, they do not include specific construction standards for tsunami. This Land Use Guide encourages building techniques and related land use options within tsunami inundation areas, to increase resilience to a tsunami.

The few tsunami land use overlay zones currently in existence are limited in scope, meeting the minimum requirements of ORS 455.446-7 as implemented through the building code. However, land use tsunami preparedness measures to be most effective should be coordinated with a community's broader and more comprehensive hazard planning program efforts and be consistent with the community's FEMA Natural Hazard Mitigation Plan. Comprehensive land use plan policies, development code provisions, financing and incentive concepts, and evacuation planning strategies set forth in this guide are focused on three main mitigation concepts: 1) helping people get out of harm's way by improving evacuation planning and infrastructure; 2) reducing or restricting certain types of development in high risk areas; and 3) encouraging building techniques that would reduce building failure in a Cascadia earthquake and tsunami event.

1.2 Benefits of the Land Use Guide

Preparing a land use plan to increase resilience to a local tsunami event can lessen the impact of a tsunami in a way that not only decreases loss of life and property damage, but also increases the ability of the community to return to its pre-disaster function as quickly as possible. This resilience work should provide, at a minimum, the following benefits to your community:

- Improve life safety functions and protect life
- Reduce social, emotional, and economic disruptions
- Minimize damage to public and private buildings and infrastructure

- Decrease disruption to critical services
- Increase access to funding sources for hazard mitigation projects
- Improve ability to implement post-disaster recovery projects

The Tsunami Land Use Guide is intended to help local governments in their responsibility to address this potential catastrophic hazard and provide a user-friendly, flexible model code. Communities are encouraged to select the most applicable comprehensive plan policies, development code provisions and mitigation strategies based on the community's geographic situation. This guide should also assist in developing land use strategies related to tsunami that have a solid nexus to increasing resilience, are transparent, and seek consensus among community residents in all phases.

1.3 Lessons from the 2011 Japanese Tsunami Event

The 2011 Japan earthquake is not the largest, nor deadliest, earthquake and tsunami to strike this century; that distinction goes to the 2004 Sumatra tsunami with a magnitude 9 (Mw) earthquake, which killed more than 230,000 people. However, the 2011 Tohoku earthquake and tsunami is an event that all Oregonians need to pay attention to and learn from, especially those living along the coast. Scientists have indicated that the Tohoku Magnitude 9 (Mw) megathrust earthquake and tsunami are closely analogous to what can be expected any time now along the Oregon coast. This is a serious threat to our coast and we need to prepare now. There should be a sense of urgency. Preparation and context can be enhanced significantly not only by review of the impacts of this event in Japan but also by what the Japanese have done, and are doing, since to prepare for the next one. Scientists here have produced new tsunami inundation maps for Oregon that capture credibly the potential inundation areas along the Oregon coast. This information should be at the core of community preparation. Additionally, this land use guide will specifically address what communities should do, from an Oregon land use perspective, in creating more resilient communities.

1.3.1 What Happened

On March 11, 2011 at 2:46 local time, a magnitude 9 (Mw) earthquake violently shook northeastern Japan, unleashing a catastrophic tsunami. The earthquake struck offshore of Japan, along a subduction zone where two of Earth's tectonic plates collide (the Pacific and the Honshu). The earthquake released centuries of built up stress between the two tectonic plates and the intense ground shaking lasted about six minutes. Japan has experienced over 1000 aftershocks since the initial earthquake; approximately 80 registering over magnitude 6 (Mw) and three over magnitude 7 (Mw).

Minamisanriku - Mayor taking refuge on antennae mast of Emergency Operations Center roof. Hospital in background.

Evacuees clung to life overnight as multiple tsunami surges splashed over the roof and swept across them at waist-deep levels

The first of many tsunami waves hit Japan's coastline soon after the earthquake. The tsunami waves reached run-up heights (how far the wave surges inland above sea level) of up to 128 feet and surged inland great distances, especially up river channels and over low plains. Land subsidence along the northern Japan coast ranged from approximately 1.5 feet to approximately 4 feet. As a result, communities along this portion of Japan's coastline are now more susceptible to flooding, even daily flooding during high tides, and significant coastal erosion as the ocean and land seek to find a new balance at a lower land elevation.

Nearly 20,000 people were killed in the disaster. Most died by drowning. The degree and extent of damage caused by the earthquake and resulting tsunami were enormous, with most of the damage being caused by the tsunami. Development within the most affected areas was nearly completely destroyed, leaving little more than piles of rubble, with few structures left standing. Two years after the quake, about 300,000 people who lost their homes were still living in temporary housing.

1.3.2 What Should Oregon Coast Communities Learn

Much of the information and graphics presented here relating to Japan's planning efforts have been provided by Jay Wilson, Hazard Mitigation Coordinator with Clackamas County Emergency Management. Jay has been instrumental in the development of the Oregon Resilience Plan and has visited Japan on multiple occasions to analyze the aftermath of this catastrophic event.

The Japan 2011 event is a close parallel to what the Oregon Coast will face in a Cascadia event, and impacts to the Oregon coast and its communities will be similarly devastating. Significant and prolonged ground shaking will occur which will damage and destroy important transportation linkages, other critical services, and structures vulnerable to intense ground shaking, leaving coastal communities isolated and severely damaged. Development within tsunami inundation areas will be, for the most part, destroyed. Land subsidence will significantly increase coastal flooding and erosion.

As part of Japan's recovery, communities and government entities are turning to land use planning options that will increase resilience to the next catastrophic event of this type.

Additionally, tremendous appreciation is expressed to our Japanese colleagues for sharing their research and on-site assistance:
Dr. Michio UBAURA, Associate Professor
Kanako Iuchi, PhD , Associate Professor Tohoku University

The Figure 1 graphic below represents Minamisanriku, a city which was destroyed by the tsunami as it was almost entirely within the inundation area. The community is using land use planning principles to re-create itself in a tsunami resilient way despite the necessity and challenges of its location. Although generalized, Figure 1 illustrates some key land use principles related to tsunami hazards being used in Minamisanriku. They are:

- Limit waterfront areas to water dependent uses that need to be adjacent to the ocean, and incorporate designs for structures that can better withstand tsunami forces.
- Develop other commercial and industrial uses in higher areas, which although still subject to larger tsunami events, are closer to high ground where good tsunami evacuation planning can be effective. Building design and construction practices which increase resilience to a tsunami event is also important in this area.
- Develop housing, tourism, and government facilities above tsunami inundation areas, designed and built to better withstand the severe ground shaking of a subduction zone earthquake event.

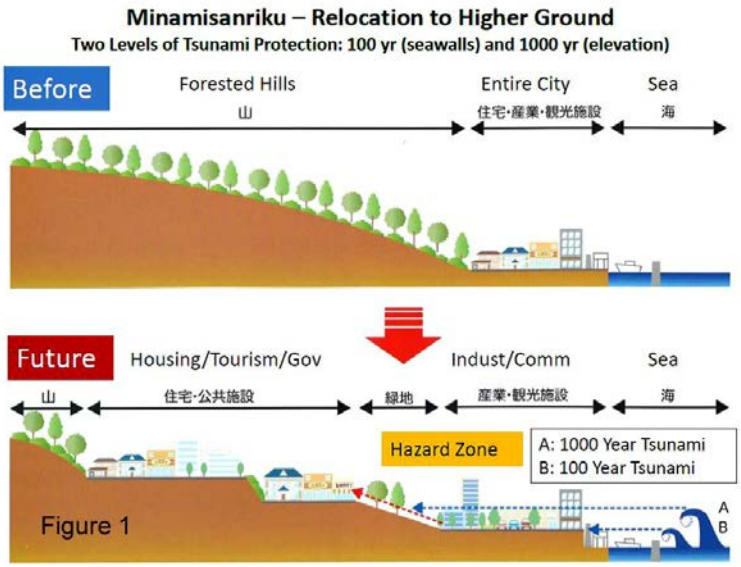
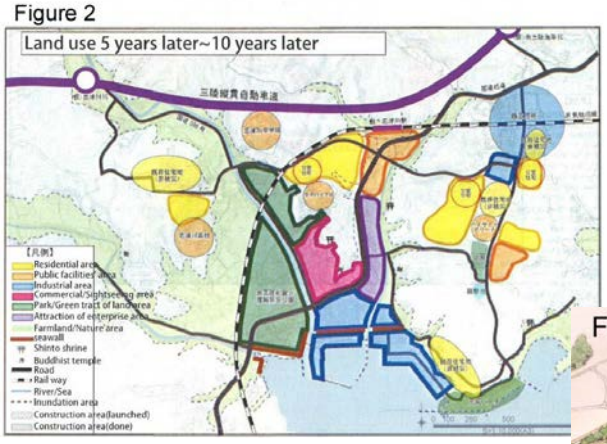


Figure 1

Figures 2 and 3 provide further spatial representations of how the concepts identified in Figure 1 would play out over time on the ground within Minamisanriku.

Figure 2



Clearly, there are a number of important differences between the circumstances of Japan's post-event redevelopment and the current situation faced by communities on the Oregon coast. However, many of the concepts applied in this example can provide useful guidance to Oregon communities for developing land use strategies to build increased resilience over time.

Figure 3

1.3.3 What Must Oregon Coast Communities Do

As indicated above, preparing for, and increasing resilience to, a catastrophic event such as a Cascadia earthquake and tsunami, requires a comprehensive community effort and must include preparation in many areas. Education and outreach, individual and family preparedness, along with planning for emergency services, evacuation, economic recovery, and land use are all critical components of community efforts to prepare. Preparation in communities along the Oregon coast is beginning to ramp up, especially since the Tohoku and Sumatra events. However, little has been done thus far to address land use planning within inundation areas.

Increasing "resilience" in this context involves actions that will help a community recover more quickly from a catastrophic subduction zone earthquake and tsunami, and will result in a greater capacity to withstand future events. Figure 4 graphically illustrates this concept and the need for Oregon to improve.

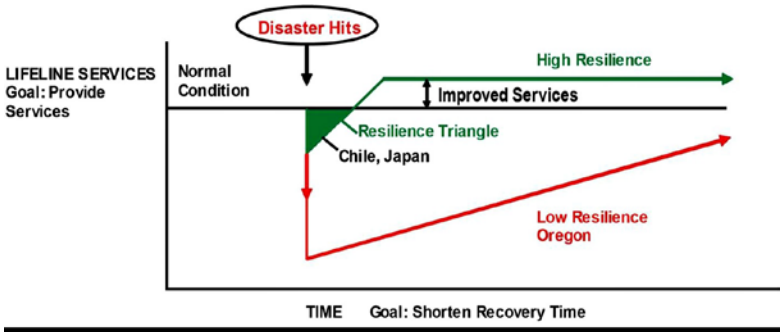


Figure 4

Despite Japan's high levels of preparation for earthquake and tsunami events, the lessons of Tohoku have been harsh. But based on these lessons, Japan is aggressively planning now for the next tsunami by looking at how the land will be used both inside and outside of tsunami inundation areas. Oregon communities must learn from this effort and begin the work of increasing community resilience by addressing land use and development in tsunami hazard areas. This land use guide can be used to develop land use strategies, requirements, and incentives to reduce tsunami risks to life and property as a significant part of a community's comprehensive earthquake and tsunami preparedness effort.

1.4 Preparation of the Land Use Guide

In developing the Tsunami Land Use Guide, researchers examined land use resilience practices within other countries at risk of a tsunami. This information helped inform a number of the measures found within the Land Use Guide. In addition, DLCD worked with experts in the field and a technical advisory committee made up of coastal local government staff and applicable state agencies and other organizations.
These individuals provided valuable information which also assisted in the development of this guide.

CHAPTER 2:
How to Use the Tsunami Land Use Guide

Chapter 2: How to Use the Tsunami Land Use Guide

This chapter provides assistance on how to get started and use the Guide. The "Getting Started" section concentrates on preparatory work, such as gathering pertinent information, developing a public process and forming an advisory committee. The "Initial Groundwork" section outlines steps for staff, advisory committees and the community to study the issue and make informed decisions about appropriate tsunami preparedness. The "Using This Guide" section describes how you can use this Guide to develop the various elements of a tsunami land use resiliency program. The remaining sections describe how to prepare resiliency program elements, including land use amendments to increase resilience to a local tsunami event.

2.1 Getting Started

Before using this Land Use Guide, community staff and citizen volunteers should have a good understanding of the community's land use and development program and the specific tsunami risk for the area.

Land Use Guide authors recommend local government staff and administrators take the following steps in preparing this land use portion of a community's overall program to address a local tsunami event:

> Note: A DOGAMI advisory committee has recommended the adoption of the "Large" (L1) scenario for application of the ORS 455 development restrictions. This recommendation will be formally considered by the DOGAMI Governing Board following a series of meetings on the coast in early 2014 to solicit public comment.

- DOGAMI Tsunami Inundation Maps (TIMs): Staff should obtain and review the community's TIMs to generally determine areas and key facilities at risk of tsunami inundation.
- Initial Risk/Exposure Evaluation: In reviewing the TIMs, staff should begin to evaluate relative risk and exposure in the community based on the various inundation scenarios and location of key community facilities in order to lead future community discussions on risk tolerance and what tools might be proposed in each of the inundation scenarios.
- Interview community members: Talk with citizens, all applicable city or county staff, hazard professionals, representatives for related technical fields, property owners, staff from hazard related agencies, and service providers. These individuals can provide important input and help in clarifying key issues related to potential tsunami impacts and preparation.
- Appoint an advisory committee: Appointed by the city council or county commission, the committee should include some of the stakeholders interviewed and representatives from the planning commission and at least one elected official. Ideally, the committee should include a mix of public and private sector stakeholders with demonstrated leadership abilities.

Tip: Step One: review the updated Tsunami Inundation Maps (TIMs) with others in your community.

The business community should be well represented. The committee of approximately 8-15 members can effectively assist elected and appointed officials by:

- Ensuring that the proposed plan provisions and code language address important community goals related to increasing resilience to a local tsunami and include perspectives from a representative cross-section of the community;
- Reviewing and commenting on preliminary drafts of the new comprehensive plan and code provisions, and other related materials; and
- Supporting public involvement and education efforts during the code adoption and implementation process.

Note: Advisory committees are typically subject to public meeting laws.

2.2 Initial Groundwork

Once the community has taken the steps in Section 2.1 to get started it is time to set the initial groundwork for this effort by working with the advisory committee on the following:

- Identify Resilience Land Use Goals and Objectives: "Goals" describe the desired outcomes or guiding principles of your effort and help to define what may be needed to achieve these goals. It is important to try to reach consensus, if possible, with the advisory committee on a few guiding goals and objectives that will help evaluate and inform proposed strategies and options.

  Note: Staff should develop some draft goals and objectives to begin the discussion with the advisory committee. These do not have to be exhaustive but should provide initial guidance to the advisory committee in developing and understanding their purpose and role in this effort. Some examples of goals could be: to assist community members become more aware of risks in the community from a local tsunami event; to use this land use guide in developing strategies and options to increase resilience to a local tsunami event; and to adopt comprehensive plan and development code provisions to increase resilience to this potentially catastrophic event. Some example objectives could be to identify high risk areas within the community based on DOGAMI Inundation Maps (TIMs); to identify vulnerable uses, structures, and populations within these risk areas; to develop an evacuation route plan to adequately provide for evacuation to high ground; to develop land use incentives an limitations for encouraging migration of vulnerable uses to higher ground and limiting future uses in highest risk areas; and to adopt specific comprehensive plan policies and implementing measures related to various focus areas identified in the guide.

Tip: TIMs and tsunami evacuation maps should be reviewed along with other resources, such as maps that display zoning designations and building locations and concentrations of population.

- Discuss with the advisory committee the community's existing comprehensive plan and codes related to tsunami preparedness. After talking with stakeholders and identifying community risk to a local tsunami, compare the community's existing tsunami regulations, if any, with the provisions in this Land Use Guide. As part of this process: 1)

review this Land Use Guide, 2) compare options and model language in the Guide with your existing comprehensive plan and development codes. It is likely that there will be few or no related land use provisions present within the existing plan and codes related to tsunami. Regardless of the condition of the community's existing tsunami provisions this land use guide will help in developing resilience to this potentially catastrophic local tsunami event.

- Identify areas in the community's land use documents which may need revision as a result of this process.
- Advisory Committee Work:
    - Review initial findings with the committee; discuss
    - Provide informational materials and training as needed, such as:
    - DOGAMI Tsunami Inundation Maps (TIMs) for the Community
    - Oregon Resilience Plan for Cascadia event earthquake and tsunami (OSSPAC) DOGAMI Clearinghouse Website
    - Tsunami Evacuation Facilities Improvement Planning: Chapter 6
    - References for materials listed above, and other materials which may be needed, are located in Chapter 8 "Other Resources" Chapter this Land Use Guide)
    - Tsunami Section of State and Local Natural Hazard Mitigation Plans
    - Applicable portion of the DLCD Hazard Planning Technical resource Guide
    - Review tsunami inundation and evacuation maps with the committee and get initial feedback on location of key facilities, vulnerable uses and potential evacuation areas. This will assist staff in more detailed work later on.
    - In consultation with committee members, develop an overall work program and tentative timeline for the effort. Explore some the big questions that your community will need to address in considering land use provisions relating to increasing resilience to a local tsunami event. While different for each community, they will likely include discussions about most at-risk areas of the community, what key facilities may need to be relocated, and status of evacuation routes and their current status.
    - Develop an agenda and materials for community forum on this effort. As part of this effort, and with feedback from the advisory committee as needed, use this land use guide to identify as many options as possible to present to the community and gain their feedback.

- Community Meetings: As with any change in local land use regulations, Oregon law appropriately provides for minimum levels of community discussion and public involvement. Addressing this significant natural hazard should be accomplished through a robust public involvement effort. This effort could be included within a broader community discussion of what community members envision a resilient community to look like. Oregonians expect to be involved in land use planning and especially should be engaged in discussions around land use options related to tsunami resilience. Community staff and the advisory committee should engage community partners, leaders and service providers to maximize community awareness and dialog. It will be important to provide broad and varied opportunities for education and outreach and to explore with the community its options.

Tip: Initial discussions with the community should include as many resilience options and strategies as possible. The committee and public processes will serve to further refine what will be carried forward to adoption.

Chapter 1 Section 1.3 of this guide provides context for Oregon communities in identifying the urgency of these resilience efforts and provides an opportunity to look forward and plan for tsunami resilient communities. The materials in Section 1.3 can be used to help in these important discussions.

2.3 Using the Land Use Guide

Local governments can choose to use this Guide in whole or in part depending on the community's exposure to tsunami inundation, and geographic situation. The work that a community will do relating to this Land Use Guide will result in comprehensive plan and development code amendments which will need to be adopted by the local jurisdiction and be administered within the local land use planning program.

Tip: Customize strategies for your community.

The Tsunami Land Use Guide contains "Tips" comments in easily identifiable text boxes. The Tips are intended to guide the reader and assist in drafting or amending local regulations. In addition, Chapter 8 "Other Resources" contains a list of technical resources, for community staff to use in updating local codes. Users of this Guide should carefully consider the needs of their community and applicable law in tailoring the regulations.

The [italicized and bracketed text] within the regulations indicates a range of options or places where communities must customize the model code. For example, a reference to "[community official]" would need to be replaced with the appropriate title. Where the model code provides a range of numerical standards (e.g., setbacks, building heights, lots sizes), communities should tailor the standards based on community input and existing conditions. Where backslashes ("/") separate two or more options, communities may choose an option or insert their own terminology (e.g., public hearing before the [Planning Commission / City Council]). The punctuation [?] provided is meant to support each option, but it too must be reviewed and edited as cities prepare their own codes.

- Comprehensive Plan Provisions: Chapter 3 includes not only a set of comprehensive plan policies related to tsunami preparedness and recovery but also a tsunami related text section that can be included within the Goal 7 (Natural Hazards) section of the comprehensive plan. The comprehensive plan text and policy sections can be used as it is or modified and tailored to meet the needs of a specific community. These policies should support development code provisions and/or other strategies.
- Development Code Provisions: Chapter 4 presents model Tsunami Hazards (TH) Overlay Zone language. This overlay zone is designed to be applied to tsunami inundation areas as determined by the DOGAMI Tsunami Inundation Maps. The provisions within the overlay zone may be modified as needed by the community. The overlay zone contains notes, tips, and options from which a community can choose.
- Tsunami Financing and Incentive Concepts: Chapter 5 includes financing and incentive concepts which can be used concurrently with land use regulations. This chapter contains an overview of these tools that communities can use to become more resilient to a catastrophic tsunami hazard event.

- Tsunami Evacuation Planning Guidance: Chapter 6 includes assistance in developing a tsunami evacuation plan. To be clear, this evacuation plan is not the DOGAMI Evacuation Route Maps, which include valuable route and assembly area information, but is a comprehensive and detailed tool integral to many comprehensive plan strategies and development code provisions including such things as evacuation route development and hardening, and purchase of land at elevations above tsunami inundation areas.

  The tsunami evacuation plan does not need to be complex but does need to include components necessary to meet the requirements of proposed funding mechanisms such as system development charges or development exactions.
- Pre-Disaster Community Planning For Cascadia Event Tsunami: Chapter 7 includes introductory information about both strategic urban growth boundary modifications if needed to move key community facilities/uses to high ground, and comprehensive pre-disaster community resilience land use planning.
- Other Resources: Chapter 8 includes additional resources that may be helpful in a community's overall efforts to plan for a local tsunami event.

2.4 Developing Your Tsunami Land Use Resilience Program

While previous sections of this Chapter provide assistance in establishing a overall community resilience framework, context, community involvement, and vision, the remaining information in this chapter discusses development and adoption of a resilience program. These include such things as comprehensive plan text and policies, development code provisions, an evacuation route plan, and financing strategies as indicated below:

- Tsunami Evacuation Route Plan: Utilizing processes outlined in Section 2.1 above, we recommend that the first planning effort related to land use preparation for a local tsunami be the development of an initial tsunami evacuation route plan consistent with Chapter 6 of this guide. A number of land use strategies, route financing/incentive concepts, and land use regulations are tied directly to a comprehensive evacuation route plan. Having this completed first will facilitate use of these strategies and concepts.

  Tsunami evacuation route plan components would include identification of both existing and needed evacuation routes and assembly areas, an evaluation of improvements needed in identified routes (including route hardening, bridge work, etc.), identification of specific projects and costs for route improvements, and other direction and policies necessary to implement effective evacuation route planning and development within the community. The evacuation route plan should address vertical evacuation routes, if appropriate, and could include an inventory of existing buildings within the community that could be considered as candidates for evacuation structures, if any. Transportation, park, and trail system plans can be used to help provide for pedestrian tsunami evacuation routes. The plan should be developed with enough detail to accommodate the requirements of specific community anticipated funding mechanisms such as system development charges (SDCs), local improvement districts, and legal exactions. The plan can be developed as a portion of an existing transportation systems plan if one is currently adopted by the local government.

Longer term community decisions relating to comprehensive strategies to increase resilience, as referenced in Section 7.2 of this guide, may potentially alter some components and strategies within the initial evacuation route plan. However, if or when that occurs, this initial evacuation route plan can be modified to be consistent with those more comprehensive resilience strategies.

- All other draft materials consistent with this Land Use Guide: Community Planning staff should, based on work summarized in the Chapter sections above, develop draft materials consistent with the Guide, develop a tsunami evacuation plan if needed, work with other key stakeholders and legal counsel in development of any land use financing mechanisms, and otherwise complete a draft package of comprehensive plan, implementation code, and other provisions which will make up the community draft tsunami impact resilience program. Planning staff should seek help from other community staff experts, DLCD staff, and others as needed throughout development of these materials. Draft materials should be reviewed by the community in the agreed upon public involvement process.

2.5 Comprehensive Plan and Development Code Adoption Once the proposed land use provisions, as developed or modified, have been vetted sufficiently with the advisory committee and the community the materials are ready to enter the formal adoption process via the "plan amendment" process. Planning staff should forward the advisory committee recommendations to the Planning Commission for review and recommendations. Once reviewed, the Planning Commission recommendations must be forward to the City Council or County Commission for adoption.

The process includes review and coordination with the Department of Land Conservation and Development (DLCD) and coordination with other applicable state agencies.

CHAPTER 3:
Comprehensive Plan Provisions

Chapter 3: Comprehensive Plan Provisions

This Chapter includes a set of sample (model) plan policies (Section 3.1) related to this effort and sample (model) tsunami related text section that can be included within the Goal 7 (Natural Hazards) section of the community's comprehensive plan. The comprehensive plan text section can be used as it is or modified and tailored to better meet the needs of a specific community. The comprehensive set of draft plan policies can be reviewed, tailored, and used to support development code provisions identified for community use.

Tip: In preparing for tsunami resilience, update the Natural Hazards (Statewide Goal 7) section of your Comprehensive Plan. Goal 7 indicates that local governments shall adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards. Natural hazards for purposes of this goal are: floods (coastal and riverine), landslides, earthquakes and related hazards, tsunamis, coastal erosion, and wildfires.

3.1 Sample Comprehensive Plan Natural Hazards Chapter Text

This section includes sample tsunami related text that can be included as a tsunami- oriented subsection within the Goal 7 (Natural Hazards) section of the local comprehensive plan. Its intent is to provide general information related to community tsunami risk, preface the applicable tsunami plan policies, and support the community's land use resilience program. This sample comprehensive plan text subsection can be used as it is or modified and tailored to meet the needs of a specific community. Sample text follows.

0.0 Tsunami

0.01 Description of the Hazard: The Oregon coast is well known for its spectacular scenery and natural resources. However, because the coast lies at the interface between land and the Pacific Ocean, it also is a zone of great instability and vulnerability. Over time, we have gained a greater awareness of our coast's geologic hazards and its risks to people and property.

Coastal Oregon is not only vulnerable to chronic coastal hazards such as coast erosion from winter storms and sea level rise, but it is also subject to the potentially catastrophic effects of a Cascadia earthquake event and related tsunami. These types of powerful and devastating earthquakes of magnitude 9+ are generated at the Cascadia Subduction Zone where the eastward-moving Juan de Fuca tectonic plate dives under the westward-moving North American plate just off the Oregon coast. These large earthquakes will occur under the ocean just offshore of our coast and will produce extremely destructive tsunamis that can strike the coast 15 and 20 minutes after the earthquake, leaving devastation in their path.
It is likely that in most Oregon coast communities, including [insert jurisdiction name], the only warning of an approaching tsunami will be the earthquake itself.

The geologic record shows that the largest of these large Cascadia Subduction Zone earthquakes and accompanying tsunamis occur about every 500 years, plus or minus 200 years. The last such earthquake and tsunami occurred over 300 years ago, on the evening of January 26th, 1700. This means that we are in the time window where a destructive Cascadia earthquake and tsunami could occur and the probability of that occurrence will continue to increase over time. This time the stakes are much higher as the great earthquake and catastrophic tsunami could occur when tens of thousands of Oregonians and visitors are enjoying coastal beaches and towns. To address this increasing risk and

substantially increase resilience within our community, the [city/county] is proactively addressing tsunami preparedness and mitigation within its land use program. Land use planning that addresses tsunami risk is an essential tool to help increase resilience to a potentially catastrophic tsunami event within [City/County].

0.02 Tsunami Hazard Maps: The Department of Geology and Mineral Industries (DOGAMI) have developed Tsunami Inundation Maps (TIMs) which provide the essential information for defining tsunami risk along the Oregon coast. The [name of city of county] has adopted the TIM's applicable to the [city/county], and its urban growth boundary, as a part of
its comprehensive plan hazard inventory. These maps are also referenced within this natural hazards element of the comprehensive plan and are the basis for establishing the boundaries of the [City's/County's] Tsunami Hazard Overlay zone. The TIMs are referenced in the tsunami related plan policies and within the overlay zone for purposes of differentiating between areas of higher versus lower risk.

0.03 Tsunami Related Policies: The [City/County] has adopted a set of comprehensive plan policies related to tsunami preparedness and recovery that are included within this and other applicable sections of the comprehensive plan. These policies have been developed to address the resilience goals of the [city/county]. They are designed to support the [city's/county's] resilience efforts within the comprehensive plan and implementing codes.

0.04 Zoning: Tsunami Hazard Overlay Zone (THO): [City/County] has adopted an overlay zone which utilizes the applicable DOGAMI Tsunami Inundation Maps (TIMs). The overlay zone includes all areas identified as subject to inundation by the largest (XXL) local source tsunami event which ensures that life/safely and evacuation route planning and development are adequately addressed. Other land use resilience strategies and requirements included within the overlay zone, which are not life safety or evacuation related, are applied within a subset of the overlay to smaller inundation scenario areas. These measures are included within the overlay zone provisions and reflect the community's risk tolerance, application of mitigation measures, and ORS 455.446-447 requirements. The overlay zone boundary has been adopted as an amendment to the official zoning map for the [City/County].

Tip: Sample policies should be easily adjusted to fit your community's plan.

0.05 Evacuation Route Plan Maps: The [City/County], as part of its land use program for tsunami preparedness has also adopted a comprehensive evacuation route plan. The evacuation route plan identifies designated evacuation routes, assembly areas and other components of the local evacuation system. The plan is a key component of the [city's/county's] efforts to reduce risk to life safety by planning for a comprehensive evacuation system and developing the detailed information necessary to establish land use requirements to implement evacuation measures and improvements. This plan and associated map(s) have been incorporated into the [City/County] [comprehensive plan natural hazard element/transportation system plan].

3.2 Sample Comprehensive Plan Tsunami Related Policies

This section includes a set of sample comprehensive plan policies related to tsunami preparedness and recovery that can be included within the Goal 7 (Natural Hazards) section, and other applicable sections of the community's comprehensive plan. The sample comprehensive plan policies should be used and tailored to meet the needs of a specific community. They are designed to be used with and support the sample development code provisions and/or other strategies within this Land Use Guide. The sample policies are as indicated below.

Goal 7: Areas Subject to Natural Hazards

General Policies

To protect life, minimize damage and facilitate rapid recovery from a local source Cascadia Subduction Zone earthquake and tsunami, the [City/County] will:

1. Support tsunami preparedness and related resilience efforts.
2. Take reasonable measures to protect life and property to the fullest extent feasible, from the impact of a local source Cascadia tsunami.
3. Use the Oregon Department of Geology and Mineral Industries (DOGAMI) Tsunami Inundation Maps applicable to [City/County] to develop tsunami hazard resiliency measures.
4. Adopt a Tsunami Hazard Overlay Zone for identified tsunami hazard areas to implement land use measures addressing tsunami risk.
5. Enact design or performance implementing code components in identified tsunami hazard areas.
6. Implement land division provisions to further tsunami preparedness and related resilience efforts.
7. Consider potential land subsidence projections to plan for post Cascadia event earthquake and tsunami redevelopment.
8. Require a tsunami hazard acknowledgement and disclosure statement for new development in tsunami hazard areas.
9. Identify and secure the use of appropriate land above a tsunami inundation zone for temporary housing, business and community functions post event
10. As part of a comprehensive pre-disaster land use planning effort, consistent with applicable statewide planning goals, identify appropriate locations above the tsunami inundation for relocation of housing, business and community functions post event. (Note: Section 7.2 of this guide addresses this type of comprehensive pre-disaster land use planning effort.)

Evacuation Policy Concepts

To facilitate the orderly and expedient evacuation of residents and visitors in a tsunami event, the [City/County] will:

1. Adopt a tsunami evacuation route plan that identifies current and projected evacuation needs, designates routes and assembly areas, establishes system standards, and identifies needed improvements to the local evacuation system.

2. Identify and secure the use of appropriate land above a tsunami inundation zone for evacuation, assembly, and emergency response.
3. Ensure zoning allows for adequate storage and shelter facilities.
4. Provide development or other incentives to property owners that donate land for evacuation routes, assembly areas, and potential shelters.
5. Require needed evacuation route improvements, including improvements to route demarcation (way finding in all weather and lighting conditions), vegetation management, for new development and substantial redevelopment in tsunami hazard areas.
6. Work with neighboring jurisdictions to identify inter-jurisdictional evacuation routes and assembly areas where necessary.
7. Provide for the development of vertical evacuation structures in areas where reaching high ground is impractical.
8. Evaluate multi-use paths and transportation policies for tsunami evacuation route planning.
9. Encourage suitable structures to incorporate vertical evacuation capacity in areas where evacuation to high ground is impractical.
10. Install signs to clearly mark evacuation routes and implement other way finding technologies (e.g., painting on pavement, power poles and other prominent features) to ensure that routes can be easily followed day or night and in all weather conditions.
11. Prepare informational materials related to tsunami evacuation routes and make them easily available to the public.

Tip: ORS 455.446-447 identifies minimum restrictions. Jurisdictions should consider limiting other uses and/or extending restrictions for some uses to other risk zones.

Policies Related to Reducing Development Risk in High Tsunami Risk Areas

The [City/County] will:

1. Prohibit comprehensive plan or zone map amendments that would result in increased residential densities or more intensive uses in tsunami hazard areas unless adequate mitigation is implemented. Mitigation shall address measures should focus on life safety and tsunami resistant structure design and construction.
2. Encourage open space, public and private recreation and other minimally developed uses within the tsunami inundation zone area.
3. Prohibit the development of those essential facilities and special occupancy structures identified in ORS 455.446 and ORS 455.447 within the [select L XL or XXL tsunami inundation area as determined by the community] tsunami inundation area.

Note: Currently, the area within which the limitation on the placement of new essential facilities and special occupancy structures is defined by the inundation line specified in ORS 455.446. The adoption of a new line for purposes of ORS 455.446 and ORS 455.447, based on the new TIMs, is being considered by the DOGAMI governing board. The jurisdiction can be more restrictive if it chooses.

4. Consider the use of transferrable development credits as authorized by ORS 94-531-94.538 to facilitate development outside of tsunami inundation zones.
5. Encourage, through incentives, building techniques that address tsunami peak hydraulic forces which will minimize impacts and increase the likelihood that structures will remain in place.
6. Protect and enhance existing dune features and coastal vegetation to promote natural buffers and reduce erosion.

Tip: Dune protection is a coastal best practice and may aid long-term resiliency, but should not be relied on to protect against locally generated tsunami events.

Hazard Mitigation Planning

The [City/County] will:

1. Addresses tsunami hazards and associated resilience strategies within the community's FEMA approved hazard mitigation plan.
2. Incorporate and adopt relevant sections of the hazard mitigation plan by reference into the comprehensive plan.
3. Ensure hazard mitigation plan action items related to land use are implemented through the comprehensive plan and implementing ordinances.

Tsunami Awareness Education and Outreach

The [City/County] will:

1. Encourage and support tsunami education and outreach, training, and practice.
2. Implement a comprehensive and ongoing tsunami preparedness community education and outreach program. (Note: Some communities have utilized Community Emergency Response Teams (CERT) or CERT-like organizations as a part of that ongoing community education and outreach. See also Chapter 6.10.
3. Collaborate with local, state and federal planners and emergency managers for the purpose of developing a culture of preparedness supporting evacuation route planning and other land use measures that minimize risk and maximize resilience from tsunami events.

Debris Management

The [City/County] will:

1. Identify and work to secure the use of suitable areas within the Tsunami Inundation Zone for short and long-term, post-disaster debris storage, sorting and management.
2. Work with other public and private entities to establish mutual aid agreements for post-disaster debris removal and otherwise plan for needed heavy equipment in areas which may become isolated due to earthquake and tsunami damage.

Hazardous Materials

The [City/County] will:

1. Limit or prohibit new hazardous facilities as defined in ORS 455.447 within tsunami inundation zones. Where limiting or prohibiting such facilities is not practical, require adequate mitigation measures consistent with state and federal requirements.

Goal 11: Public Facility and Services

The [City/County] will:

1. Consider and address tsunami risks and evacuation routes and signage when planning, developing, improving, or replacing public facilities and services.
2. Update public facility plans to plan, fund, and locate future facilities outside of the tsunami inundation zone, whenever possible.

Goal 12: Transportation

The [City/County] will:

1. Develop multi-use paths that both enhance community livability and serve as tsunami evacuation routes.
2. Coordinate evacuation route and signage planning in conjunction with existing or proposed transportation system plan pedestrian and bicycle route planning efforts.
3. Locate new transportation facilities outside the tsunami inundation zones where feasible.
4. Where feasible design and construct new transportation facilities to withstand a Cascadia event earthquake and be resistant to the associated tsunami.

Goal 14: Urbanization

The [City/County] will:

1. Limit the allowable uses on property in the tsunami hazard area vacated as the result of an urban growth boundary expansion to relocate existing development. Such limitations shall include permitting only low risk uses, or requiring uses which implement adequate protection or mitigation measures for seismic and tsunami hazards.
2. Restrict the development of lodging facilities and higher density residential housing in tsunami inundation zones or require the implementation of protective measures.
3. Plan for the location or relocation of critical facilities outside of tsunami hazard area when conducting the land needs analysis.
4. Include pre- and post-tsunami disaster planning as part of urban reserve planning processes.

Tip: A DOGAMI advisory committee has recommended the adoption of the "Large" scenario for application of the ORS 455 development restrictions. This recommendation will be considered by the DOGAMI Governing Board who will make the final determination.

3.3 Map Amendments

The comprehensive plan and development code text amendments developed using this Land Use Guide will need to be accompanied by associated map amendments. The following maps should be adopted or otherwise incorporated into the appropriate elements of the local comprehensive plan and implementing regulations:

a. DOGAMI Tsunami Inundation Map (TIM): Communities should adopt the map, or maps in the DOGAMI Tsunami Inundation Map (TIM) Series applicable to their jurisdiction as a part of the comprehensive plan inventory, as they provide the essential information for defining tsunami risk. The TIMs include five inundation scenario areas including small,

medium, large, extra large, and extra extra large tsunami events. The TIMs will typically be referenced in the natural hazards element of the comprehensive plan, and will also be used as the basis for establishing the boundaries of a Tsunami Hazard Overlay zone. The TIMs may also be referenced in plan policies and/or the overlay zone for purposes of differentiating between areas of higher versus lower risk. For example, the official ORS 455 tsunami inundation zone (which is currently being considered for updating based on the current TIMs), will identify the area to which ORS 455 development restrictions will apply.

b. Tsunami Hazard Overlay Zone Map (THO): The overlay zone map(s) should be developed using the applicable DOGAMI Tsunami Inundation Maps or TIMs. In developing the overlay map it is recommended that the overlay area include all five inundation scenarios identified on the TIMs (S, M, L, XL, and XXL) which would ensure that life/safely and evacuation route planning and development are adequately addressed. Other land use resilience strategies and requirements included within the overlay zone, which are not life safety or evacuation related, may be applied within a subset of the overlay to smaller inundation scenario areas subject to the community's risk tolerance, application of mitigation measures, and ORS 455.446-447 requirements. The map(s) should be adopted in the form of an amendment to the official zoning map for the community.

   A community may also coordinate with DOGAMI to develop water depth mapping associated with various tsunami inundation scenarios found on the TIMs which could be used to further define or clarify areas where land use provisions would apply.

c. Evacuation Route Plan Maps: The Evacuation Route Plan will typically include a map or maps that identify designated evacuation routes, assembly areas and other components of the local evacuation system. This map would be included in the adoption of the overall Evacuation Route Plan. The Evacuation Route Plan should, in turn, be incorporated into the community's comprehensive plan or transportation system plan, as appropriate.

Tip: In adopting the applicable TIMs, communities should identify and make reference to the specific number and publication date of the map for their community.

CHAPTER 4:
Development Code Provisions

Chapter 4: Development Code Provisions

Implementation of comprehensive plan policies and other related community development goals is typically accomplished through the specific regulations of the development code. The model code sections of this chapter are intended to provide templates for communities to follow in incorporating land use regulations addressing tsunami risk in their local development codes. Most of the substantive provisions are incorporated into the Tsunami Hazard Overlay. The use of a tsunami-specific overlay provides a mechanism to apply standards within the defined tsunami hazard area. This approach thus provides an additional tier of regulations specifically addressing tsunami risk, which are applied to new development in conjunction with the standards of the underlying zone.

Tip: The model code sections of this chapter are intended to provide examples for communities to follow in incorporating land use regulations addressing tsunami risk into their local development codes.

As with any model code, not all of the approaches or standards incorporated into the Land Use Guide will be suitable for use in every community. Local governments should carefully consider the community's exposure to tsunami hazard, acceptable level of risk, and support for tsunami preparation in evaluating the appropriate use of the development code provisions. In general, most of the individual sections of the overlay zone are "severable", that is they can be used on an individual basis, or in any combination, when being adapted for use in a community's land use code.

4.1 Tsunami Hazard Overlay Zone

The Tsunami Hazard Overlay zone is designed to serve as the principal implementation mechanism for land use measures addressing tsunami risk. As the name indicates, it is designed to be applied in the form of an overlay zone, i.e. in combination with underlying base zones. The boundaries of the overlay would correspond to the area of the jurisdiction subject to inundation from a local source tsunami as indicated in Section 4.1.2 below. In form and application, it is similar to the flood hazard overlay zones in place in most jurisdictions.

The model overlay focuses on three main approaches to reducing risk and increasing resilience:

- Placing restrictions and limitations on certain categories of uses.
  These limitations apply primarily to uses which present a high potential for life safety risk, or to uses which provide an essential function during and after a disaster event. ORS 455, which is implemented through the state building code, currently prohibits certain facilities and structures in the tsunami inundation zone as defined by the Oregon Department of Geology and Mineral Industries as indicated in Section 4.1.2 below. The model overlay incorporates these requirements, and also provides examples for local jurisdictions which may choose to limit other uses, or provide a higher margin of safety for some essential facilities.
- Integrating the development and improvement of evacuation infrastructure into the land use and development review process.

Tip: See Chapter 6 for more information on evacuation route planning.

These provisions establish requirements to incorporate appropriate evacuation measures and improvements in most new development, consistent with an overall evacuation plan for the community. It is important to note that effectiveness of this component of the overlay is largely dependent upon the development and adoption of an Evacuation Route Plan. This plan identifies evacuation needs, designates routes, establishes system standards, and identifies needed improvements to the local evacuation system. Such a plan is essential to the implementation of evacuation route development/improvement in conjunction with the land use review and approval process. Evacuation route plans may be simple or more complex, depending on the circumstances and needs of the jurisdiction. Every jurisdiction is urged to develop such a plan as a tool to enhance the development of evacuation infrastructure. Please see Chapter 6 of the guide for detailed guidance on the development of an Evacuation Route Plan.

Tip: A development overlay zone can provide incentives for development designs which reduce risk and increase resiliency.

- Providing incentives for development designs which reduce risk and increase resiliency. The overlay incorporates an optional development process which would permit modifications to many code standards when an overall design incorporates higher degrees of risk reduction. Similar in concept to a planned development, this approach permits deviation from the standard, prescriptive dimensional requirement of the code in order to encourage designs and development measures that achieve higher levels of risk reduction.

4.1.1 Tsunami Hazard (TH) Overlay Zone

1.100 Definitions for Section 1.110

As used in Section 1.110:

(1) "Essential Facilities" means:

(a) Hospitals and other medical facilities having surgery and emergency treatment areas; (b) Fire and police stations;

(c)Tanks or other structures containing, housing or supporting water or fire-suppression materials or equipment required for the protection of essential or hazardous facilities or special occupancy structures;

(d) Emergency vehicle shelters and garages;

(e) Structures and equipment in emergency preparedness centers;

(f) Standby power generating equipment for essential facilities; and

(g) Structures and equipment in emergency preparedness centers.

(2) "Hazardous facility" means structures housing, supporting or containing sufficient quantities of toxic or explosive substances to be of danger to the safety of the public if released.

(3) "Special occupancy structures" means

(a) Covered structures whose primary occupancy is public assembly with a capacity greater than 300 persons;

(b) Buildings with a capacity of greater than 250 individuals for every public, private or parochial school through secondary level or child care centers;

(c) Buildings for colleges or adult education schools with a capacity of greater than 500 persons;

(d) Medical facilities with 50 or more resident, incapacitated persons not included subsection (a);

(e) Jails and detention facilities; and

(f) All structures and occupancies with a capacity of greater than 5,000 persons.

(Note: The above definitions are taken from ORS 455.446)

(4) "Substantial improvement" means any repair, reconstruction, or improvement of a structure which exceeds 50 per cent of the real market value of the structure.

(5) "Tsunami vertical evacuation structure" means a building or constructed earthen mound that is accessible to evacuees, has sufficient height to place evacuees above the level of tsunami inundation, and is designed and constructed with the strength and resiliency needed to withstand the effects of tsunami waves.

(6) "Tsunami Inundation Maps (TIMs)" means the map, or maps in the DOGAMI Tsunami Inundation Map (TIM) Series, published by the Oregon Department of Geology and Mineral Industries, which cover(s) the area within [jurisdiction name].

4.1.2 Tsunami Hazard Overlay Zone

Tip: This section includes sample code provisions that may be customized for your community.

(1) Purpose

The purpose of the Tsunami Hazard Overlay Zone is to increase the resilience of the community to a local source (Cascadia Subduction Zone) tsunami by establishing standards, requirements, incentives, and other measures to be applied in the review and authorization of land use and development activities in areas subject to tsunami hazards. The standards established by this section are intended to limit, direct and encourage the development of land uses within areas subject to tsunami hazards in a manner that will:

(a) Reduce loss of life;

(b) Reduce damage to private and public property;

(c) Reduce social, emotional, and economic disruptions; and

(d) Increase the ability of the community to respond and recover.

Significant public and private investment has been made in development in areas which are now known to be subject to tsunami hazards. It is not the intent or purpose of this section to require the relocation of or otherwise regulate existing development within the Tsunami Hazard Overlay Zone. However, it is the intent of this section to control, direct and encourage new development and redevelopment such that, over time, the community's exposure to tsunami risk will be reduced.

(2) Applicability of Tsunami Hazard Overlay Zone

All lands identified as subject to inundation from the XXL magnitude local source tsunami event as set forth on the applicable Tsunami Inundation Map(s) (TIM) published by the Oregon Department of Geology and Mineral Industries (DOGAMI) are subject to the requirements of this section.

Note: The overlay zone should include all of the area subject to inundation by the highest local source tsunami event, XXL, depicted on the DOGAMI TIMs. By using the limits of the XXL event, all of the area subject to tsunami risk will be included.

However, the regulatory and other standards may be applied differentially within the overlay, based on the different levels of risk for the five modeled events, the purpose of the standard, and overall community objectives.

(3) Tsunami Depth Information Required

Except for single family dwellings on existing lots and parcels, all applications for new development, substantial improvements and land divisions in areas subject to the requirements of this section shall include, in addition to the other information required by this chapter, data specifying the maximum depth of inundation on the subject property from the M, L, XL and XXL local source tsunami events as modeled on the applicable Tsunami Inundation Map (TIM) and other data products available from the Oregon Department of Geology and Mineral Industries (DOGAMI).

(4) Uses

In the Tsunami Hazard Overlay Zone, except for the prohibited uses set forth in subsection (5), all uses permitted pursuant to the provisions of the underlying zone may be permitted, subject to the additional requirements and limitations of this section.

(5) Prohibited Uses

Unless authorized in accordance subsection (6), the following uses are prohibited in the specified portions of the Tsunami Hazard Overlay Zone:

Note: Under ORS 455.446, the uses listed in subsection (a) are prohibited within the tsunami inundation zone as adopted by the DOGAMI governing board, currently the "L" local source event. Based on individual circumstances and overall risk to the community, local governments may consider establishing further limits on uses based on the need to reduce exposure to tsunami risk. This could include extending the prohibition to include other important and/or high risk uses, expanding the area subject to the prohibition by specifying a larger (e.g. XXL) design event, or some combination of these methods. The provisions of subsection (b) provide one example of an approach to extending use limitations beyond the minimum prohibitions of ORS 455.446. In any case, use prohibitions and/or limitations beyond the minimum requirements of ORS 455.446 should be based on the risk tolerance, overall exposure to risk, and individual needs of the community.

(a) In areas identified as subject to inundation from the [specify design event; L is the minimum under ORS 455.446] magnitude local source tsunami event as set forth on the Tsunami Inundation Map (TIM), the following uses are prohibited:

(A) Hospitals and other medical facilities having surgery and emergency treatment areas.

(B) Fire and police stations.

(C) Structures and equipment in government communication centers and other facilities required for emergency response.

(D) Buildings with a capacity greater than 250 individuals for every public, private or parochial school through secondary level or child care centers.

(E) Buildings for colleges or adult education schools with a capacity of greater than 500 persons.

(F) Jails and detention facilities.

> Note: The following Essential Facilities and Special Occupancy Structures are currently permitted in the tsunami inundation zone, subject to consultation with DOGAMI regarding mitigation for tsunami risks.
> See ORS 455.447 (4). It is recommended that local governments evaluate these uses and relative levels of risk to determine whether it is appropriate to place additional limitations on these uses in higher risk areas, as provided in the example below.

(b) In areas identified as subject to inundation from the [choose design event; recommend M] magnitude local source tsunami event as set forth on the Tsunami Inundation Map (TIM), the following uses are prohibited:

(A) Tanks or other structures containing, housing or supporting water or fire-suppression materials or equipment required for the protection of essential or hazardous facilities or special occupancy structures.

(B) Emergency vehicle shelters and garages.

(C) Structures and equipment in emergency preparedness centers.

(D) Standby power generating equipment for essential facilities.

(E) Covered structures whose primary occupancy is public assembly with a capacity of greater than 300 persons.

(F) Medical facilities with 50 or more resident, incapacitated patients.

> Note: The following uses are not subject to regulation or review under ORS 455.446-447, but in adopting land use standards for tsunami risk reduction, it is suggested that local governments consider placing limitations on some or all of these uses, particularly in higher risk areas (e.g. M event), based on the overall needs of their community.

(G) Residential uses, including manufactured home parks, of a density exceeding 10 units per acre;

(H) Hotels or motels with more than 50 units.

(c) Notwithstanding the provisions of [cite non-conforming use section of code], the requirements of this subsection shall not have the effect of rendering any lawfully established use or structure nonconforming.

Note: The Tsunami Hazard Overlay is, in general, not intended to apply to or regulate existing uses or development. A provision such as (c) is recommended to preclude the application of nonconforming use restrictions.

(6) Use Exceptions

A use listed in subsection (5) of this section may be permitted upon authorization of a Use Exception in accordance with the following requirements:

(a) Public schools may be permitted upon findings that there is a need for the school to be within the boundaries of a school district and fulfilling that need cannot otherwise be accomplished.

(b) Fire or police stations may be permitted upon findings that there is a need for a strategic location.

(c) Other uses prohibited by subsection (4) of this section may be permitted upon the following findings:

(A) There are no reasonable, lower-risk alternative sites available for the proposed use;

(B) Adequate evacuation measures will be provided such that life safety risk to building occupants is minimized; and,

(C) The buildings will be designed and constructed in a manner to minimize the risk of structural failure during the design earthquake and tsunami event.

(d) Applications, review, decisions, and appeals for Use Exceptions authorized by this subsection shall be in accordance with the requirements for a Type III procedure as set forth in Section [cite administrative/procedural section of code].

(7) Evacuation Route Improvement Requirements

Note: The following provisions are largely dependent upon an adopted Evacuation Route Plan that identifies evacuation needs, designates routes, establishes system standards, and identifies needed improvements to the local evacuation system. Such a plan is essential to the implementation of evacuation route development/ improvement in conjunction with the land use review and approval process. Evacuation route plans may be simple or more complex, depending on the circumstances and needs of the community. Every jurisdiction is urged to develop such a plan as a tool to enhance the development of evacuation infrastructure. Please see Chapter 6 of the Guide for detailed guidance on the development of an Evacuation Route Plan.

Except single family dwellings on existing lots and parcels, all new development, substantial improvements and land divisions in the Tsunami Hazard Overlay Zone shall incorporate evacuation measures and improvements, including necessary vegetation management, which are consistent with and conform to the adopted Evacuation Route Plan. Such measures shall include:

(a) On-site improvements:

(A) Improvements necessary to ensure adequate pedestrian access from the development site to evacuation routes designated in the Evacuation Route Plan in all weather and lighting conditions.

(B)Frontage improvements to designated evacuation routes that are located on or contiguous to the proposed development site, where such improvements are identified in the Evacuation Route Plan. Such improvements shall be proportional to the evacuation needs created by the proposed development.

(C) Where identified in the Evacuation Route Plan as the only practicable means of evacuation, tsunami evacuation structure(s) of sufficient capacity to accommodate the evacuation needs of the proposed development.

(b) Off-site improvements:

Improvements to portions of designated evacuation routes that are needed to serve, but are not contiguous to, the proposed development site, where such improvements are identified in the Evacuation Route Plan. Such improvements shall be proportional to the evacuation needs created by the proposed development.

(c) Evacuation route signage consistent with the standards set forth in the Evacuation Route Plan. Such signage shall be adequate to provide necessary evacuation information consistent with the proposed use of the site.

(d) Evacuation route improvements and measures required by this subsection shall include, at a minimum, the following:

(A) Improved streets and/or all-weather surface paths of sufficient width and grade to ensure pedestrian access to designated evacuation routes in all lighting conditions;

(B) Improved streets and paths shall provide and maintain horizontal clearances sufficient to prevent the obstruction of such paths from downed trees and structure failures likely to occur during a Cascadia earthquake; and

(C) Such other improvements and measures identified in the Evacuation Route Plan (e) When it is determined that improvements required by this subsection cannot be practicably accomplished at the time of development approval, payment in lieu of identified improvements shall be provided in accordance with [cite applicable section of code establishing standards and requirements for payment-in-lieu].

(8) Tsunami Evacuation Structures

(a) All tsunami evacuation structures shall be of sufficient height to place evacuees above the level of inundation for the XXL local source tsunami event.

> Note: Depending on individual circumstances, some communities may find that building evacuation structures to the elevation of the XXL event is impracticable. In such cases, communities may choose to consider a case-by-case process to allow for exceptions to this elevation requirement. It is recommended that tsunami evacuation structures not be permitted to a standard lower than the L local source tsunami event and anything below XXL may be at some risk.

(b) Tsunami evacuation structures are not subject to the building height limitations of this chapter.

(9) Flexible Development Option

(a) The purpose of the Flexible Development Option is to provide incentives for, and to encourage and promote, site planning and development within the Tsunami Hazard Overlay Zone that results in lower risk exposure to tsunami hazard than would otherwise be achieved through the conventional application of the requirements of this chapter. The Flexible Development Option is intended to:

(A) Allow for and encourage development designs that incorporate enhanced evacuation measures, appropriate building siting and design, and other features that reduce the risks to life and property from tsunami hazard; and

(B) Permit greater flexibility in the siting of buildings and other physical improvements and in the creation of new lots and parcels in order to allow the full realization of permitted development while reducing risks to life and property from tsunami hazard.

(b) The Flexible Development Option may be applied to the development of any lot, parcel, or tract of land that is wholly or partially within the Tsunami Hazard Overlay Zone.

> Note: Subsection (c) is intended to provide maximum flexibility for development and for achieving risk reduction by permitting any type or mix of uses, notwithstanding the underlying zoning. Local governments should evaluate this allowance to determine if it is appropriate for application within their jurisdiction. The other provisions of this section may still be fully utilized without including this provision.

(c) The Flexible Development Option may include any uses permitted outright or conditionally in any zone, except for those uses prohibited pursuant to subsection (5) of this section.

(d) Overall residential density shall be as set forth in the underlying zone or zones. Density shall be computed based on total gross land area of the subject property, excluding street right-of-way.

(e) Yards, setbacks, lot area, lot width and depth, lot coverage, building height and similar dimensional requirements may be reduced, adjusted or otherwise modified as necessary to achieve the design objectives of the development and fulfill the purposes of this section.

(f) Applications, review, decisions, and appeals for the Flexible Development Option shall be in accordance with the requirements for a Type II [or Type III] procedure as set forth in Section [cite administrative/procedural section of code].

(g) Approval of an application for a Flexible Development Option shall be based on findings that the following criteria are satisfied:

(A) The applicable requirements of sub-paragraphs (b) and (d) of this subsection are met; and

(B) The development will provide tsunami hazard mitigation and/or other risk reduction measures at a level greater than would otherwise be provided under conventional land development procedures. Such measures may include, but are not limited to:

(i) Providing evacuation measures, improvements, way finding techniques and signage at a level greater than required by subsection (7) of this section;

(ii) Providing tsunami evacuation structure(s) which are accessible to and provide capacity for evacuees from off-site;

(iii) Incorporating building designs or techniques which exceed minimum structural specialty code requirements in a manner that increases the capacity of structures to withstand the forces of a local source tsunami; and

(iv) Concentrating or clustering development in lower risk portions or areas of the subject property, and limiting or avoiding development in higher risk areas.

(10) Hazard Acknowledgement and Disclosure Statement

(a) All applications for new development or substantial improvements in the Tsunami Hazard Overlay Zone shall be accompanied by a Hazard Acknowledgement and Disclosure Statement, executed by the property owner, which sets forth the following:

(A) A statement that the property is subject to inundation by a local source Cascadia event tsunami, including the DOGAMI scenarios (S, M, L, XL, or XXL) that could potentially flood the site, and that development thereon is subject to risk of damage from tsunami;

(B) A statement that a local source tsunami poses a potential life safety threat to occupants of the property, and that the protection of life safety will require occupants to evacuate to high ground in the event of a local source tsunami; and

(C) A statement acknowledging that the property owner accepts and assumes all risks of damage from tsunami associated with the development of the subject property.

(b) Approval of new development or substantial improvements in the Tsunami Hazard Overlay Zone shall be conditioned to require the recording of the required Hazard Acknowledgement and Disclosure Statement in the deed records of [insert name of county].

CHAPTER 5:
Tsunami Financing and Incentive Concepts

Chapter 5: Tsunami Financing and Incentive Concepts

A number of financing and incentive concepts can be used concurrently with land use regulations for use with tsunami mitigation and resilience efforts. These concepts may not be new. However, their application in tsunami mitigation may be new. This chapter contains an overview of some of the tools that communities can use to become more resilient to a catastrophic tsunami hazard event.

Tip: This chapter gives some ideas for financing tsunami evaluation route improvements.

Several of these financing options can be directly linked to land use regulations in Chapter 4 related to tsunami evacuation route improvements. Evacuation route planning and development will likely provide the most initial value in a community's resilience effort as it concentrates on life and safety. A community that is interested in making this a priority in its tsunami preparation efforts should emphasize development of a comprehensive evacuation route plan (see Chapter 6) that provides information to address specific funding requirements. Other financing may likely be helpful for other aspects of a community's program to increase resilience to a Cascadia tsunami event.

Tip: Some communities have indicated that the tools most likely to succeed for enhancing a community's evacuation route system are 1) using existing right-of-ways, 2) negotiating/ purchasing easements, and 3) purchasing new right-of-way. Some of the financing tools in this section may assist with obtaining new easements and right-a-ways.

With any of these potential financing options or tools, seek local assistance from expert community staff (e.g. legal counsel), and other qualified professionals (e.g., League of Oregon Cities), to assist in proper establishment, function and consistency with legal requirements.

5.1 FEMAs Funding Programs

5.1.1 NFIP Flood Insurance

Most homeowner, renter and business policies do not cover damage from flooding of any type. However, National Flood Insurance Program (NFIP) flood insurance covers losses due to flooding, including tsunami. Coastal communities, as part of their tsunami preparedness and resilience strategies should consider providing property owners with technical information about tsunami hazards and conducting outreach efforts to encourage the purchase of flood insurance for properties within the tsunami hazard area (but outside of the special flood hazard area outlined in NFIP Flood Insurance Rate Maps). Contact FEMA NFIP staff for further information.

5.1.2 NFIP Community Rating System

The Community Rating System (CRS) is a component of the National Flood Insurance Program that provides incentives for communities to enhance floodplain management and other programs to reduce the risk of flood damage. By participating in the CRS, communities, through specific actions, receive credits that result in a reduction in flood insurance rates in their community. Actions to mitigate tsunami risk are eligible for CRS credits; guidance on eligible activities related to tsunami risk has recently been revised by FEMA in conjunction with the Insurance Services Office (ISO). The CRS includes 19 creditable activities organized under four categories: public information activities, mapping and regulations, flood damage reduction, and warning and response. Communities are also

Tip: Actions to mitigate tsunami risk are eligible for CRS credits.

invited to propose alternative approaches to these activities. Please see Chapter 8 "Other Resources" for link to the 2013 CRS Coordinators manual and the 2006 FEMA CRS Credit for Mitigation of Tsunami Hazards manual. In addition, you can contact FEMA for information about the CRS tsunami program (CFM CRS Specialist, ISO Community Hazard Mitigation,
503-342-6138).

5.1.3 Pre-Disaster Mitigation, Hazard Mitigation, and Flood Mitigation Assistance Funding Programs

- The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. Eligible Applicants include States, local governments, and Indian tribes or other tribal organizations.
- The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Eligible Applicants include States, local governments, Indian tribes or other tribal organizations, and private non-profit organizations
- The Flood Mitigation Assistance (FMA) program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist States and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under NFIP. Eligible Applicants include states, local governments and Indian tribes or other tribal organizations.

Tip: Urban renewal can be an effective tool in creating needed infrastructure investments for tsunami preparedness

5.2 Urban Renewal

Urban renewal is a public financing tool to improve local infrastructure for tsunami evacuation and could facilitate new improvements or the redevelopment of existing improvements. It is a valuable tool for those with existing urban renewal programs and those contemplating developing one. The following are examples of how this financing tool has been used by two coastal communities, in tsunami mitigation planning efforts:

- In 2005, the City of Waldport used urban renewal to modernize public facilities and assist in relocation safety facilities out of tsunami hazard zones.
- In 2012, the City of Newport used urban renewal funds to match FEMA Hazard Mitigation Funds for the South Beach Tsunami Evacuation Route Enhancements.

Urban renewal is funded through a strategy called tax increment financing. When an urban renewal district is established, the county assessor determines the current assessed

value of all property within the district, and freezes that tax base. Once the base is frozen, the property tax revenue local jurisdictions receive from all property within the district is likewise set at a fixed amount until the urban renewal area is terminated. Over time, as property values increase, all tax revenues generated by the "increment" between the frozen value and the current real market value of all properties in the district are directed to improvement projects within the urban renewal district. Assessed values can increase yearly at the 3% maximum allowed amount by state statute, or by more than this if new development occurs within the area. When the urban renewal area expires, the frozen base also expires, and the local taxing jurisdictions resume receiving taxes on the full assessed value of the area.

Tax increment financing can be used to fund a variety of improvement projects including projects that help mitigate tsunami risk. Projects such as multi-use paths and green spaces that can double as tsunami evacuation routes and assembly areas, infrastructure upgrades (water, sewer, and utility), and the relocation of critical facilities outside of tsunami hazard areas are examples of work that could be accomplished through urban renewal financing.

For more information about urban renewal visit the following websites:

State of Oregon - Urban Renewal Webpage
http://www.oregon.gov/DOR/PTD/Pages/IC_504_623.aspx

Urban Renewal in Oregon: History, Case Studies, Policy Issues, and Latest Developments
http://www.rockawaybeachor.us/Portals/56/urOregon.pdf

An Overview of Urban Renewal
http://www.oregon.gov/oprd/HCD/PROGRAMS/docs/omsc_2011_ur101_main_street.pdf

5.3 System Development Charges

System Development Charges (SDCs) are one-time charges on new development, and certain types of redevelopment, to help pay for existing and planned infrastructure to serve the development. SDCs are one means available to local governments for financing growth. State law creates a framework for local SDCs and specifies how, when, and for what improvements they can be imposed. Under ORS 223.297-223.314, SDCs may be used for capital improvements for:

- Water supply, treatment and distribution
- Wastewater collection, transmission, treatment and disposal
- Drainage and flood control
- Transportation
- Parks and recreation

System development charges may be charged to new development based on a fee to reimburse for unused infrastructure capacity and/or to make planned improvements that increase infrastructure capacity. System development charge revenues may only be used for capital costs. They cannot be used for ongoing system or facility maintenance or projects that fix existing system deficiencies or replace existing capacity.

Tip: Tsunami evacuation route investments may be financed by system development charges. Consult your legal counsel and other resources for assistance as needed.

Local governments must establish their SDCs by ordinance. They must have a methodology to calculate a reimbursement fee and/or an improvement fee and provide credit if a developer finances a qualified capital improvement. Prior to imposing an SCD based on an improvement fee for capital facilities, the local government must have in place: 1) a capital improvement plan; 2) a public facilities plan or comparable plan that lists improvements to be funded with the improvement fee portion of the SDC; and 3) an estimate of the cost and timing for each improvement.

System development charges could be utilized for evacuation plan route component financing if those components are directly related to capital improvements that SDCs can legally fund (e.g., transportation, parks, and recreation) and the charges are developed consistent with ORS 223-297. These SDCs should be directly linked to the local government's capital improvement plan and detailed evacuation route plan which has comparable components to a public facilities plan. The plan must include specific associated standards for evacuation route paths, bridges and other related improvements (i.e., size, width, seismic capacity, and cost for each listed improvement). As indicated in the applicable statute, development of a legal formula to apply system development charges to these improvements is required and addresses rough proportionality as necessary. Improvements may be evacuation route facilities associated with the transportation system (e.g., streets/bridges). They may also be associated with multi use paths or trails that would fall within the transportation, park, or recreation systems of the community.

The local government should seek guidance and direction from its legal counsel and other qualified professionals to assist in the use of this option and in potential development of this tool. Local government organizations (LOC, AOC) may also have information on this option.

For more information about system development charges visit the following websites:
ORS 223-297(SDCs): http://www.leg.state.or.us/ors/223.html
http://www.oregonlaws.org/ors/223.302

5.4 Legal Exactions

Tip: Exactions are one tool to consider for ensuring that evacuation improvements and other measures to reduce risk are implemented for new development.

The term "exactions" refers to a broad range of regulatory techniques used by local governments to require developers to contribute to the cost of community public facilities. Specifically, exactions require contributions toward public improvements that fall outside the boundary of the development (such as access roads or off-site drainage easements), or will serve larger segments of the community in addition to the specified development (such as new parks or a new evacuation route needed to adequately serve the area where the development is located).

The underlying and common legal issue with respect to fees, dedications, and exactions is the connection, also referred to as the "nexus," to the impact of land development. Without this nexus, land development regulations that impose exactions may be deemed unconstitutional takings of property without just compensation. The United States Supreme Court has held that under limited circumstances, a government may have the right to limit

certain uses, and invoke certain permit conditions and exactions if they are necessary to limit or avoid specific public harms threatened by the development. The Court has set forth a three part test to determine whether an exaction results in an unconstitutional taking. To avoid resulting in a taking, an exaction must:

- Substantially advance a legitimate public purpose;
- Be based on an essential nexus between that purpose and the harm threatened by the proposed use; and
- Be roughly proportional to the degree of threatened harm.

The public purpose advanced by exactions for tsunami evacuation improvements is to reduce life safety risk. New or intensified development within the tsunami hazard area will, by definition, place more people at risk from tsunami; thus the clear nexus for evacuation related exactions is to mitigate the harm presented by this increased risk. Proportionality can be addressed by establishing a process for evaluating the impacts of new development in terms of increased risk exposure, and identifying evacuation improvements or other measures that are roughly proportional to those impacts.

In adopting regulations that establish evacuation system related exactions, jurisdictions should incorporate findings that address these three requirements. Such findings should clearly articulate the purpose of the regulations, the essential nexus between new development and increased risk, and the process for determining proportionality. The evacuation route plan provides a key foundation for these findings and the establishment of regulation based exactions.

The local government should seek guidance and direction from its legal counsel and other qualified professionals to assist in development of this option. Local government organizations such as the League of Oregon Cities and Association of Oregon Counties also may have helpful information on this topic.

5.5 Local Improvement District

Local improvement districts, or special assessment districts, function as mainstays of local improvement financing. A local improvement district is a geographic area in which real property is taxed to defray all or part of the cost of a public improvement. The distinctive feature of a special assessment is that its costs are apportioned according to the established benefit that will accrue to each property. In Oregon, local improvement districts are governed by local ordinances, but the Bancroft Bonding Act (ORS 223.205-295) addresses the means by which local governments may finance public improvements.

In the case of tsunami evacuation route improvements, a local government can use this financing mechanism to work with neighborhoods lacking needed route facilities to help them overcome those deficiencies in their portion of the evacuation route system. The costs of the needed evacuation route improvements would be apportioned to each property owner according to the direct benefit of the route improvement to the property.

The local government should seek guidance and direction from its legal counsel and other qualified professionals to assist in development of this tool. Local government organizations (LOC, AOC) may also have information on this option.

5.6 Land Trusts

A land trust is a nonprofit organization that, as all or part of its mission, actively works to conserve land by undertaking or assisting in land or conservation easement acquisition, or by its stewardship of such land or easements.

Land trusts work with landowners and the community to conserve land by accepting donations of land, purchasing land, negotiating private, voluntary conservation agreements on land, and stewarding conserved land through the generations to come.

Land trusts can be used in tsunami mitigation to:

- Acquire developable land in high risk areas
- Create buffer zones to protect urban development from tsunami impacts
    - Acquire open space for community assembly areas: For more information go to the following site: https://www.landtrustalliance.org/land- trusts

For more information about land trusts, visit the following websites:

Oregon Land Trust Contacts

http://www.opb.org/programs/oregonstory/land_trusts/resources/page_2.html

Land Trust Alliance

http://www.landtrustalliance.org/

5.7 Conservation Easement

A conservation easement, which is a legal agreement between a landowner and a land trust or government agency, can be used to permanently limit the use of land in order to protect its conservation value. It allows landowners to continue to own, use, or sell their land.

When a conservation easement is put in place by a landowner, some of the rights associated with the land are given up. For example, in high-risk inundation areas the right to build certain types of structures could be given up, while retaining some or all of the land as open space. Conservation easements are permanent, and future owners are also bound by the easement terms. The easement holder is responsible for making sure the easement's terms are followed. Easement holders are typically a land trust or other conservation oriented NGO, but may also be governmental entities.

While conservation easement are typically focused on preserving important natural resource or open space values, as voluntary, non-regulatory mechanisms for limiting development, conservation easements may also serve to help reduce exposure to tsunami risk.

For more information, see:

Conservation Easements Oregon

http://www.nature.org/about-us/private-lands-conservation/conservation-easements/conservation-easements-oregon.pdf

Southern Oregon Land Conservancy

http://www.landconserve.org/content/conservation-easements

Cannon Beach Conservation Easement

http://www.ci.cannon-beach.or.us/News/EcolaCreek/OWEBease.pdf

Land Trust Alliance – Conservation Easements Webpage

https://www.landtrustalliance.org/conservation/landowners/conservation-easements

National Park Service

http://www.nps.gov/tps/tax-incentives/taxdocs/easements-historic-properties.pdf

5.8 Transferable Development Credits (TDC)

This option is more widely known as "Transfer of Development Rights" or TDR. Currently this option has limited utility as current Oregon statute (ORS 94.531-538) on "TDR" sending areas is limited to "resource lands." The term "resource lands" is defined in a way that would not allow sending areas to be designated based solely on tsunami hazard/risk; sending areas would have to possess other defined natural resource/conservation values in order to qualify. However, if a jurisdiction has an existing TDR program it may be able to provide secondary hazard mitigation value in addition to its primary purpose of conserving "resource lands."

In cases where qualifying resource land sending areas are within a tsunami hazard area, Transfer Development Rights (TDR) would be another incentive-based approach that could be used to limit development in high risk inundation zones and encourage development outside of inundation zones.

For more information about this strategy visit the following website:

ORS 94.531-538

http://www.leg.state.or.us/ors/094.html

5.9 ODOT Bicycle & Pedestrian Program Grants

Multi-use paths and transportation facilities can also serve a dual purpose as evacuation routes when these transportation facilities are also identified as necessary routes within the community's evacuation route plan. Information for this funding source is located at:

http://www.oregon.gov/ODOT/HWY/BIKEPED/pages/grants1.aspx

5.10 Recreation Related Funding Sources

Recreation District: ORS 198.010 and 198.335 authorizes 28 types of districts and includes "park and recreation" districts. Special Districts are financed through property taxes, fees

for services, or a combination of these. Recreation districts in Oregon are directed by OAR 226 and may provide for a variety of recreational facilities. If the community has a recreation district, or is contemplating developing one, which includes or would include hiking and biking trails and other multi-use facilities it may be possible to utilize these funds to further develop evacuation routes if the primary purpose of these routes is recreation.

The Special Districts Association of Oregon (SDAO) provides support services to member districts throughout the state in the areas of research and technical assistance, legislative representation, training programs, insurance services, information and reference materials, financing services, and employee benefits programs.

OPRD Recreation Trails Program (RTP) Grants: These federally funded grants provide awards for recreation trail-related projects such as hiking, running, bicycling, off-road motorcycling and all-terrain vehicle riding. Information for this funding source is located at: www.oregon.gov/OPRD/GRANTS/pages/about_us.aspx.

5.11 Purchase Strategies

Local governments can purchase property, through fee simple acquisitions for a variety of public purposes. A number of communities have implemented programs to acquire land to conserve critical ecosystems or natural features, as well as, to provide open space for recreational benefits to their communities. In some cases, such acquisitions may also serve to remove properties at risk from tsunami hazard from the private market; alternatively, a community could specifically identify tsunami hazard mitigation as an objective for a land acquisition program or strategy. Some communities have successfully used purchase strategies for negotiating/purchasing easements and acquiring new right-of-way. Other specific tools and strategies may include fee simple purchases, acquisition of development and easement rights, and relocation of existing structures in the hazardous areas pre- disaster. These programs can be costly for local government, although in certain cases, significant life safety benefits may be realized.

Local governments should seek guidance and direction from legal counsel and other qualified professionals to assist in development of this tool. Local government organizations (LOC, AOC) may also have information on this option.

CHAPTER 6:
Tsunami Evacuation Facilities Improvement Planning

Acknowledgements: Chapter 6 was replaced in April 2015 with more comprehensive tsunami evacuation facilities improvement plan guidance. The Department of Land Conservation and Development was assisted in this work by:

Carole Connell (Lead), Land Use Planner, AICP - Connell PC Associates Incorporated

Daniel "DJ" Heffernan – Land use Planner/Finance Analyst - Daniel Heffernan Company

Chapter 6: Tsunami Evacuation Facilities Improvement Planning

Tsunami evacuation route planning and development will likely provide the most initial value in a community's resilience effort as it concentrates on life safety. In this effort a community should emphasize development of a comprehensive Tsunami Evacuation Facilities Improvement Plan (TEFIP) that not only establishes evacuation routes but also provides for development of infrastructure needed to facilitate and improve effective evacuation.

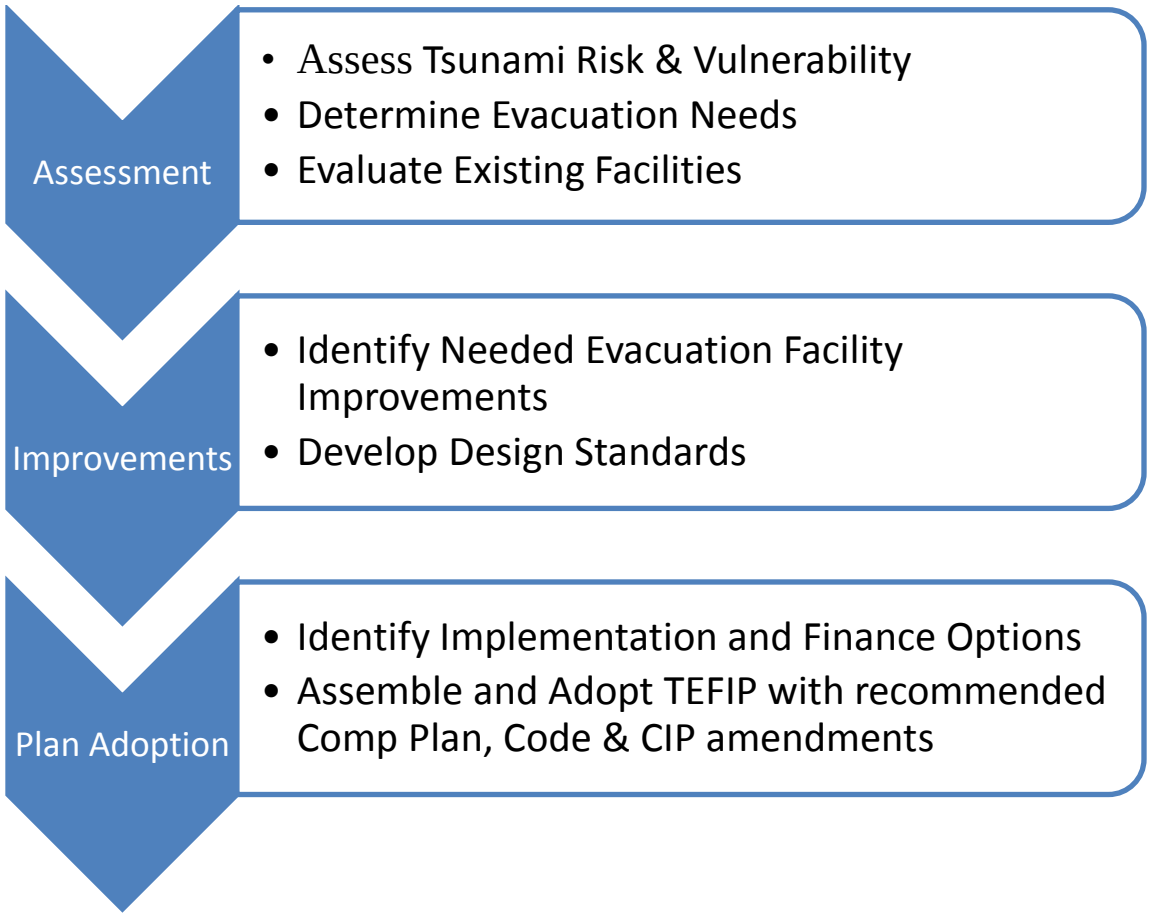
This chapter provides guidance on the development of a TEFIP, including approaches to evacuation route planning and a discussion of methods to finance the development and improvement of evacuation facilities. Examples of comprehensive plan policies needed to support a TEFIP are in Chapter 3 of this guidebook. Examples of development code provisions to implement plan purposes and policies are in Chapter 4 of this guidebook.

The local TEFIP is not the same as the DOGAMI Evacuation Route Maps. While the DOGAMI Evacuation route maps may provide valuable route and assembly area information that could provide a baseline for development of the TEIFP if more detailed modeling effort is not available, the TEFIP itself is an all-inclusive local program that addresses the full range of considerations related to evacuation needs and infrastructure. It identifies evacuation needs, designates routes, establishes system standards, and identifies needed improvements to the local evacuation system (including route hardening, bridge work, way finding technologies, etc.). It will include goals and policies, implementation strategies, identification of capital projects, and provides the basis for development code provisions necessary to implement effective evacuation route planning and development within the community. A comprehensive TEFIP is essential to the implementation of evacuation route development and improvement in conjunction with the land use review and approval process.

Typically, the TEFIP is adopted as a component of the comprehensive plan, and may also be incorporated into the local Capital Improvement Plan and/or Transportation System Plan. This plan should also be coordinated with local park and trail system plans that can help provide for pedestrian tsunami evacuation routes.

TEFIP's may be simple or complex, depending on the circumstances and needs of the jurisdiction. Every jurisdiction is urged to develop such a plan as a tool to support and enhance the development of evacuation infrastructure The purpose of this chapter, in coordination with the other chapters in this guidebook, is to give communities specific programmatic methods to develop a comprehensive TEFIP.

STEPS TO PREPARING A
TSUNAMI EVACUATION FACILITIES IMPROVEMENT PLAN



PUBLIC EDUCATION AND OUTREACH

An essential element of effective tsunami evacuation planning is to develop an ongoing public education, outreach, and involvement process. The process outlined in Chapter 2 of the user's guide provides suggestions for public involvement and community engagement that can be used to develop this plan.

Public outreach and education should continue and potentially increase once the plan is adopted and being implemented. It is essential that community members and visitors be educated in the need to move to high ground as soon as prolonged ground shaking subsides by disseminating maps and procedures to the public, conducting evacuation drills and training exercises. This is an on-going requirement. Education materials and their regular updates should be continuously replenished in schools, hospitals, care facilities, public places, tourist facilities, public websites and other accessible locations. Practice drills should occur every season, every year. These efforts should be coordinated with the Oregon Office of Emergency Management (OEM) staff. Ongoing awareness is vital to saving lives in the event of a Cascadia Subduction Zone tsunami.

These efforts to establish and maintain public awareness of the critical need for evacuation is essential to successful development and implementation of a TEFIP. An education and outreach effort will help build awareness of the need for development and improvement of necessary tsunami evacuation facilities. This will in turn help to establish support for funding and regulatory processes deemed necessary and appropriate to implement needed evacuation infrastructure improvements.

The community may seek assistance from agencies and organizations charged with assisting in hazard education. In your region consult the countywide Hazard Mitigation Plan or the Community Emergency Response Teams (CERT) or CERT-like organizations that provide local education and outreach efforts. Extensive statewide information is available from the Oregon Department of Geology and Mineral Industries, Oregon Office of Emergency Management, Oregon Sea Grant, and The Oregon Partnership for Disaster Resilience to support development of this critical program. The NOAA TsunamiReady program components may also be helpful in accomplishing portions of this task. Please see the link to these programs within Chapter 8: Other Resources of the guide.

PREPARING THE TSUNAMI EVACUATION FACILITIES IMPROVEMENT PLAN (TEFIP)

The process for developing a TEFIP is outlined below in the form of five overall tasks. For each task, a set of distinct and specific Action Steps needed to accomplish the task is described. These Action Steps may take slightly different forms in different communities, depending the individual needs and circumstances of the community. But it is important to maintain a focus on the overall task and its outcome to ensure that the final plan contains the necessary elements to achieve its purpose.

Also, it is important to keep in mind that effective plan implementation and maintenance over time will require community support and an ongoing public education program.

6.1: Tsunami Risk and Vulnerability Assessment

The purpose of this task is to identify "who" and "what" are in harm's way, and "where" these assets are located within the community. The goal of the task is to:

- Identify maps that precisely locate the inundation zone for a Cascadia Subduction Zone (CSZ) tsunami event in order to identify areas and assets most vulnerable to damage.
- Develop estimates of population subject to evacuation based on existing and projected land uses, including an identification of the most risk-prone populations.

6.1.1: Hazard Identification Resources:

The purpose of hazard identification is to identify areas that are most vulnerable to damage and, especially, life safety risk, from earthquake and tsunami. Coastal communities need to know where life threatening inundation from local and distant tsunami is most likely to take place in order to make informed decisions about evacuation needs.

Mapping produced by the Oregon Department of Geology and Mineral Industries (DOGAMI) is the definitive source of information for the identification of areas subject to tsunami inundation. DOGAMI has produced two map products depicting tsunami inundation for the Oregon coast; the DOGAMI Tsunami Evacuation Maps and the Tsunami Inundation Maps (TIM series maps).

The DOGAMI Tsunami Evacuation Maps illustrate two inundation zones. One is based on a "Distant Tsunami" such as those generated by the 1964 Alaska earthquake or the 2011 Japan earthquake. The distant tsunami scenario projected by DOGAMI is of a much smaller magnitude than that generated by a local Cascadia event and thus results in a correspondingly smaller inundation area. The TEFIP will not focus on these distant tsunami events. The other inundation zone depicted on the Tsunami Evacuation Map is the "Local Cascadia Earthquake and Tsunami". This local Cascadia earthquake and tsunami inundation area is based on the worst case scenario Cascadia subduction earthquake (also identified by DOGAMI as the XXL tsunami on the TIM series). This local tsunami generated by an earthquake just off the Oregon Coast is of very large magnitude and thus the inundation area is much larger. Also, unlike a distant tsunami that can be predicted several hours prior to its arrival, this local tsunami can strike the coast within 15 – 20 minutes after the ground stops shaking from the earthquake.

The focus of all evacuation planning is life safety. Because life safety risk is present in all areas potentially subject to inundation during a tsunami event, communities should use the "Local Cascadia Earthquake and Tsunami" (aka XXL) as the design event for evacuation facility planning. This means that evacuation planning and facility development will be based on the worst-case scenario, which is consistent with the purpose of the TEFIP to help ensure that all areas potentially subject to tsunami inundation can be effectively evacuated.

The Tsunami Inundation Maps (TIM series maps) depict the

projected tsunami inundation zone from five different magnitude seismic events. Using a "T-shirt size" method of identification, the TIMs identify tsunamis in a range of small, medium, large, extra-large or extra extra-large (S, M, L, XL, & XXL) events. These different modeled events are associated with differing levels of risk in terms of the relative likelihood of tsunami inundation. The different inundation scenarios depicted on these maps have applications for land use planning, and can also be used to tailor implementation standards based on relative levels of risk. See Chapter 4 for detailed guidance on various potential applications of the TIMs.

Tip: Find DOGAMI tsunami maps at www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm

6.1.1 ACTION STEPS

1. Collection of hazard location data

- Obtain the Tsunami Evacuation and Inundation Map (TIMs) for your community from the Department of Geology and Mineral Industries (DOGAMI).
- Obtain Evacuation Maps for your community from the Department of Geology and Mineral Industries (DOGAMI). These maps are consistent with the National Tsunami Hazard Mitigation Program (NTHMP) mapping standards (http://nthmp.tsunami.gov/publications.html). Any additional community evacuation/assembly area mapping should also be consistent with these standards
- Most communities have already received this information from DOGAMI however, if necessary, the following web link can assist in becoming more familiar with the two map products noted above: www.oregongeology.org/tsuclearinghouse/pubs-evacbro.htm
- Obtain the DOGAMI Evacuation Time Modeling Map/report if available for your community for use in future steps.

Outcomes:

1) A collection of all tsunami hazard related maps necessary to identify areas of the community that are subject to potential life safety risk and need to be evacuated during a tsunami event.

6.1.2: Prepare a Tsunami Risk and Vulnerability Assessment

After identifying where the tsunami hazard is, the next step in developing the Tsunami Evacuation Facilities Improvement Plan (TEPIF) is to determine the overall numbers of people and identify, to the extent possible, vulnerable population groups that are within the tsunami inundation zone areas and thus in harm's way. The goal is to estimate how many people will need to be evacuated, and to identify the characteristics and locations of populations that may have specific additional needs or requirements for evacuation.

The initial step in the assessment is to estimate the population likely to be within the tsunami inundation/evacuation area. This should include both an estimate of current population as well as future projections based on assumed development and population growth.

Current residential population can be estimated by using (or compiling) residential unit counts and applying an average household size multiplier. To the extent that Census tracts correspond to the identified evacuation area, the Census can also be a useful data source for estimating residential population on a sub-area basis. Commercial and institutional uses should be identified individually and assigned a population based on their rated occupancy. Communities with high visitor populations should pay particular attention to hotels, motels, and similar overnight lodging facilities within the inundation zone, as these uses will represent significant concentrations of people requiring evacuation. Where available, room counts or other comparable occupancy data from the facility operators should be used to establish population estimates for lodging facilities. In all cases, population estimates should assume the highest seasonal occupancy so that design capacities will be based on the maximum potential evacuation need.

Estimates of future population within the evacuation area should be based on the community's projected growth rate, coupled with an analysis of the build-out potential of the remaining developable and redevelopable lands within the inundation zone. This build-out analysis should assume maximum densities permissible under the existing comprehensive plan and zoning.

Communities should also strive to identify vulnerable population groups that may need special accommodation for evacuation. Initially, this should include groups or populations that can be identified with specific locations or facilities within the evacuation area. Examples would include the occupants of schools, hospitals, correctional facilities, and nursing or other residential care facilities. Depending on the level of detail available from census data, it may also be possible to identify other populations within the evacuation area that may have specific evacuation needs.

Estimates of future overall population and vulnerable population groups will be important in future steps to assist the community in identifying deficiencies and prioritizing evacuation improvements.

6.1.2 ACTION STEPS

1. Estimate current and future population within the identified evacuation area using:
    - Current residential population estimate.
    - Residential unit counts and commercial and institutional facility occupancies
    - Future population and development forecasts.
2. Develop estimates for vulnerable populations that may require special accommodation for evacuation.

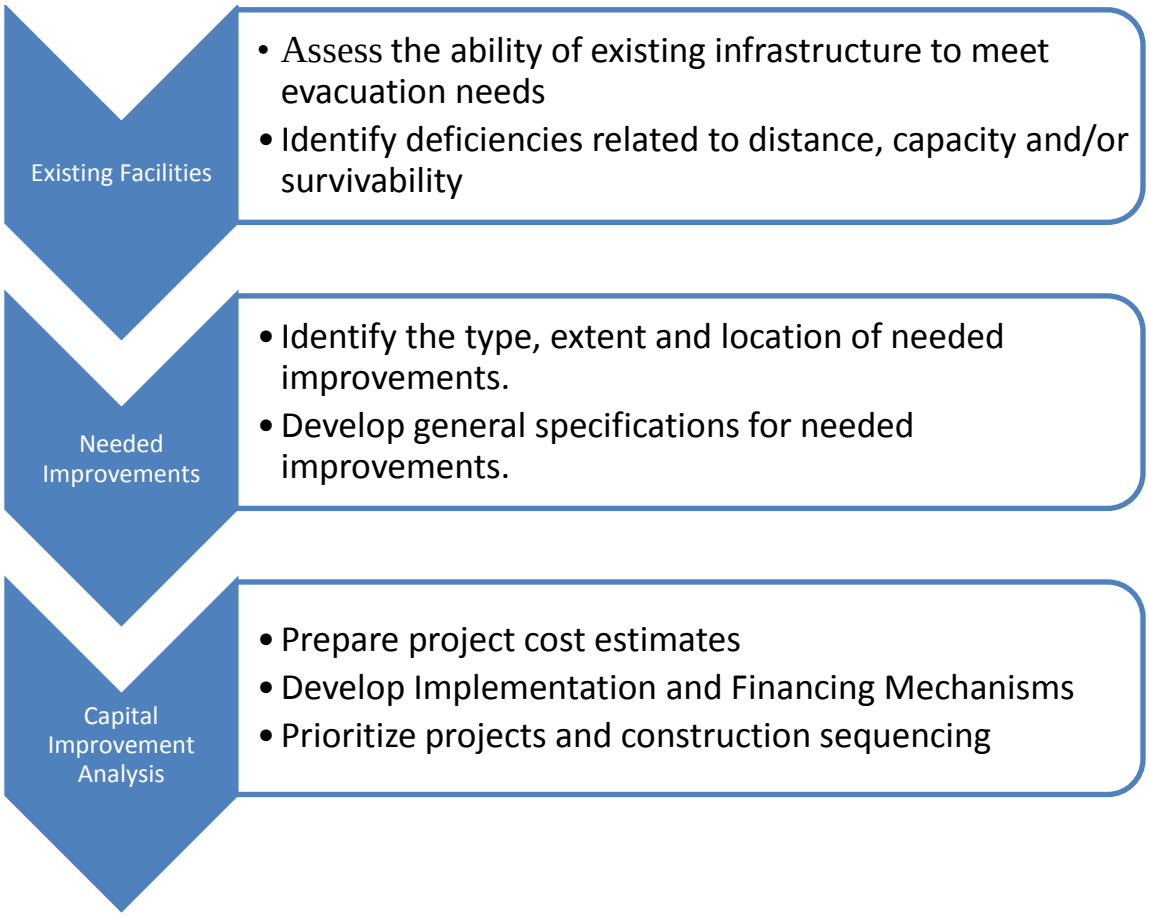
Outcome:

1) Community overall and vulnerable population estimates that identify the number and location of people that will need to be evacuated from the inundation zone.

6.2: Analyze Existing Evacuation Facilities

The purpose of this task is to identify and evaluate the adequacy and suitability of current evacuation facilities. The focus will be on identifying existing system deficiencies that impede or preclude effective evacuation.

STEPS FOR ANALYZING EVACUATION FACILITIES AND IMPROVEMENT NEEDS



6.2.1: Existing Facilities Analysis

Time and Distance Analysis

The first step in evaluating the adequacy of existing evacuation routes and facilities is some form of time and distance analysis. This involves calculating clearance times for evacuation from the range of locations within the inundation area, using existing available routes. The Oregon Department of Geology and Mineral Industries (DOGAMI) is currently conducting tsunami evacuation modeling in communities along the Oregon coast that addresses this need. This DOGAMI modeling provides the most detailed and comprehensive information available to evaluate evacuation needs and estimate clearance times. As of early 2015, this work is underway for several north coast communities. As resources become available, DOGAMI hopes to complete this work for all at-risk Oregon coastal communities over the next few years.

The DOGAMI analysis can model multiple scenarios and can be used to calculate, for any given location within the inundation area, clearance times based on existing routes and facilities. The

analysis can then be used to identify system deficiencies for locations or areas where clearance times fail, i.e. where they exceed the estimated time available to evacuate before the tsunami arrives. For example, the model can show where existing routes are inadequate or distances to high ground are too great to allow timely evacuation, and therefore alternatives need to be considered. Similarly, it can be used to determine the impact of potential infrastructure failures (e.g. bridge collapse) on clearance times, thus allowing the identification of the need for improvements or for the consideration of other alternatives. Because this GIS-based system allows a very efficient and accurate assessment of the performance of existing evacuation routes and facilities, where this modeling is available, communities should employ it as the primary method for evaluating the adequacy of existing facilities.

Where the DOGAMI time and distance modeling is not yet available, communities will need to employ alternative methods for assessing the adequacy of existing routes and facilities. One basic way for communities to estimate clearance times is by simply live-testing and recording the time it takes to walk from representative locations within the inundation area to the nearest high ground. This type of testing should involve a series of timed walkthroughs from selected locations to the nearest high ground, and should account for differences in the time of year, time of day, weather conditions, likely post-earthquake disturbances, etc. The DOGAMI Tsunami Evacuation Maps should be used for the initial identification of evacuation routes to be time tested; this information can be supplemented by input from local stakeholders. Communities should consult with DOGAMI to determine estimated time windows available for evacuation at selected locations.

In identifying a range of locations within the inundation zone for time testing, it will be very useful to develop and map “evacuation sheds”, based on calculations of the shortest time to high ground. Each main evacuation route will have an “evacuation shed”, which would include that portion of the inundation zone from which occupants would evacuate via that route, based on the shortest time to reach high ground. For purposes of evaluating existing facilities, it will be helpful to estimate the population to be evacuated from each “evacuation shed”, so that facility capacity can be considered. The population estimates developed in 6.1 based on residential unit counts and facility occupancies can be used in arriving at estimates for each “evacuation shed”.

As a part of this time testing, communities should also identify known or likely locations of system failures (e.g. bridge collapse), so that required alternative routes can be timed and compared. In all cases, clearance time estimates should be conservative to account for travel speeds of elderly and disabled citizens. Smartphone wayfinding applications, such as “Map My Tracks”, may be helpful in this work.

Another resource in areas where DOGAMI detailed time/distance modeling is not available is the U.S. Geological Survey (USGS) regional evacuation time-modeled map for the Oregon Coast. USGS has also published several articles on how to prepare GIS evacuation models; further information on these models can be found in Chapter 8.

The completion of the time and distance analysis for existing facilities will yield information that should provide the initial focus to the community’s efforts to improve its evacuation system. A

principal product of this work should be a detailed map depicting the most effective and time efficient evacuation routes, and the "evacuation-shed" for each route. In particular, there should be a focus on identifying areas for which existing routes are determined to be inadequate or in need of improvement in order to accomplish effective evacuation. The work products for this task may take different forms for different communities, but should always include the following basic documentation:

- Calculated clearance times based on quantified time-travel distance on existing evacuation routes within inundation areas
- Identification of areas where clearance times fail based on existing conditions.
- Identification of route weaknesses (capacity, accessibility, strength) and conditions by reviewing such factors as width, surface, condition, grade, potential obstruction hazards (including adequacy of bridges and other structures).

Assembly Areas/Facilities

In addition to the basic network of routes needed for evacuation, communities should consider the needs for assembly areas and/or facilities that serve as evacuation destinations. Tsunami evacuation and shelter demand analysis should be based the estimated population subject to evacuation as determined in 6.1, and should include current information on assembly area and/or shelter locations and capacities. The community can start with the DOGAMI evacuation route maps where the community provided initial information related to these assembly areas. This information should be supplemented by information gleaned from processes identified in previous steps.

Wayfinding Signage

An important component of a tsunami evacuation network is wayfinding signage. Evacuation routes, in particular should be clearly marked within the tsunami evacuation zone. As an initial step, communities should inventory and map the location and type of existing signage. Signage and wayfinding is not specifically prescribed by state requirements but local communities can use the guidelines found in Chapter 8 to help in evaluating signage needs. In addition, the publication *Up and Out, The Oregon Tsunami Wayfinding Research Project* published by the Oregon Office of Emergency Management (OEM) provides detailed guidance on the design, use and placement of effective evacuation signage. It is recommended that communities consult with OEM and this resource for evaluating signage and other wayfinding needs.

Based on the inventory of existing signage and an evaluation of signage guidelines, communities should identify and document the location of areas where additional and/or improved signage is needed or desirable.

6.2.1 ACTION STEPS

1. Evaluate Existing Evacuation Facilities
   - Use DOGAMI time modeling (or alternate method) to measure and document the performance of existing routes and facilities

- Assess the adequacy of existing assembly areas and wayfinding signage
- Inventory and map identified deficiencies in the existing evacuation facilities

Outcomes:

Documentation of the adequacy of existing evacuation routes and facilities and an inventory of identified evacuation facility deficiencies.

6.3 Identify, Evaluate and Prioritize Needed Evacuation Facility Improvements

After concluding the inventory steps in 6.1 and 6.2, communities will have completed an assessment of the extent of the hazard and the vulnerability of their community, and through documentation of the performance of the existing system, will have identified known deficiencies in the evacuation system. The purpose of this task is to use this factual base to identify and evaluate facility improvements to address identified needs, and to develop strategies and methods to finance and construct those needed improvements.

6.3.1 Identifying Needed Improvements

Communities should begin this process by using the inventory of deficiencies in the existing evacuation system identified in 6.2, and identification of population concentrations or vulnerable populations in 6.1. Using this information, each of the identified deficiencies should be evaluated to determine its overall impact on life safety. Each system deficiency should then be assigned a priority of high, medium or low, based on the impact on life safety. For example, high impact deficiencies such as highly concentrated population areas with failing clearance times, and vulnerable population areas, should be given higher priority in this evaluation process.

As a part of this process, communities should also identify portions or areas of the existing system that may currently be adequate, but for which there is potential to significantly enhance performance. Finally, communities should identify areas within the inundation zone where future development and/or population increases will require improvements to the system to accommodate the evacuation needs created by this growth. As with the existing system deficiencies, desirable system enhancements and needed future improvements should be evaluated and assigned a priority of high, medium or low.

Next, communities should develop a list of potential system improvements that address the identified deficiencies and other potential enhancements. In some cases, there may be two or more alternative approaches to addressing deficiencies or accomplishing system enhancements, or some individual improvements may address more than one need. This initial list of potential improvements should be organized in a way that clearly matches prospective projects or improvements to one or more identified deficiencies and/or needed enhancements. This process of identifying potential improvements needs to be a community effort involving local experience and knowledge. This should include staff with technical expertise in local infrastructure, as well as other stakeholders familiar with the community and knowledgeable of local conditions.

In communities where the DOGAMI time modeling work has been completed, the model has the capability to test the efficacy of potential additions or improvements to the evacuation system, such as the development of new routes or the placement of vertical evacuation structures. Such testing will require the local government to contract with DOGAMI to perform this work. During the process of identifying potential improvement projects, communities should work closely with DOGAMI for guidance on the methods and costs associated with the modeling of proposed improvements.

6.3.1 ACTION STEPS

1. Identify Needed Evacuation System Improvements
   - Identify and assign general priorities to needed evacuation improvements
   - Where time modeling is available, contract with DOGAMI to model and test the efficacy of potential system improvements

Outcomes:

1) Evacuation system improvements analysis including:
   a. Identification of needed improvements
   b. Priority of needed improvements
   c. Associated map of improvements

Tip: Expert advice is recommended as part of this step to establish the design requirements for critical infrastructure and estimated costs. Engineers and geo-scientists may be retained to do this work, or involved on peer review basis, or engaged to prepare value engineering studies.

6.3.2: Project Identification and Cost Estimate Analysis

Tip: Cost estimating resources are available on line that communities may use in this process. Some are listed below. Expert review of design assumptions and results is recommended.

http://www.aacei.org/resources/ppg/

http://www.wbdg.org/design/dd_costest.php

http://www.epa.gov/superfund/policy/remedy/pdfs/finaldoc.pdf

https://bookstore.transportation.org/collection_detail.aspx?ID=122

https://www.fema.gov/expert-panel-cost-estimating-public-assistance-program

This task is used to integrate the improvement projects identified in subtask 6.3.2 into the local public facility plan or capital improvement plan (CIP), including project cost estimates, and identifying when/how they will be constructed. Guidance for public facility planning can be found in Statewide Planning Goal 11 and OAR660-011-000. Cost estimates need not be prepared all at once. The work may be combined with a future master-planning program, such as the next update of the Transportation System plan or Park Master Plan, or the next update to a Public Facility Plan.

The cost analysis should include operating and maintenance (O&M) costs as well as capital

costs. O&M costs include, for example, the cost to inspect and perform routine maintenance on new or improved bridges and retaining walls, the cost to repave or resurface pathways and to keep evacuation routes clear, the cost to update and replace signage, the energy cost to light evacuation routes. Taking a "life-cycle" approach helps determine if the cost to design, build and maintain evacuation infrastructure is less costly than alternative strategies that might avoid these investments or reduce their scale. Existing program budgets and managers should be able to help develop O&M and life-cycle cost information.

Most cities have procedures in place for programming projects into their Capital Improvement Program (CIP)[1] and a budget process that commits O&M funds for public systems. In many small cities, the CIP process by default is the annual budget. The process and rigor by which projects are screened and selected for construction may not be objective in some cases; trade-offs and public priorities need to be balanced with available resources. For this reason, no project should appear in a CIP until funding has been secured to build and operate it. A CIP should not include "wish list" items; that is what plans are for.

Tip: In this task it is important that the process results in clear assignments for:

- ensuring that this work is included in future planning exercises;
- compiling the information on costs and developing a financing plan for building the improvements (see Section 6.4);
- integrating system investment needs, costs, and priorities, and for sequencing this program into the local CIP.

For rural communities, the CIP process is complicated by the need to integrate projects and programs into the county budget. There is more discussion in Section 6.4 for how to reduce the risk that investments in tsunami evacuation infrastructure may become subordinated to other community investment interests/needs. Suffice it to say that the process of identifying infrastructure needs and accurately assessing the cost to build and maintain this infrastructure is only the first step. A well-coordinated strategy and a commitment to its implementation must be devised and followed.

6.3.2 ACTION STEPS

1. Develop Facility Improvement Cost Estimates (see Tip box above)
   - Compile cost information and integrate this information into the master plans that will guide building the improvements, such as park master plans, transportation plans, emergency management plans, etc.
   - Include Operations and Maintenance (O&M) life-cycle information in cost estimates.
   - Ensure that relevant Transportation and Parks Master Plans are updated to include evacuation facility improvements and costs. Identify personnel responsible for this task over time.
2. Integrate high priority projects into the Capital Improvement Program (CIP).

[1] The acronym CIP is used here to mean a capital improvement *program*, which is different from the capital project element in a master plan. CIPs are used to program projects that have funding in place for their construction and operation.

- Identify personnel responsible for using the information on system needs, costs, and priorities to sequence high-priority projects into the community's CIP.
- Amend the CIP to include evacuation facility improvement projects for those projects that have secured funding.

Outcomes:

1) Facility cost estimates
2) Updated CIPs and transportation/parks master plans as indicated above.

A community may find that in certain areas the cost to design, build, and maintain evacuation infrastructure is so high that the prospect calls into question the rationale of allowing large scale development. Similarly, there may be situations where evacuation infrastructure costs needed to serve existing development are very high. These situations pose a complex and difficult set of issues. Appendix D- "Life Cycle Analysis, Sensitivity Analysis, and No-Build Solutions" addresses this issue further.

6.3.3: Develop Evacuation Facility Design and Construction Standards

The TEFIP should establish design and performance requirements for the evacuation facilities listed in the plan. The plan does not need to include detailed dimensions, performance measures (e.g. walking capacity/minute), or quantified seismic resistance standards but it should provide the basis for them to be developed and included in local regulations. Adding design standards for tsunami evacuation infrastructure to local public works standards is an appropriate way to codify these requirements. This also will help ensure that evacuation infrastructure built concurrent with new development will be appropriate to serve identified needs.

Tip: Include evacuation routes & improvements in relevant transportation, utility and parks planning and financing plans; in utility easement plan locations and other dual use opportunities

In most cases, evacuation infrastructure will employ the use of existing public facilities such as local streets, parks and trails. General design standards can be applied in the evaluation of the adequacy of these facilities for meeting the demands that will be placed on them in an emergency. In addition, design standards are essential to ensure that both system improvements and new facilities will meet identified evacuation needs. For example, in areas where high ground is not within reach, vertical evacuation structures may be needed. The general design features and needed structural capacity of these facilities should be set forth in the TEFIP so that accurate cost estimates for their construction can be developed.

Evacuation infrastructure design criteria and specifications will change over time as scientific understanding and engineered solutions improve. The TEFIP, therefore, should cite the need to update facility design standards so they remain current.

Tip: For communities considering a new facility which may have limited capacity to move evacuees through them, such as a pedestrian bridge, a community may want to develop design requirements which consider the number of potential evacuees, potential vulnerable populations (travel speed), and available time to evacuate to high ground. The following information may be helpful in this effort:
US Dept. of Homeland Security has commissioned studies analyzing the evacuation of stadiums and buildings that may be helpful for analyzing crowd through-put in a built environment. For example, http://www.dhs.gov/sites/default/files/publications/Evacuation%20Planning%20Guide%20for%20Stadiums.pdf
Computer models have been developed for this purpose. For example: http://traffgo-ht.com/downloads/pedestrians/downloads/publications/Kluepfel2004b.pdf

6.3.3: ACTION STEPS

1. Develop Evacuation Facility Design and Construction Standards

- Determine a general range of standards for route width, surface and structural elements to meet peak demand on trails, roads and bridges.
- Determine design requirements for wayfinding signage, (e.g. size, color, symbols, materials, etc).
- If applicable, identify the location, design and structural requirements of vertical evacuation structures. See FEMA P646 Design of Structures for Vertical Evacuations from Tsunamis for design criteria.
- Develop Assembly Area Design Criteria, including shelter and supply caches

Outcomes:

A range of construction and design standards for evacuation facilities that can help provide a basis for determining improvement cost estimates and provide standards for improvement required for new development.

6.4: Develop Options for an Evacuation Facilities Financing and Regulatory Strategy

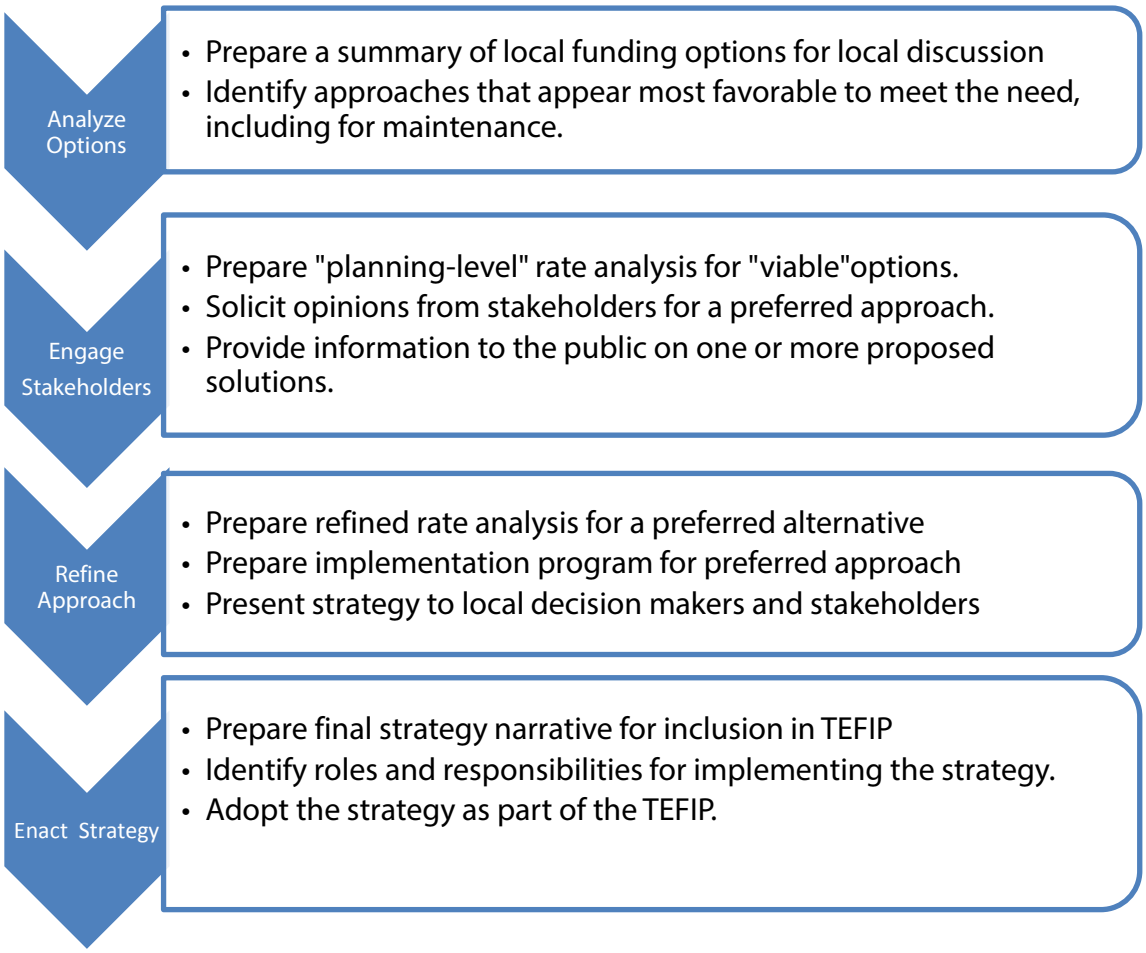
The purpose of this section is to provide information for financing and maintaining evacuation infrastructure. There is a wide variation in evacuation needs among Oregon' coastal communities. In towns that are relatively compact and built adjacent to coastal headlands, providing evacuation routes may require only wayfinding signage to high ground using existing roads, and identifying assembly areas with appropriate improvements. In other areas where development is located in coastal plains, evacuation infrastructure may require extensive upgrades to bridges, the construction of new pedestrian trails or routes, or building specially designed vertical evacuation structures.

There are as many financing approaches that local jurisdictions may use to build tsunami evacuation infrastructure (TEI) as there are coastal communities. The question is not "Can the funding be found?" but rather "Is there the will to take up these issues and find agreement for an approach?" There is no "perfect" solution. In many communities, new sources of funding will be needed to build tsunami evacuation infrastructure, but the amount will vary considerably depending on local conditions. Where the solutions are especially complex and expensive, state and/or federal assistance may be necessary.

One consideration in this regard is the role that the local comprehensive plan should play in shaping policy for financing infrastructure investment. In addition to providing direction relating to financing for tsunami evacuation investments, the comprehensive plan can provide a mechanism to establish a framework for allocating costs between public and private interests. For example, the plan can include policies that outline the propriety of using various financing mechanisms for different funding needs (e.g. utility fees vs special taxes); policies limiting the use of fees; and policies for imposing real property exactions. In effect, the plan can put policies in place that promote balance between the development community and the community at large for financing public infrastructure investment. A more detailed discussion of these issues can be found in Chapter 8 as "Sullivan and Lester. "Comprehensive Plan in Infrastructure Financing"." The Urban lawyer Vol. 37, No. 1 Winter 2005. http://www.oregonlandusetraining.info/tsunami-resources/ComprehensivePlanInfrastructureFinance.pdf "

Finally, the community discussion of how to plan for and build tsunami evacuation infrastructure will likely raise a number of issues related to basic governance and equity, including fundamental questions such as what entity should be responsible for various assets and how should the cost of such assets be equitably apportioned. For a complete discussion of the range of these questions, please see Appendix C.

STEPS FOR DEVELOPING A FINANCING STRATEGY



Given the myriad of programs and approaches that can be used to finance infrastructure, discussions about the TEFIP capital program also raises questions about governance and equitable ways to assign costs. A review of these issues is included in Appendix B. Local governments are encouraged to "think outside the box" and to consider creative multi-party solutions that may help leverage participation by a broader beneficiary base to lower individual costs.

Tip: Consider alternative governance approaches to implement the TEFIP, such as:

- County General Service District (ORS 451)
- Special Districts (ORS 198)
- Multi-party Intergovernmental Agreements (IGAs)
- State supported Public-Private Partnerships (see appendix C)
- Oregon Administrative District Program Oversight (COGs)

Local officials and elected leaders need to consult citizens when examining how to finance tsunami evacuation infrastructure. Questions that need to be examined include:

- Do citizens consider this to be an important public issue that requires a public remedy?
- Who directly benefits from the design, construction, and operation of these assets?

- Who indirectly benefits from the presence of these assets when not needed for an emergency?
- Do citizens have a preference among the various options available to finance the infrastructure investment?
- Is the scale of the need within the means of the community to finance or is outside assistance necessary?
- Should different strategies be used to elicit funding from seasonal vs. year-round residents?
- Is needed infrastructure within the jurisdiction/control of the community, or is there a need to engage other units or levels of government?

Appendix B includes a list of program resources that communities may be able to tap to finance evacuation infrastructure.[2] Rather than reviewing specific programs, this chapter focuses on the pros and cons of the various financing techniques that are frequently used to pay for public infrastructure. We also review the steps typically followed to use these approaches. The aim is to help decision makers think strategically about their choices. Case studies are referenced for places that have used these tools to solve similar financing needs. The tools are compared in a summary table in Appendix B.

6.4.1 - Local Fees and Taxes

Systems Development Charges (SDCs) – SDCs are one-time fees collected from new development to offset the cost to build public infrastructure to support the development. The cost of SDCs need to be proportional to their benefit and cannot be used to underwrite system improvements that raise the level of service for all existing development. SDCs in Oregon may only be collected for five public systems: water, sanitary sewers, storm drainage, parks, and transportation. The projects funded by SDCs must be identified in a master plan. The master plan usually establishes the share of benefit that eligible projects provide to new development; this must be considered when setting an "improvement fee". SDCs also can include a "reimbursement" fees [see ORS 223.299(3)] to recover a fair-share of previously invested public funding that financed construction of extra system capacity, such as an oversized intersection or sewage treatment plant that was designed specifically to serve future residents. SDC fees may be assessed city-wide. Add-on supplemental SDC fees may be collected in select areas to address special system needs that disproportionately benefit one area apart from the rest of the system.

There are two SDC eligible systems that could include tsunami evacuation infrastructure: parks and transportation. The master plans for these systems need to be reviewed to assess what parts of the evacuation system may be financed using these SDCs. Example improvements could include recreational trails, special needs parks, bridges, and emergency egress roads. The need for this evacuation infrastructure should be included in a separate chapter in the master plan on this topic. The master plan also needs to establish the design assumptions for the evacuation assets, so that the SDC methodology can establish a cost basis for their construction and allocate costs between current demand and future demand.

[2] Most infrastructure master plans, such as transportation system plans and park master plans also include a chapter that reviews financial tools and programs that local jurisdictions may use to finance public improvements.

The down-side to SDC financing is that it can take a long time to accumulate enough money to build planned improvements. SDC revenue is not predictable; no growth, no money. SDCs may not be viable in communities with stable or slow population growth. Even in cities that are growing, SDCs can only finance growth-related demand for new system capacity, which may leave a sizable need that must be financed by another source. Additionally, the tsunami evacuation infrastructure (TEI) projects must compete within an SDC program that also must finance other capital improvements; TEI projects may not be seen as important as other eligible projects. For these reasons, SDCs may be useful but should be treated as one part of a multi-faceted financing strategy.

Another caution with regard to SDCs: adding new projects to an SDC capital projects list may trigger a methodology update, which would subject the methodology to judicial review. This would be the case if the TEI projects fall outside the current definition of eligible system assets, or if a new area-specific fee is envisioned (e.g. a SDC fee on development west of HWY 101), or if the cost to build the TEI projects triggers a revision to the system's cost/fee basis. Jurisdictions should weigh carefully the administrative costs and legal ramifications associated with including TEI projects in their existing transportation and park SDC programs.

Implementation steps for SDCs:

a. Update the system master plan (e.g. Transportation System Plan, Park and Recreation Master Plan) to include TEI and identify the improvements within each system that address the need. Include cost estimates for each project and prioritize them for the next five years and for year-six and beyond. Amend the design requirements for dual-purpose system assets (e.g. a local street that also is designated an evacuation route) to meet evacuation needs and/or establish a project category for tsunami evacuation system improvements. Communities that prepare tsunami evacuation plans should cross reference the TEFIP in their SDC system master plans so that it is clear which system assets are included in both plans.
b. Review the current SDC methodology and determine if the current fee structure is sufficiently broad in its definition of eligible uses to include projects that address tsunami evacuation needs.
    i. Where the methodology can accommodate tsunami-related projects, and where the fee structure is sufficient to pay for them, add specific projects to the list of SDC eligible projects. Make sure to calculate the project cost percentage that is SDC

       eligible for TEI projects.
    ii. Where the methodology cannot accommodate tsunami-related projects, update

       the methodology to include the growth-related cost associated with those projects,

       adjust the fee accordingly, and update the list of SDC eligible projects.

Urban Renewal/Tax Increment Financing (TIF) - Oregon law allows municipalities to set up special financing districts that can finance public improvements and special programs, such as downtown redevelopment, beautification, and promotion. TIF does not give tax breaks to property owners. Rather, it allocates tax revenue within each district so that some of the revenue is available to finance specific improvements and programs. In essence, existing ad valorem (property value) taxes are frozen and the value of new tax revenue from development is diverted to finance bonds issued to pay for public improvements. When the bonds are retired and the purpose for the district is met, the district is dissolved. The Oregon Legislature amended the law governing these districts in 1997 and again in 2001 to address concerns about the effect of TIF districts on other taxing entities and the local general fund. For information on TIF districts in Oregon, read:

- http://www.oregon.gov/dor/stats/docs/303-405-1.pdf, and
- https://www.pdx.edu/sites/www.pdx.edu.realestate/files/3Q9-5-Stapleton-TIF-7-28-09.pdf

It is easy to envision how this tool could be used to finance evacuation infrastructure but there are limitations in the law that may make it more feasible in some communities than others. For example the area included in a district for a city of less than 50,000 residents cannot be greater than 25% of the city's territory nor include more than 25% of its total assessed value. There are other special taxation and benefit tests that must be met. These specialized requirements mean that most TIF districts are set up with the help of consultants that specialize in this field. That said, TIF could be useful for financing evacuation assets in certain locations, particularly if combined with other development objectives.

Implementation steps for TIF Districts:

a. Identify areas that may be suitable candidates for TIF/Urban Renewal financing and TEI projects within those areas;
b. Prepare an Urban Renewal/TIF plan for the area, including a list of projects that may be eligible for funding, with the involvement of property owners and taxing districts;
c. Determine the maximum indebtedness of the area and revenue projections for the planning horizon, including a review of the district's viability given obligations of other taxing districts vis a vis Measure 5 and 47/50 requirements;
d. Develop a management strategy for the district (e.g. separate district authority, city council)
e. Adopt the district and refer approval to voters, if required.

Transient Room (Hotel/Motel) Tax – Oregon collects a 1% transient room tax to promote tourism. The statute allows local governments to also impose such a tax.. The local rate is not regulated or capped. The law allows discretionary use of 30% of the local tax revenue with the balance restricted to uses that promote and serve tourism. Coastal cities and counties that collect transient room taxes may use the discretionary share of their local room tax revenue for building and maintaining tsunami infrastructure. This source is more relevant in tourist destinations. For more information, read:
Oregon Local Hotel/Motel Lodging Taxes: http://www.orcities.org/portals/17/A-Z/HB2267Summary.pdf
On-line Transient Lodging Services: http://www.orcities.org/Portals/17/A-Z/2013HB2656.pdf

To implement a room tax program to finance TEI, communities need to take the following steps.

a. Consultation with local hospitality businesses and the community at-large regarding the proposed use of room tax revenue for TEI is strongly encouraged.
b. In communities that collect a hotel/motel tax, update the local ordinance to specify that all or a portion of their discretionary revenue should be used to build and maintain tsunami evacuation infrastructure. Amend the budget to establish a fund for segregating this revenue and tracking its use.
c. In communities that do not currently collect a hotel/motel tax, consult with your city attorney re: the steps necessary to develop and pass an ordinance. The statewide 1% tax makes it easier and less expensive to add-on a local tax rate.

In some coastal communities, this revenue source could provide significant resources for needed improvements. There also it potential to combine the lodging tax with other funding mechanisms such as an excise tax on vacation rentals. Enforcement could be an issue but as a way to address seasonal population impacts, this could be a clear source of revenue to for some communities.

Special Excise Taxes - Cities and counties may collect an excise tax (i.e. sales tax) on goods and services with voter approval. Unlike a general sales tax, a special excise tax is targeted to a specific activity or good, such as a local tax on motor vehicle fuel sales. There generally is a link or nexus between the enterprise being taxed and the beneficial use of tax proceeds. Ashland, OR, for example, taxes restaurant receipts to offset the added cost that tourism has on its sewerage treatment system and parks.

In coastal areas where evacuation infrastructure must accommodate large numbers of seasonal visitors, an excise tax program could finance the added demand placed on the evacuation system

by seasonal visitors. An excise tax program could be designed to place a tax on vacation rental property use (e.g. houses and condominiums leased for stays of less than 30 days), on recreational equipment sales and rentals, on restaurant food and beverage sales, or on a local fuel. An excise tax on short term rentals could exempt properties that are subject to a local transient room tax.

Enacting a local excise tax requires voter approval but, once approved, would provide a stable source of revenue to the local jurisdiction. Individual cities may find this approach untenable if it puts its tourism trade at a competitive disadvantage. A regional approach (e.g. county-wide) may be more acceptable to address local competitive concerns. The regional tax would need to address how revenue would be shared among participating jurisdictions.

Steps for implementing an excise tax program:

a. Regional dialog about such a program is important regardless the outcome. Local governments should consider using county-wide or regional government forums to host early discussions on the issue.
b. As with all rate-based tax programs, an analysis is needed of the annual revenue goal, the characteristics of the market (e.g. the vacation rental market), and the rate basis (e.g. fixed or percentage basis) as well as the cost to collect and enforce the program. Indexing the rate,

which adjusts the fee or tax amount to keep pace with inflation, is recommended. This analysis may require professional assistance.

c. A significant public outreach and feedback loop needs to be included alongside the analysis. It is often useful to appoint an ad-hoc committee that includes representation from stakeholders and interest groups so that details of the program can be reviewed by those most impacted by the program. Frequent feedback briefings with the elected officials that will refer the measure to the ballot and to the community at-large are recommended.
d. Once a rate proposal has been agreed to, the matter needs to be referred to the voters. Oregon law specifies when and how such maters may be voted on. Legal advice is critically important when preparing the ballot measure. The measure needs to be written so that the intent of the program is not diluted by ambiguous language. The language in the ballot measure must be clear enough that funds are used only as intended but not so tightly that the program is unable to take advantage of new technologies and priorities.
e. Once approved, local budgets need to be amended to include appropriated funds to account for collection and use of tax revenue. This will typically require establishing "Special revenue Funds" that account for the receipt and use of program revenue.

Service and User Fees – Cities may collect service fees and use the revenue to build and maintain public assets. An example that is relevant to tsunami evacuation infrastructure would be a transportation utility fee collected from every dwelling and business to pay for transportation system maintenance and capital projects. A surcharge could be added to general city transportation

fee to address special transportation needs in areas threatened by tsunami flooding. Another example would be a trail-head parking fee with proceeds used to maintain and possibly widen city trails.

Service fees differ from taxes in law. The amount of the fee needs to be directly related to benefits that accrue to payees. A monthly park maintenance fee, where 100% of that cost is born by city households, may be calculated as follows:

Annual Maintenance Cost ÷ City Dwelling Units ÷ 12

The above example fee could be made more equitable by reducing the amount charged to apartments because apartments tend to have smaller household sizes, which equates to lower demand, or the program's cost could be split between residences and businesses with the latter group shouldering the cost of maintaining downtown parks. With greater complexity, however, comes added cost and potentially diminishing returns.

There also is a point where a fee program can cross the "rational nexus" boundary and become a tax. For example, revenue collected for water use cannot be called a fee if the revenue is used to run the police department because there is no "rational nexus" between monthly water use and police service. There is more discussion on the tax vs. fee issue in Appendix C.

Enacting a fee program generally is not as complicated as enacting a tax program. For one thing, voter approval is not required. With fee programs, however, it is important to pay careful attention to the

program's cost basis and to how the cost is allocated to beneficiaries. Fees generally may be advanced using the following steps.

a. The local legislative body should discuss the need for the fee program first so that staff has clear direction for the analysis that follows and so that the public is on-notice that the issue is under review.
b. Conduct a cost recovery study or rate analysis to establish the cost of service, the cost-recovery options, and associated fees. Indexing, which automatically adjusts the fee to keep pace with inflation, is recommended for programs where the fee amount is fixed but the program costs are not.
c. Include the cost to administer and collect the fee and make sure this cost is reflected in the rate analysis. Cities may find that certain fees are too costly to implement.
d. As with tax measures, an ad-hoc committee with stakeholder representation is recommended, especially when the program has broad community impacts. Frequent briefings to elected officials are recommended.
e. Develop an ordinance for the fee program. Legal council should review the ordinance. New fees may be phased in.

Sinking Fund – A sinking fund is like a savings account that is dedicated to a specific purpose. Saving

money for capital projects in a sinking fund avoids debt service costs. The use of sinking funds works well for smaller-scale capital projects, where project funding accumulates in a few years, or where the scale of successive projects is relatively small, or where a third party agreement limits their diversion. For example, SDC Improvement fee revenue typically accumulates in a sinking fund that is restricted by state law; they can only be used for capital projects related to the system for which they were collected.

Another type of sinking fund is one created using local discretionary authority. These funds typically are approved using a budget ordinance or resolution. Money from one or more local sources is reserved for use at a later time. This type of sinking fund is used less frequently in part because the

cost to borrow has become relatively inexpensive compared to historic rates. Secondly, discretionary sinking funds have sometimes become targets for legislative diversion (e.g. inter-fund borrowing or altering the sinking fund's purpose). The use of a discretionary fund to build TEI should be designed carefully so that money intended for the projects is not later "re-purposed" for other civic needs.

Sinking funds may be established using the following steps.

a. The local legislative body should discuss the purpose of the sinking fund and what steps should be taken to ensure the money is spent as intended. This will provide staff clear direction for designing the internal procedures for the fund.
b. Sinking funds can be created as part of the General Fund, a Special Revenue Fund, or an Enterprise Fund. The fund is established through adoption of the local budget. Review by the local budget committee generally precedes legislative adoption.

c. When included in the General Fund, local governments should consider an oversight committee with authority to review and recommend how fund revenues are to be used.

Bonded Debt – The revenue sources listed above may be pledged to retire bonds issued by a local government. The use of debt leverages the funds needed for building tsunami evacuation infrastructure so that they can be built sooner rather than later. There are two types of bonds that Oregon local governments and districts may issue: general obligation or revenue bonds. Each carry different default risks and hence the interest rate associated with them varies accordingly. The revenue generated by one or more of the sources cited above may be pledged to pay debt service on either type of bond.

The most secure pledge a community can offer to bond buyers is a general obligation (G.O.) bond backed by an ad valorem (property tax) pledge. Oregon's constitution allows G.O. backed bonded debt for essential capital improvements even when the bond issue results in property tax assessments that exceed the State's 1.5% maximum limit on assessed value (see Measure 5). Voter approval is required for G.O. backed bond issues.

Revenue bonds do not require voter approval; legislative bodies (e.g. a city council or county commission) have authority to issue revenue bonds. Jurisdictions may seek voter approval for revenue bonds. Some jurisdictions in Oregon have a standing policy to do so when the bond obligation adds to their constituents' tax or fee burden.

Oregon laws regarding the issuance of public debt are complex. Consultation with legal counsel and financial advisors is strongly recommended from the outset. Given the complexity of this approach, the following sequence of steps portrays simplified sequence for implementing a capital program with debt financing. Using debt, however, may be the only way for communities that want TEI put in place quickly to get that result.

a. The local legislative body should discuss its preferences for financing TEI and the time horizon for having a functioning system in place. This will provide staff clear direction for exploring the use of debt to achieve implementation goals.
b. Hire outside financial and legal advisors to assist the community in analyzing the TEI program for elements that are suited to debt financing. It is likely that these will include "big ticket items with a long shelf life", such as structurally reinforced bridges and vertical evacuation platforms. Assess cost and revenue recovery strategies. Investigate state, federal, and private financing resources.
c. Establish a community-based task force to work concurrently with financial advisors to review debt-financing options. Use community and on-line forums to obtain feedback for alternatives.
d. Present recommendations to local elected officials and adopt an approach. Secure necessary local approval for issuing debt. This process would be similar to a community's issuing of debt for such things as a water or sewer plant. The League of Oregon Cities (LOC) may be a helpful resource here.

e. Move forward with budget authorization for securing revenue, selling bonds, and managing the debt-financed capital program.

Local Improvement District (LID) – Oregon law allows cities and counties to issue debt on behalf of private property owners to build necessary public improvements. The debt is retired through assessment collected from the benefitting properties. The assessments need not be ad valorem based (i.e., a rate applied to the property's assessed value). Many assessment methodologies are possible, such as the length of property fronting public right of way, the area of the property, or the prospective development density of the property. Approval by a majority of the benefitting properties is required as is willingness on the part of the local government to sponsor the LID.

Assessments generally are collected annually but the law allows for more frequent collection if voters and the sponsoring municipality agree to more frequent assessments. Collection is often contracted to the County Assessor but that arrangement is optional. With the advent of stronger development codes that exact public improvements from developers, and the use of SDC programs

for capacity-related financing, LIDs are used less frequently to finance infrastructure improvements.

In the right circumstances, however, LIDs can be a useful and creative financing tool.

LIDs take significant time and effort to set up and implement. Hence many jurisdictions in Oregon

have become reluctant to sponsor them. The League of Oregon Cities has resources that can help

guide sponsors through the LID creation steps. In summary, the sequence is as follows.

a. Property owners meet with the jurisdiction and propose an LID to address a specific need.
b. The sponsoring jurisdiction obtains an "engineer's report" that details the estimated cost of the public improvements, establishes a clear pathway to public ownership for the improvements after construction, and recommends a formula for allocating costs to the benefitting properties. The latter may require frequent meetings with the benefitting property owners, the majority of whom must approve the assessment methodology.
c. The sponsoring jurisdiction either obtains letters of consent from benefitting properties or schedules a vote to secure approval for the district.
d. If approved, the requisite legal process for selling bonds and collecting assessment is initiated. This can be time consuming, especially if a buyer for the bonds is not identified in advance.

6.4.2 - Public / Private Partnerships and Grants

Route Sponsorship – local, county, and state agencies have made use of sponsorships to finance maintenance of public facilities. For example, the clean highway program that ODOT has used to underwrite litter patrol of highways. Sponsors are recognized through signage and in other ways. This source likely is better suited to help underwrite operating costs than capital financing. Route

Sponsorship may be established using the following steps:

a. Develop a list of tsunami evacuation routes that are eligible for sponsorship. Prepare standardized cost and format for sponsor recognition (e.g. $500/year; name of sponsor shown on signs at specific vantage points.
b. Develop list of sponsor duties and a tracking system logging sponsor volunteer hours, if applicable (e.g. replacing route pavement decals, debris removal, replacing way finding signs). Develop job duties for issuing volunteer certificates and time reports to participants (e.g. 1099 forms).
c. Solicit sponsors and monitor compliance with sponsor agreements.

Public-Private Partnerships (PPP) – Oregon, Washington, California, and British Columbia have established a regional initiative to advance public private partnerships. Historically most PPPs have not involved shared capital risk. The public entity that owned an income-producing asset would sell the right to operate that asset to a third party (e.g. the sale of the Chicago Skyway Toll Bridge). New approaches to PPPs are advancing participation by both parties in construction as well as in operations. For example, the Portland Airport Light Rail line was built as a public-private partnership at about 1/3 the cost to build a similar length facility. The private contractor turned the line over to the transit agency after construction and received developable land adjacent to the line in exchange for its construction. A more conventional arrangement would be one where a design-build-operate agreement is signed for a toll road where public bonds finance the project and a private entity builds and operates the road. The private entity is responsible for making debt service payments in exchange for the exclusive right to operate the asset at a profit.

There is a non-profit organization that is helping promote this approach called the West Coast Infrastructure Exchange. The WCIX is working on several proposed projects in Oregon, which has a more favorable regulatory environment toward PPPs than other western states. One project that has been studied by the WCIX as a PPP is reconstruction of the Multnomah County Courthouse to address seismic risk. There may be opportunities for PPPs in tsunami risk areas. For example, a city in need of vertical evacuation could grant a private party access to public financing and the exclusive operating right to an observation deck and in exchange for building the structure.

There are various techniques local jurisdictions can use to help secure financing for private entities. They could issue certificates of participation (COP), sell bonds, or grant a long-term lease with guaranteed rents in exchange for private participation in the deal. As with public debt, these arrangements are complex and involve levels of risk that are not typical of most public financing arrangements. The concept is new, innovative, and evolving.

PPP's are currently unique, not yet well understood, and primarily will be enacted through complex contract agreements. An example PPP that may be applicable on the Coast would be if a convention center were to be granted approval to expand on the condition that the roof is designed as a public evacuation assembly area. Added revenue from events would finance the structural modifications necessary to accommodate evacuation and assembly.

Development Agreement – Developer agreements are often used to help finance public improvements that provide benefits to other properties beyond the boundary of a private development. In essence, the city uses private financing to build public improvements for which it does not have sufficient cash reserves. There is often a mutual interest in the improvement. A developer may want a small public plaza adjacent to a new building but not want to own and operate it long term. The city may also want the plaza and has the ability to maintain it but not to build it.

A common arrangement is when a developer may be asked to dedicate land and build a neighborhood park that not only serves the subdivision he/she is building but also other developed

and undeveloped properties in the vicinity of the project. The city and developer enter into an agreement where the developer is paid back over time for the park. The city may pledge revenue from a variety of sources including future park SDC payments generated in a specified area, or a share of the property tax payments that are collected in that area, or property tax credits on the unsold lots that the developer owns. The agreement may include an annual cap on the amount of these payments, and/or a cap on the total reimbursement paid, as well as a timetable on the

duration of the agreement. Developer agreements often include a renewal provision that extends the term of the agreement if certain conditions are not met, such as when the sum of reimbursement payments falls below some threshold.

Many cities adopt local rules for how and when developer agreements may be used. These rules typically limit the term of the agreements, establish the type of revenue that may be pledged to repay them, limit the type of public improvements that can be covered (e.g. parks, streets and sidewalks, traffic signals, trails, plazas, etc.), and set borrowing limits. The League of Oregon Cities is a good resource for information about these programs. Examples of their use may be found in Corvallis, Portland, Salem, Bend, Washington County, and many other cities throughout the state. For example, see http://www.bendparksandrec.org/Current_Projects/Park-Projects/Discovery_Park/

Developer agreements may provide a useful way to finance tsunami evacuation infrastructure, such as when evacuation routes require access adjacent to or through a private property and the improvement also would serve other properties. The general steps for setting up a developer agreement program are as follows.

a. Design and adopt an ordinance that outlines procedures for negotiating developer agreements, including what they may be used for, who is responsible for initiating them, and how they get approved. Include tsunami evacuation infrastructure as one of the eligible uses for developer agreement financing
b. List developer agreements as one of the potential financing tools in the local TEFIP.

These are not viable in towns without significant staff to help monitor performance and enforce the terms of the agreement.

Grants – There are a variety of public and private resources available to communities that confront disasters. Community resiliency and adaptation are emerging as important issues by grant agencies and foundations. More attention is being given by these resource agencies to help communities prepare for

and avoid disaster impacts rather than simply responding to them in the aftermath. Some resources to consider include:

http://www.rockefellerfoundation.org/grants

http://www.orinfrastructure.org/Infrastructure-Programs/Seismic-Rehab/

http://www.oregon.gov/OMD/OEM/Pages/fin_rec/Hazard-Mitigation-Grants.aspx

http://www.fema.gov/grants

http://www.oregoncf.org/grants-scholarships/grants

6.4.3 - Regulatory Options

Legal Exactions - The term "exactions" refers to a broad range of regulatory techniques used by local governments to require developers to contribute to the cost of community public facilities. Specifically, exactions require contributions toward public improvements that fall outside the boundary of the development (such as access roads or off-site drainage easements), or will serve larger segments of the community in addition to the specified development (such as new parks or a new evacuation route needed to adequately serve the area where the development is located).
The underlying and common legal issue with respect to fees, dedications, and exactions is the connection, also referred to as the "nexus", to the impact of land development. Without the nexus, land development regulations that impose exactions may be deemed unconstitutional takings of property without just compensation.

The United States Supreme Court has held that under limited circumstances, a government may have the right to limit certain uses, and invoke certain permit conditions and exactions if they are necessary to limit or avoid specific public harms threatened by the development. The Court has set forth a three-part test to determine whether an exaction results in an unconstitutional taking. To avoid resulting in a taking, an exaction must: 1) Substantially advance a legitimate public purpose; 2) Be based on an essential nexus between that purpose and the harm threatened by the proposed use; and 3) Be roughly proportional to the degree of threatened harm.

The public purpose advanced by exactions for tsunami evacuation improvements is to reduce life safety risk. New or intensified development within the tsunami hazard area will, by definition, place more people at risk from tsunami; thus the clear nexus for evacuation related exactions is to mitigate the harm presented by this increased risk. Proportionality can be addressed by establishing a process for evaluating the impacts of new development in terms of increased risk exposure, and identifying evacuation improvements or other measures that are roughly proportional to those impacts.

In adopting regulations that allow for tsunami evacuation system exactions, jurisdictions should incorporate findings in the land use decision that triggers the exaction that address these three requirements. Such findings should clearly articulate the purpose of the regulations, the essential nexus between new development and increased risk, and the process for determining proportionality. The tsunami evacuation facilities improvement plan provides a key foundation for

these findings and the establishment of regulation based exactions.

Typical exactions, which would be required as a condition of development approval, could include such things as dedication of a public easement through private property that provides an emergency egress to high ground, construction of a trail or pathway leading to high ground, or construction of an emergency evacuation road leading to an evacuation route.

To understand how a community might use an exaction that addresses evacuation needs in the process of reviewing a development application, consider the following example:

> A residential subdivision is proposed on an undeveloped property within the inundation
>
> zone; time modeling for this property contained in the TEFIP shows failed clearance time. The local Tsunami Hazard Overlay Zone contains a provision that allows new development proposals only where adequate clearance times for tsunami evacuation can be provided. It also contains standards for the construction and improvement of new evacuation facilities. In reviewing the proposal, the jurisdiction determines, through application of the time/distance modeling, that construction of a new evacuation route across a currently unimproved right of way located off of the development site will allow the new occupants of the property to evacuate within the required time.
>
> Based on these facts and the requirement of the local ordinance for adequate clearance times for new development, the jurisdiction approves the proposed project, but this approval is subject to a condition that requires the developer to construct the new, off-site evacuation route. This exaction is justified based on (1) the impact of the development; specifically the creation of greater risk by placing additional people within the inundation zone; and (2) the exaction directly reduces or mitigates this risk (impact) by providing adequate evacuation facilities. Together, these facts form the required nexus between the potential harm created by the development, and the exaction that serves to limit this potential harm. Proportionality is achieved by (1) identifying the type and level of improvements that are necessary to serve the evacuation needs of the development as set forth in the local standards; and (2) specifying in the condition of approval that the required improvements are to be constructed to meet this standard.

In establishing a process for imposing legal exactions, communities should consider the following:

- The land use regulating body should discuss the need for regulatory exactions first and provide staff with clear direction for drafting regulations.
- The type of exactions allowed should be clearly specified in the regulation.
- The approval criteria and findings necessary to trigger an exaction need to be spelled out in the local regulation.
- Regulations for exactions need to be adopted by ordinance into the local development code.

For more information about the steps to codify these requirements, see Chapter 4 of this Guidebook.

6.5: Develop and Adopt Tsunami Evacuation Facilities Improvement Plan

Like most planning documents that affect land development and the public infrastructure needed to support that development, the TEFIP must be adopted as part of the local jurisdiction's comprehensive land use plan in compliance with statewide planning goals.

ACTION STEPS:

1) Assemble the completed TEFIP based on the steps and processes outlined above. Analyze and identify revisions to the comprehensive plan, functional plans and implementing regulations needed to integrate the TEFIP priorities and standards into the community's planning process.
    a. Comprehensive Plan Text, Policies and Maps: Develop new or revised plan policies, text, and maps as needed to provide a clear linkage between evacuation policies and the priorities identified in the TEFIP.
    b. Functional Plan Revisions: Identify revisions to applicable functional plans (e.g., transportation system plans, public facility plans) to incorporate identified needs for tsunami evacuation infrastructure. For example, depending on the nature and structure of these functional plans, they should include or reference the list of tsunami evacuation improvement projects identified in the TEFIP Projects should indicate an approximate timeframe for construction and financing sources.
    c. Zoning Amendments: Implementation of some portions of the TEFIP require modifications to the local development regulations.. As needed, draft code revisions should be developed and included in the package of amendments to be adopted in conjunction with the TEFIP. New or modified regulations may alter the development review process and approval criteria in areas subject to tsunami inundation. For example, the development code may require that new developments that front tsunami evacuation routes must conform to the design standards for evacuation routes rather than for typical frontage improvements. These amendments must be adopted as part of the tsunami hazard overlay zone or other applicable area of the development code.

2) Adoption: The completed TEFIP and associated comprehensive plan, functional plan and land use regulation amendments can then proceed through the legislative review process following the post acknowledgement plan amendment (PAPA) procedure.

3) Capital Improvements: The TEFIP will recommend capital improvements to facilitate evacuations; these projects should be incorporated into the local capital improvement program (CIP). Most jurisdictions have an approved CIP process that consolidates capital projects into a common CIP program. This approach helps local governments coordinate capital investments and schedule them for inclusion into the budget. The Capital Improvement Program (CIP) must be revised to include specific tsunami related projects to program available funding. In some communities, this may be the annual city budget. In larger cities and counties, this will involve supplementing policies and procedures for the capital budgeting program that are used to commit resources to projects to make sure that tsunami evacuation projects are coordinated into the process along with other capital projects. In addition, when the proposed capital improvements require new financing to underwrite the capital program, the jurisdiction needs to adopt the related financing tools, such as SDC fees, local improvement districts, or special taxes and fees. Enacting the financial program to support TEFIP capital investment may take place incrementally over several years.

Outcomes:

1) Adopted Tsunami Evacuation Facilities Improvement Plan (TEFIP)
2) Adopted comprehensive plan and development code amendments as needed to integrate the TEFIP into the local land use process, including revisions to applicable functional plans.
3) Adopted revisions to the jurisdictions CIP and/or annual project budget.

CHAPTER 7:
Long Range Community Land Use Planning for Cascadia Event Tsunami

Chapter 7: Long Range Community Land Use Planning for Cascadia Event Tsunami

Adequately preparing for a catastrophic event, such as a Cascadia event tsunami, will require a comprehensive effort by an at risk community and will include many aspects of preparation including such things as education, family, emergency services, evacuation, economic, and land use. As indicated previously, this Land Use Guide concentrates on one aspect of community preparedness to a Cascadia tsunami event: land use options and strategies. This Chapter of the Land Use Guide is focused on land use options related to efforts to relocate key community facilities as well as more comprehensively planning for relocating higher risk uses.

Tip: This Chapter of the Land Use Guide is focused on land use options related to efforts to relocate key community facilities as well as more comprehensively planning for relocating higher risk uses.

7.1 Strategic Land Use Planning for Key Community Facilities/Uses (Goal 14 Urban Growth Boundary Modifications Relating to Tsunami Preparedness Planning for Key Community Facilities)

In the long term, communities should undertake a comprehensive risk-based approach to reducing exposure and vulnerability to all natural hazards that potentially affect the community. At the same time, it is recognized that additional resources are needed for such planning and may not be available within a community's window of need or opportunity to plan for moving critical and essential facilities. With that in mind, this section addresses specific and targeted relocation of key community facilities when it is necessary to amend the community's urban growth boundary (UGB) in order to accommodate relocation.

In 1995, the Oregon legislature established a statewide policy prohibiting the building of new schools, hospitals, fire and police stations and a number of other building types identified as "essential facilities" and "special occupancy structures" within the tsunami inundation zone; the inundation zone map establishing the area of this prohibition has been adopted by DOGAMI by rule (ORS 455.446-447). This prohibition has been implemented through the administration of the building code. However, to be consistent with local land use programs it is important to also address these limitations though the local comprehensive land use plan and implementing ordinances. This is particularly true when addressing planning for tsunami preparedness for key community facilities. As more and more communities work to increase their resiliency to tsunami risk, they will need to work through these land use siting issues, especially when suitable land is not available within the urban growth boundary which is outside the tsunami inundation areas. In these cases, OAR 660-024-0060 authorizes the establishment of site suitability criteria for key community facilities. These criteria would be applied at the time of a proposed UGB expansion and would function to limit the scope of the alternatives analysis for these new facility sites, required by Statewide Planning Goal 14, to locations above the tsunami zone. UGB amendments for the purpose of siting key community facilities would be required to develop findings which include the necessity of moving these facilities out of the tsunami hazard zone.

Tip: In 1995, the Oregon legislature established a statewide policy prohibiting the building of new schools, hospitals, fire and police stations and a number of other building types identified as "essential facilities" and "special occupancy structures" within the tsunami inundation zone.

The initial emphasis of community development planning efforts for tsunami preparedness usually focuses on certain critical facilities. Generally, these are buildings or facilities which, due to their occupancy, pose significant life safety risks (e.g. schools, care facilities, high occupancy assembly buildings) or which must remain operational post-event to provide critical response services (e.g. hospitals, emergency operations centers, etc.). In some communities, relocation of these types of facilities to areas outside of the tsunami inundation zone may require bringing additional land into the urban growth boundary (UGB). Goal 14 provides for the specification of suitability characteristics for particular land uses for purposes of determining land need during the need analysis phase of the UGB amendment process. The reduction of risk exposure of critical facilities and key community facilities from catastrophic hazards can be a suitability characteristic which is sufficient to justify expansion of a UGB in order to accommodate relocation. The same suitability characteristics for specific land needs are to be applied both when the city reviews alternatives within the UGB (OAR 660-024-0050) and when the city considers alternative boundary locations (OAR-660-024-0060).

Vacated Sites

Exposure to tsunami hazard can be used as a basis for establishing a land need for the relocation of certain facilities under Goal 14 and OAR 660, Division 24, provided that this need is established within the context of overall risk reduction so that vacated sites are not redeveloped for other high risk exposure uses.

Tip: A hazard-based justification for new key community facility sites must be viewed as just part of an overall approach to reducing community risk.

Although tsunami hazard mitigation may be a sufficient basis to establish a land need under Goal 14, a significant caveat to this is that the "vacated" sites resulting from the relocation should be limited by the jurisdiction to uses that are low risk or that can be appropriately mitigated for seismic and tsunami risks. This limitation of future uses on vacated sites is based on the important principle that a hazard-based justification for new key community facility sites must be viewed as just part of an overall approach to reducing community risk. Obviously, allowing the redevelopment of vacated sites for new high-risk urban uses (e.g. hotels or high density residential) would be contrary to that principle. The types of land uses that should be precluded from establishment on vacated sites would be at least the same as those identified as appropriate to establish a Goal 14 land need for relocation. The list of uses set forth in ORS 455.446-447 provides a baseline for these uses in that it identifies uses that are prohibited in (and by inference, justified to be relocated from) the tsunami hazard area. Based on risk exposure, other uses that should be considered for this list include hotels or lodging facilities, and high density (e.g. greater than 10 units per acre) residential. In general, new higher density residential and lodging facilities should not be located in vacated site areas. However, it may be possible to allow these uses if they are of such a scale and built to such a standard as to include a tsunami evacuation structure constructed consistent with appropriate design requirements. In addition, redevelopment planned or proposed for vacated sites should be required to clearly demonstrate that proposed uses are consistent with - that is, will not reduce, or will improve – the capacity to effectively evacuate the site and adjacent areas in the event of a tsunami.

Certain community facilities such as police and fire facilities and hospitals should be "life safe" and fully operational immediately following a Cascadia event earthquake and tsunami. Other facilities such as schools and emergency shelter type facilities need to be "life safe" and usable during repairs immediately following a Cascadia event earthquake and tsunami. This means that communities should plan to site these types of facilities in a way to avoid any risk to life and should be sited in a way to avoid most if not all inundation risk.

Tip: Certain community facilities such as police and fire facilities and hospitals should be "life safe" and fully operational immediately following a Cascadia event earthquake and tsunami.

Department of Land Conservation and Development (DLCD) staff can help communities working through these issues. Please do not hesitate to coordinate with the Department on any UGB issues relating to increasing community resilience to a catastrophic tsunami event.

7.2 Comprehensive Pre-Disaster Land Use Planning for a Catastrophic Tsunami Event

OAR 660, Division 21 (Urban Reserves) provides for a method for coastal communities to plan for long term reduction of exposure and vulnerability to natural hazard risks, especially tsunamis. Urban reserves may improve "post tsunami resiliency" of communities by helping to relocate existing community facilities exposed to tsunami risks. As part of this planning process a community will need to address "vacated" areas by limiting new uses allowed in those areas to low risk uses, or those uses that can be appropriately mitigated for seismic and tsunami risks. The Department of Land Conservation and Development (DLCD) will assist and support communities seeking to use urban reserve planning for post tsunami disaster resiliency.

In part, the purpose of urban reserves is to "… authorize planning for areas outside urban growth boundaries to be reserved for eventual inclusion in an urban growth boundary and to be protected from patterns of development that would impede urbanization." This purpose is consistent with the critical need for coastal resiliency planning. Communities who wish to use this tool will be planning for efficiently "moving" portions of the community, over the long term, and to quickly and more comprehensively move portions of the community after a disaster.

In any urban reserve planning effort a community must address and meet all applicable requirements of Division 21. A community, for example, in determining the amount and location of land to be included in urban reserves, must follow general procedures used for determining a 20-year UGB under Statewide Planning Goal 14 and additional requirements of the Division. All farm and forest land protection requirements would remain applicable for land designated urban reserve – it is not "urban land" unless and until the UGB is amended and the land included.

Any community resiliency planning effort that results in the relocation of community land uses will need to plan for appropriate uses in "vacated" areas resulting from relocation. A community should only allow uses on these areas that are lower risk or that can be appropriately mitigated for seismic, tsunami, and other natural hazard risks. This limitation of future uses on vacated sites is based on the important principle that a hazard-based

Tip: Any community resiliency planning effort that results in the relocation of community land uses will need to plan for appropriate uses in "vacated" areas resulting from relocation.

urban reserve justification must be viewed as part of an overall approach to reducing risk in the community. Allowing the redevelopment of vacated sites for new high-risk urban uses (e.g. hotels or high density residential) without adequate mitigation would be contrary to that principle.

Tip: An effort of this type will likely need to utilize appropriate education and outreach efforts, and require cooperation and support from a large number of property owners.

The land use processes within OAR 660, Division 21 are comprehensive in nature. They represent a significant potential effort with substantial citizen involvement and input. An effort of this type will likely need to utilize appropriate education and outreach efforts, and require cooperation and support from a large number of property owners. Although this type of effort will provide some high risk communities with the land use tools necessary to comprehensively address resilience to a local tsunami event it will likely include controversy and community debate.

Department of Land Conservation and Development (DLCD) staff can assist communities that wish to explore this comprehensive plan use option further. Please do not hesitate to coordinate with coastal Department staff on urban reserve planning relating to increasing community resilience to a catastrophic tsunami event.

CHAPTER 8:
Other Resources

Chapter 8: Other Resources

In development of this Land Use Guide various additional resources were found from a variety of sources including internet research, interviews, and feedback from state agencies and local governments. The following list provides references to the most pertinent of these resources. Click on the links below for each resource to access the document or website. To view all the source documents in one location, go to http://www.oregonlandusetraining. info/tsunami-resources.

- Applied Technology Council. "Vertical Evacuation from Tsunamis: A Guide for Community Officials." Federal Emergency Management Agency, National Oceanic and Atmospheric Administration," June 2009. http://www.oregonlandusetraining.info/tsunami-resources/TsunamiVertical_EvacuationGuide_FEMA2009.pdf
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Appendices:
Related to Chapter 6

Appendix A: Terms and References

Fund Accounting Terms:

- General fund (GF) – money which may be used at the discretion of the local governing body (city council, county commission, etc). Local government examples include property taxes and interest income on GF revenue.
- Special revenue fund – money that is restricted by law or contract, such as money from a state or federal grant whose use is limited to a specific purpose. E.G. state-shared gas tax revenue; local lodging tax receipts.
- Enterprise Fund – revenue collected for city services that are supposed to be self-supported and operate like a business. E.G. city water utility.
- Sinking Fund – money reserved in a special fund whose use is limited to a specific program or purpose. May be used to save money for capital projects, such as a *Library Capital Reserve Fund*, or a *Water Fund System Development Charge Account*. Restrictions on the use of money in sinking funds vary based on third-party limitations, budget notes, and the language in the ordinance that created them.
- Reserve Fund – used to provide cash reserves for emergencies. They sometimes are called a "rainy-day fund. Bondholders often require local government borrowers to establish and maintain a debt service reserve fund at a certain level (e.g. 1-year of debt service) to ensure money is available to meet future payment obligations. Operating reserves balance seasonal variances between revenues and expenditures.

Appendix B – Local Government Financing Techniques

A. Property taxes – local municipal governments, ports, and special districts may elect to collect property taxes, which is expressed as a tax rate per $1000 of real and personal property value. They are often referred to by the Latin term "ad valorem" taxes. This revenue flows into the jurisdiction's general revenue fund and it may be used for any purpose allowed by law for that local government. Oregon's constitution sets limits on the tax rates and value of property to which these rates may apply. New taxing districts may be formed and set their own tax rate, subject to voter approval and state-wide valuation limits.
B. Utility Service Fees – fees charged by city, county or special service districts to finance utility operations as well as savings (sinking) funds for capital projects and debt service for capital programs. Most municipal utilities in Oregon provide water and sewer services but a growing number of communities have adopted transportation utilities, park service fees, and storm water management fees. Fees may include operating and capital components. They may be enacted by local ordinance and typically are accounted for in an enterprise fund.
C. Systems Development Charges (SDCs) – state law allows local governments and special districts to collect fees from new development to pay for the cost of expanding infrastructure systems to serve new growth and development. Local system master plans establish the levels of service (LOS) for each system and the development fees can only charge rates that maintain existing levels of service. There is flexibility to redefine qualitative measures that make up the base-line level of services. For example, the park system LOS may be based on a certain number of acres per 1000 residents, but the local jurisdiction can modify its standards for the amenities that need to be in each park. In this way, SDC rates can increase without altering the basic LOS measure. By redefining the attributes of the transportation system or park system, service providers may be able to include infrastructure improvements that primarily address a transportation or recreation need and also address an emergency evacuation need. As a fee, SDCs may be enacted by local ordinance.
D. Lodging Tax – a state-wide tax is collected from purveyors of transient lodging services (hotel/motel tax). Local governments may add their own tax to the state's 1% tax. For lodging taxes adopted after 2003, 70% of local tax revenue must be spent on tourism or tourism-related facilities. Legal question have been raised for what constitutes a tourism facility. The other 30% of the local revenue is unrestricted. The tax may be enacted by local ordinance through legislative action (city council or local board approval).
E. Local Excise Taxes (e.g. gas tax, food and beverage tax, real estate excise tax) – Oregon has no state sales tax but local governments may impose local sales excise taxes when approved by voters, or when allowed by state law. In 1990, Ashland voters approved a 5% local tax on the sale of prepared food and beverages. Many Oregon cities have

enacted a local tax on the sale of motor fuels to supplement state-shared gas tax receipts. Use of these excise tax revenue is subject to local ordinance restrictions. For example, most local fuel tax ordinances require that the revenue be used for street system maintenance and/or capital improvements. Ashland's food and beverage tax is dedicated to buying park land (1%) and to offset debt service for a sewer plant upgrade (4%).

F. Urban Renewal – sometimes referred to as tax increment financing (TIF), this money is generated by "freezing" the property assessed value for general government use. As property values in the district rise, the total property tax generated increases. The increment above the frozen base level is used to finance planned public improvements and programs. TIF financing can be controversial but also can be an effective way to finance special projects in areas where property values are expected to rise.

G. Debt financing – there are many ways local governments can borrow money to pay for capital projects when there is insufficient cash on hand. Usually, the local government sells bonds to a financier and uses the sale proceeds to build the project. Local taxes and fees are pledged to retire the bonded debt over time. There is a hierarchy to bonded debt. The highest level of security a local government can offer a creditor is a General Obligation (GO) bond, which is backed by the full faith and credit of all property owners. GO bonds may be retired using property tax assessments, or other dedicated revenue sources. The bondholder has the assurance that if revenue from one source falls short, the community is obligated to tap any and every means necessary to meet the debt service obligation. GO bonds require voter approval. Cities also may issue revenue bonds and notes. These offer the creditor less security and therefore carry higher interest rates. They typically do not require voter approval, although some local home-rule charters may require voter approval for debt issued above a certain level regardless the type of bond.

H. Local Improvement Districts – Oregon allows cities to act as agents for its citizens for financing improvements in special assessment districts where only the residents and businesses in that district pay to finance the debt. Sometimes called Bancroft bonds or local-improvement districts (LIDs), the bonds sold to pay for local improvements traditionally are financed by special assessments on the property owners in the district. The assessments need not be ad valorem (property value) based; other measures of "benefit" could be used to determine the assessment.

Table B-1 Summary of Financing Resources

Financing Tool	Source	Type	Reliable	Strength	Weakness	Implementation	Examples
Property taxes	General Fund or Special Assessment	Tax	High	"Progressive" given higher value properties contribute more	Demands on GF and discretionary review make them difficult to rely on over time; constitution limits growth.	Easy – councils and boards have annual discretion over their use but competing demands may limit ability to sustain investment over time.	Contact League of Oregon Cities
Service fees	Monthly charges or one time fees	Fee	High	Equitable, reliable, program beneficiaries bear the cost.	Collection costs can be high; time consuming to implement and administer.	Easy to hard depending on the issue and local setting. Put into effect by local ordinance.	Contact League of Oregon Cities
User Fees	Parking permits, etc.	Fee	Medium	Those that use facilities pay; generates revenue from visitors;	Revenue varies with demand for the service.	Easy to hard depending on the issue and local setting. Put into effect by local ordinance.	Oregon State Parks; City of Portland
Income tax	General Fund	Tax	High	"Progressive" when higher income earners contribute more.	Expensive to collect; does not generate contributions from visitors;	Difficult; requires voter approval.	Portland, State of Oregon
GO Bond	Various	Tax	High	"Progressive" given higher value properties contribute more	Time consuming and expensive to "sell" to the public.	Difficult; requires voter approval.	Contact League of Oregon Cities

Financing Tool	Source	Type	Reliability	Strength	Weakness	Implementation	Examples
Revenue Bond	Various	Local	High	Generates funding up front for projects that otherwise would have to wait a long time to accumulate cash reserves.	Carry higher interest rate than GO bonds; requires debt-service reserves and other financial requirements that may affect rates and fees.	Moderate – can be approved legislatively but requires significant legal and financial analysis and legislative "investment".	Contact League of Oregon Cities
Gas tax	Local sales tax	Local/ Regional Excise Tax	High / Medium	Generates revenue from visitors and pass-through traffic as well as local; once approved easy to collect.	Unpopular with voters. Requires significant public-outreach to "sell" the idea. Capital spending on non-auto improvements are unpopular; shift to electric and high-mileage cars is eroding revenues.	Difficult. Requires voter approval.	Stanfield, Milwaukie,
Sales/ Excise taxes	Targeted local sales tax	Local/ Regional Excise Tax	High	Predicable during "normal" economic cycles.	Take time to "sell" to the electorate; cyclical downturns when economy is down	Difficult. Requires local voter approval.	Ashland, OR; Metro
Lodging tax	Tax on short-term lodging	Local Excise tax	High	Clear authority to collect and apply locally.	70% of revenues restricted; "Tourism-related" use may limit spending on tsunami evacuation infrastructure.	Easy. The state-wide fee makes monitoring compliance and collecting easier.	Contact League of Oregon Cities
System Development Charges	Special Revenue Fees	Develop-ment Fee	Medium to Low	Work well in growing communities.	Capital only, cannot finance operations; can only finance growth-related cost to maintain current level-of-service.	Medium. Requires professional assistance ut cost to set up may be recovered through the fee program.	Bend, Hillsboro, Newport.

Financing Tool	Source	Type	Reliability	Strength	Weakness	Implementation	Examples
Tax Increment District (Urban Renewal)	Property taxes	Local	Medium	In growth areas provide revenue for special projects that can enhance redevelopment opportunities and economic vitality	Deep seeded opposition to TIF districts by some taxing districts and some voters; can not finance operating costs; take time and money to set up.	Public vote required in many communities; budget and accounting systems.	Canby Downtown and Industrial Area URD; Bend Juniper Ridge URD;
Sponsorships	Private	Local	Medium	Leverage private funding for investment/maintenance of public assets.	Sponsorships may be hard to sustain over time; need to monitor and renew pledges and find new sponsors.	Legal agreement between sponsor and local government with performance requirements and penalties for non-performance.	ODOT; Oregon Parks

Appendix C – Governance and Equity Considerations

A fundamental question likely to emerge when discussing how to plan for and build tsunami evacuation infrastructure is which public entity(s) should be responsible for coordinating and underwriting public investments? Should each community bear responsibility for constructing their evacuation assets? What about unincorporated places; is the county responsible for those places? Should there be a regional entity that has a role in coordinating this process, such as a Council of Governments, special service district, or a coalition of communities? What role should the state play? Every county in Oregon already has an emergency management program in place; should they be in charge of the program or just provide technical assistance? What additional legal authority and responsibilities need to be put in place to ensure that the commitments made by local entities are carried out? Should communities be allowed to do nothing?

The importance of these questions will never be more apparent and looked at with greater scrutiny than in the days after the next Cascadia Subduction Zone earthquake and tsunami. We cannot say at this time what that assessment will be but given what we now know about the risk, what should be done to minimize the loss of life and property? Public officials face a difficult task. Public resources to plan for and finance emergency systems are scarce but when disaster strikes the questions raised always include an examination of what was not done and why?

One question that public officials should consider is should evacuation assets be developed for all areas or is the cost so high for some areas that it makes more sense to admit the cost is too great and simply let people living there know about the risk they assume while there? Do public entities that choose this approach bear added liability if, knowing the risk of catastrophic loss, they continue to plan for and permit development in these areas? Are there places where the risk is so high that we should consider abandoning development there?

After the 2012 tsunami in Japan, which was triggered by a 9.0 subduction zone earthquake like Oregon will experience someday, Japan embraced the later choice in areas where the loss of life and property was extraordinary. These areas are not being redeveloped the way they were. There are parts of Oregon that have similar level of development and risk characteristics to the most devastated communities in japan. In these areas, should we build “interim” evacuation resources with the intention that over time they will depopulate? Should communities decide on their own what level of risk they are willing to assume? Should we appoint a state or regional agency to make? these decisions because a third party can more easily balance risks and costs between high impact and low impact areas, between high-cost vs low cost locations, and

between rich and poor communities? The answers to these questions are evolving. The point here is not to answer them but to explore the pros and cons of various governance and financing solutions.

One thing is clear: most Oregon communities are not well prepared for a 9.0 subduction earthquake and tsunami. Even communities that are better prepared, like Seaside and Cannon Beach, who have not operated their evacuation investments for a long enough period of time to fully understand the level of commitment needed to sustain them over time. Sustained investment in the necessary systems to evacuate and care for tsunami survivors, which may require a century or more of sustained investment, is an extraordinarily challenging undertaking.

It is not clear which approach is best; different approaches have their own strengths and weaknesses. It also is clear that we are dealing with dynamic circumstances that will change over time. However DOGAMI maps are "best available information" and changing sea levels (chronic hazards) will not likely change catastrophic tsunami maps. Even with this, socio-economic and regulatory schemes are likely to change and affect local plans. Hence, the response by local governments and type of infrastructure investment decisions made will need to be re-examined and adjusted over time.

Governance

The following table reviews some of the strengths and weaknesses of various governance approaches for building and financing evacuation infrastructure. Different ratings may be appropriate for other tsunami response needs, such as care for survivors and restoring the built environment afterwards. Those issues are no less important but they are beyond the scope of this analysis.

Type	Strength	Weakness
City	Local control and ownership, access to financing, able to experiment with solutions, permitting/enforcement authority	Geographic limits, conflicting priorities, access to essential expertise, economic disparity
County	Access to financing, regional perspective, not constrained by city boundaries,	Conflicting priorities, unaccustomed to servicing urban environments
Special District	Dedication to single purpose,	Unclear legislative authority, asset ownership,
County Service District	Regional perspective, ability to develop/operate multiple services, flexibility, permitting/enforcement authority, financing,	Governance and budget oversight rests with county,
Regional Entity	Regional perspective, common purpose,	Unclear path to enacting, unclear financing authority, unclear governance authority
State Agency	Regional perspective, financing, balancing competing interests, technical expertise,	Slow to respond to changing conditions, creativity, legislative /rule making process,
Public/private	Creativity, access to private	Geographic limits, case by case

Partnership	and public capital, solution tailored to local need.	solution, time consuming to develop.

Fiscal Equity

Fiscal equity is important to every public financing decision. Citizens, businesses and elected officials should question the fairness and equity of the approaches being considered for financing evacuation infrastructure. While communities and policy makers need to consider the implications of their financing strategy, perfect equity is never possible. At some point, the debate needs to end and a course of action taken. The first course of action is to seek grants but beyond that the issue boils down to one question: should we finance the local share with a fee or a tax?

There is a legal difference between public fees and taxes. Fees are held to a higher "fairness" test, which requires a "rational nexus" between the amounts of the fees, the cost of the service provide, and the benefits provided to the rate payers. Fee revenue also may be spent only on the service for which the fee is collected. Taxes, on the other hand, do not require a proportional nexus between the amount paid and the benefit received. The following light-hearted examples illustrate the difference.

Fee Example: City "A" collects a Pet Environmental Service Fee. The revenue is used to clean up city dog parks and to pay the cost of treating pet waste. The fee was calculated after a year of data collection and analysis that determined how much time and material city park workers used cleaning up dog parks, and the cost to treat pet waste based on samples taken at storm water treatment facilities and at the sewer plant. Pet owners must register animals with the city – that is free – and then pay a monthly fee. The fee for cats is more than the fee for dogs because while there were no cat sightings at dog parks sampling showed that the percentage of pet waste being treated at the treatment plant was greater for cats. The analysis considered the marginal difference in sewerage treatment costs for pet vs. non-pet households. The final rate was calculated by dividing pet clean up and treatment costs by the number and type of registered pets. The revenue goes into an "enterprise fund" that can only be used for pet cleanup. There was no vote; the City Council adopted the program by ordinance.

Tax Example; City "B" collects a tax on the sale of pet food and pet paraphernalia (e.g. dog collars, pet play toys, etc.). The tax is 1% of the sale amount. The tax was approved by a public vote per state law. The tax revenue goes into the city's general fund. The city council decided that ¼ of the money should be used to maintain dog parks and ¼ on storm water facilities. The rest of the money is used for debt service on bonds sold to upgrade the sewer plant. When the bonds are retired in two years, the measure instructs the city council to use tax proceeds to mitigate environmental impacts caused by pets. The council has been discussing ways to pay for pigeon management in the town square. The city attorney said pigeons may be considered "pets" because people feed them.

These tongue in cheek examples illustrate differences between fees and taxes. The equity test is higher for the fee. By law, however, voter approval is not needed to enact fees. The City "A" fee program has a rational nexus between the fee, its use, and the proportional allocation of costs. Some residents may not like the program, but the rational for who pays the fee, how much they pay, and how the money is used are tied together in a rational policy framework and methodology.

The City "B" tax seems kind of arbitrary in the way the money is spent. Cat owners may feel they do not get much benefit from the program. Dog owners may like the dog parks but probably complain that there is no logic in using pet taxes to manage pigeons. Pet owners, however, have no legal recourse to challenge the program's fairness because it is a tax, not a fee. They could complain to "the court of public opinion" but they lost the battle when the voters passed the tax.

Fairness questions arise whenever people are asked to contribute to a public cause and divergent opinions always seem to emerge regarding cost-benefit.

Appendix D – Life Cycle Analysis, Sensitivity Analysis, and No-Build Solutions

Some communities may find that in certain areas the cost to design, build, and maintain evacuation infrastructure is so high that the prospect calls into question the rationale of allowing large scale development. This poses a complex and difficult set of choices. If the cost to build viable evacuation infrastructure is too high to implement, what risk/liability does the community incur by choosing not to build the evacuation infrastructure but also allowing development to proceed in line with current land use plans?

One method that can be used to assess the choices related to this conundrum is to examine the cost to build the evacuation assets and compare that to the cost to manage the risk by altering, reducing, or eliminating the need for evacuation infrastructure. A variety of planning and economic techniques may be used in the analysis, such as those used to conduct environmental impact statements, which analyze a range of alternatives. These analyses may use both objective economic factors to compare relative costs and subjective criteria for comparing the impacts and benefits of alternatives.

An example scenario where this type of analysis could be useful would be planned development in a coastal plain where there is no possible way to reach high-ground within the time available. Vertical evacuation would then be the only viable solution but it may be complicated by soils that cannot support the weight of a tower and platform without heavy foundation improvements whose reliability is not well understood. An alternative to building the evacuation tower would be to re-plan the area for alternative uses that pose less risk. That solution may require re-writing the local land use plan and development regulations. Options could include significantly limiting any new development or adding restrictions that only allow development with private insurance and signed waivers/disclosures by existing and future property owners concerning the risk. Benefits of a restrictive approach might include avoided or reduced public costs, improved wildlife habitat, and reduced emergency management cost in the aftermath of a disaster.

The complexity of this issue in a generic sense is very high and the number of locations where it might be necessary is limited in Oregon. Detailed guidance is not provided here for how conduct such an analysis. Instead, if this becomes an important issue within a jurisdiction, it is recommended that local evacuation plans identify the circumstances that could merit more in-depth review of alternative approaches to conventional evacuation planning and infrastructure investment. Local jurisdiction would then develop a work program for analyzing an appropriate response with local property owners, investors and public agencies. The need for these supplemental plans should then be included in the local TEFIP and identified as a follow-up project to implement the plan. The project would include analyze project costs and benefits to assess areas where

the cost of evacuation is extremely high relative to other areas; preparation of a

project description for conducting a follow-up analysis to determine an appropriate solution; and include the cost to carry out this project and the timing for completing it in the TEFIP implementation plan.