Adapting to Coastal Erosion Hazards: A Plan for the Community of Neskowin

July 2012

DRAFT, Revision 3

Tillamook County Department of Community Development

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http://www.co.tillamook.or.us/gov/ComDev/

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Preface

This report is the result of study and examination by the Neskowin Coastal Hazards Committee (NCHC). The NCHC is a Tillamook County *ad hoc* committee formed to respond to the present erosion threat from the ocean in the county and to the beach and community of Neskowin. Since its inception in Fall 2009, the committee has met monthly, with sub-committees meeting more frequently. There have been public meetings to garner feedback and many sessions with experts to gain input, all of which have contributed to this report.

The NCHC has been guided by its mission statement in its work and the mission is evident throughout this document. The mission and objectives of the committee are as follows:

Mission: The mission of the Neskowin Coastal Hazards Committee is to—in priority order--plan ways to maintain the beach and protect the community through short term and long term strategies; recommend to state and county agencies and officials ways to maintain the beach and protect the community; and explore ways to plan for and adapt to the potential future changes in the Neskowin coastal area.

Objectives: 1) Become more knowledgeable about past and current dimensions of the situation and study expert projections for the future. 2) Provide information to alert Neskowin beach users to potential dangers of coastal hazards. 3) Investigate options (short and long term) for maintaining the beach and preserving the community. 4) Publish Committee findings and advocate actions likely to be most effective in fulfilling our mission. 5) Help garner support and resources necessary to implement agreed upon actions.

The next step in the development of this plan is for the Neskowin Citizens Planning Advisory Committee (CPAC) to solicit community input and support, and develop implementation steps, including public communication, education, and ultimately any necessary ordinance and community plan changes to be adopted by Tillamook County.

It should be noted that this draft plan is specific to Neskowin but is part of a much larger county and state planning effort. This draft plan is intended to be a "sub-plan" of the countywide adaptation plan that is being developed concurrently. The Department of Land Conservation and Development may also use the product of this committee in other communities on the Oregon coast.

This report examines the land use recommendations and active protection measures separately, though knowing they are intricately intertwined. The NCHC will continue to explore the active protection recommendations until they are fully developed and ready to be shared with the community. Options for implementing these recommendations will also be developed and shared at that time. Land use recommendations listed in this report have been developed to the extent possible by this committee and will now be reviewed and processed by the Neskowin CPAC.

Special thanks to Mark Labhart, Tillamook County Commissioner, who has been chairman of the committee and liaison to numerous federal and state agencies, and without whose leadership this plan would never have been developed. Credit for the development of this plan also goes to Bill Busch, Larry Glickman, Randall Koch, Dave Kraybill, Gale Ousele, Pete Owston, Guy Sievert, Alex Sifford, and Charlie Walker, all Neskowin residents; Pat Corcoran, an Oregon State University Sea Grant Extension Coastal Hazards Outreach Specialist, who organized and facilitated our meetings; Tony Stein, Coastal Land Use Coordinator at State of Oregon Parks and Recreation; Laren Woolley, State of Oregon Department of Land Conservation & Development, Coastal Shorelands Specialist; Valerie Sutton (Soilihi), past Tillamook County Community Development Director; and Dr. Jonathan Allan, Coastal Geomorphologist, Coastal Section Leader, State of Oregon Department of Geology and Mineral Industries, Coastal Field Office, who has shared his resources with the Committee.

A special thanks also to Mitch Rohse, who compiled the first draft of this document under a grant from the Oregon Department of Land Conservation & Development.

1. Introduction

In January of 2009, the Coastal Management Program of the Oregon Department of Land Conservation and Development (DLCD) issued a report on the potential impacts of climate change on coastal communities (see "Climate Ready Communities" http://www.oregon.gov/ENERGY/GBLWRM/docs/climate_ready_communities.pdf). The draft document presented here was prepared by the Neskowin Coastal Hazards Committee (NCHC), representing its best analysis on how to respond to the coastal erosion hazard threats identified in the DLCD report; in this case, specifically for the unincorporated community of Neskowin, Oregon. It is intended for use by the residents and property owners in Neskowin to review and revise based on additional community input and to incorporate into the Neskowin Community Plan last reviewed by Tillamook County in 2001. This draft responds to the broader coastal hazards Framework Plan draft recently developed for Tillamook County[1] in a way that is specific to the challenges that face the Neskowin community. The next review process for this draft plan will be overseen by Neskowin's Community Planning Advisory Committee (CPAC). The final draft will be submitted by the CPAC to the County Planning Commission for review and eventual approval by the County Board of Commissioners.

This plan was initially drafted for the NCHC with the support of a federal grant awarded by the Oregon Coastal Management Program (OCMP) of the DLCD. Laren Woolley, DLCD's Coastal Shores Specialist, was project manager. Planning Consultant Mitch Rohse was the lead author.

The current draft plan for Neskowin is a result of information, ideas, and comments provided by the NCHC, a Tillamook County *ad hoc* advisory committee chaired by County Commissioner Mark Labhart. From its inception in the Fall of 2009, this committee, consisting of state and county officials and local community members, with significant support from Oregon State University (OSU) researchers, has met monthly and spent countless hours learning more about coastal erosion hazards faced by Neskowin (Chapters 2 and 3) and exploring possible methods for dealing with them (Figure 1).

Two subcommittees of the NCHC were especially active in helping to prepare this plan. The Active Protection Subcommittee conducted extensive research and analysis of structural and engineered hazard-alleviation techniques (HATS) as well as non-structural HATS such as beach nourishment that might be used in Neskowin. The results of that effort are reflected in this draft plan's chapters on HATS (Chapter 4) and implementation strategies (Chapter 5). The Land Use Subcommittee of the NCHC researched and analyzed policy, planning, and land-use HATS for application within the community. That subcommittee's work is seen mainly in Chapter 5.

This process of recommending both engineered and land-use responses to the potential hazards of future climate change is meant to promote local community participation with an opportunity to customize future actions to community needs and wants.

[1] *Adapting to Coastal Erosion Hazards in Tillamook County: Framework Plan, Final Draft, June 10, 2011*. This will be cited throughout this draft document as the "Framework Plan."

Figure 1. The Neskowin Coastal Hazards Committee meeting at the Neskowin Valley School, May 11, 2010.

The NCHC accepted the evidence that climate changes are affecting wave height, storm intensity, and sea level. The committee did not see any value in debating the causes of climate change. Rather, the committee used evidence of changes in the ocean and in storms over the last 30 years and projections of what the next 50 years may bring. These are projections based on the best available science, and the committee recognizes that this evidence may change as additional information is gathered in the future. Nevertheless, the committee believes that it is best to plan for the possibility of increased threats before they happen. Thus, this draft plan is, first and foremost, about preparedness. It is hoped that this is the first of a number of such plans to be developed by and for the communities that line Tillamook County's coast and face the prospect of erosion and related flooding from the Pacific Ocean.

Although some of the information that follows has some indirect applicability to tsunami preparedness, it is primarily a plan for dealing with year-in and year-out coastal erosion hazards rather than catastrophic events related to earthquakes and tsunamis. These latter issues are being dealt with by governmental emergency-management entities.

1.1 How Neskowin's Coastal Erosion Adaptation Sub-Plan Came About

During the early 1990s, as Neskowin's Community Plan was being written, coastal erosion was not a concern. The plan did note that, "Most of Neskowin is in the coastal lowlands, which are underlain by easily eroded sediments such as sand dunes."[2] But only a few properties in South Neskowin and The Point had or needed shorefront protective structures such as riprap to protect them from coastal erosion. The great majority of shorefront properties—the lots, cottages, condos and motels atop the main foredune—were protected by a broad expanse of beach. It seemed that the great buffer of sand would last forever. The plan concluded:

> Neskowin's beach is relatively stable, with no net loss or gain of sand on an annual basis. Summer waves generally replace sand lost in winter.[3]

The perception of the beach as "relatively stable," however, was changing even as those words were being written. By the turn of the 21st Century, rising sea level had come to be today's fact rather than tomorrow's theory. Winter-storm wave heights (a key factor in coastal erosion) were increasing dramatically. Geologists discovered solid evidence that Cascadia Subduction Zone earthquakes had caused our coastal shores to suddenly drop several feet in the not-so-distant past and seems likely to do so again. The State's Department of Geology and Mineral Industries (DOGAMI) began monitoring erosion along the Oregon coast with new methods and instruments. Eventually, the monitoring revealed that portions of the beach at Neskowin had retreated by more than 50 meters (164 feet) during the decade from 1997 to 2008. During this period, several powerful winter storms caused dramatic narrowing of the beach and erosion of Neskowin's foredune.[4]

The most dramatic of the storms occurred in February and March of 1999. Off-shore wave heights reached 13 meters (42 feet), waves overtopped Neskowin's foredune, and the dune escarpment in some places receded several feet per day, cutting deeply into yards of some shorefront properties.[5] In response, owners of shorefront properties in the main part of the village installed riprap. They did so largely under the provisions of a new set of administrative rules that were adopted in 1998, enabling property owners to obtain permits to install riprap when "property is in imminent peril of being destroyed or damaged by action of the Pacific Ocean or waters of a bay or river, landslide, or other natural disaster."[6]

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[2] *Neskowin Community Plan*, Appendix A, page A-1.

[3] *Neskowin Community Plan*, p. 37

[4] The forces and trends summarized here are described in detail in chapters 5 through 8 of Tillamook County's *Adapting to Coastal Erosion Hazards in Tillamook County: Framework Plan,* Final Draft, June 10, 2011.

[5] For a detailed account of these storms and the installation of shorefront protective structures in Neskowin during the late 1990s, see *The Effectiveness of the Emergency Rules of 1998, As Implemented during the Erosion Event in Neskowin Oregon, 1999, by* Amy Windrope, a graduate student in Marine Resource Management at Oregon State University. The unpublished thesis is available on-line at http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/7323/Windrope_Amy.pdf;jsessionid=246464BFB05DC9E3E17F5D1986749B46?sequence=1

[6] Oregon Administrative Rule 736-020-0050(1). The rules for emergency permits (OAR 736-020-0050 through -0070) enable the Oregon Parks and Recreation Department to issue an emergency permit quickly, before going through public review. Such review still must occur, but it can take place after the riprap or other shorefront protective structure has been installed. See http://arcweb.sos.state.or.us/rules/OARS_700/OAR_736/736_020.html

To provide technical data and conduct risk assessments for the county, the DLCD's Ocean and Coastal Management Program (OCMP) partnered with four other agencies:

- Oregon Department of Geology and Mineral Industries (DOGAMI)
- Oregon Parks and Recreation Department (OPRD)
- Oregon State University and OSU Sea Grant
- US Geological Survey (USGS)

In 2010, the DLCD awarded a grant to Tillamook County to develop a plan for identifying areas subject to coastal erosion and adapting to it – an "adaptation plan"—using information and ideas from the agencies listed above. The county contracted with planning consultant Mitch Rohse to write the plan. Throughout the project, the county's Department of Community Development worked closely with the agencies and consultant and helped manage the project.

At its outset, the project was expected to consist of a series of adaption plans, one for each community in Tillamook County threatened by coastal erosion. Neskowin was to be the first of those community adaptation plans. It soon became clear, however, that developing a series of stand-alone adaptation plans for as many as a dozen coastal communities in Tillamook County would cause redundancy and duplication as each community "reinvented the wheel" of adaptation planning. Thus, it was agreed that the project would be modified, to consist of two parts: a broad "framework plan" applicable to the county's entire coast, and a series of "sub-plans" dealing with the specific (and sometimes quite different) erosion hazards and needs of each individual coastal community (Figure 2). Neskowin would be the prototype, the first community to develop an adaptation sub-plan that rested on the foundation provided by the county framework plan.

A first draft of the county framework plan was completed and submitted to county officials in February 2011. It was reviewed and extensively revised in response to comments and new technical information and maps, to produce a revised draft of June 10, 2011. That revised version of the *Framework Plan* will be posted on the website for Tillamook County's Community Development Department at http://www.co.tillamook.or.us/gov/ComDev/ when it is ready for public review.

The *Framework Plan* describes coastal erosion hazards in Tillamook County, and it explains the various factors and forces that cause and affect coastal erosion – rising sea level, for example. The *Framework Plan* also catalogs "hazard alleviation techniques" or HATs, measures and steps that can be taken to adapt to or prepare for coastal erosion.

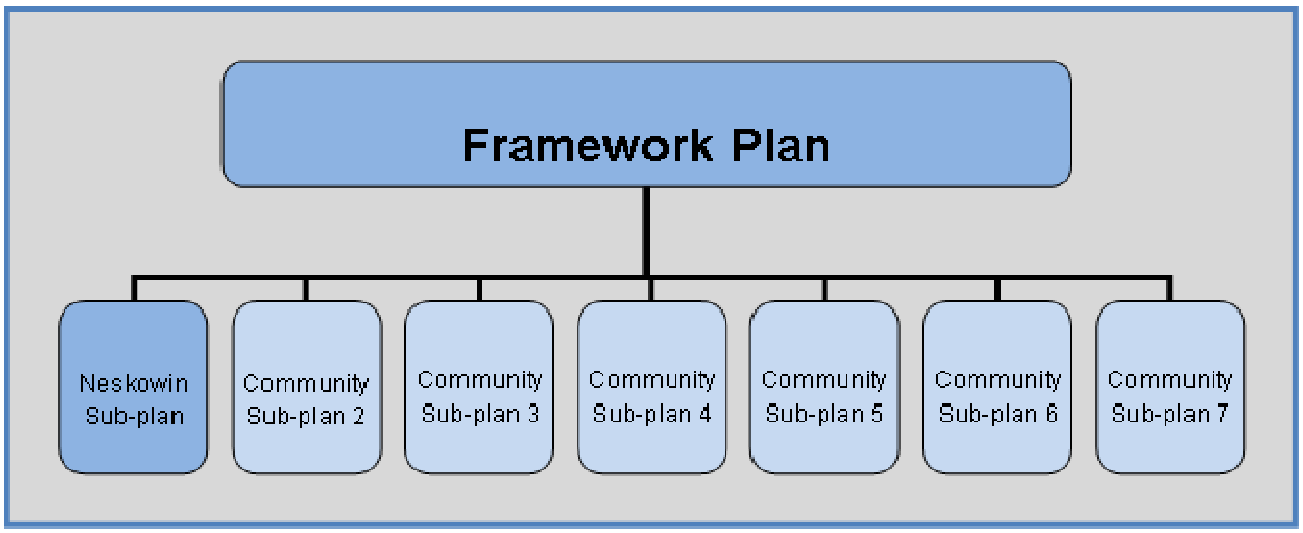


Figure 2: Tillamook County's erosion hazards adaptation plan is to have two "tiers": a broad framework plan, and a set of detailed sub-plans for the various coastal communities. Neskowin's sub-plan is the first in that series.

Neskowin has a community plan that was adopted in 1999 (*Community Plan for the Unincorporated Community of Neskowin*).[7] It is one element of Tillamook County's much larger Comprehensive Plan.[8] This draft adaptation sub-plan is an extension of and complement to those documents. It does not repeal or replace any of their provisions.

[7] See on-line at http://www.co.tillamook.or.us/gov/ComDev/documents/community/nesk_plan.pdf
[8] The county's plan and related documents are available on-line at https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/2866/Tillamook_County_Compplan.pdf?sequence=1

2. Coastal Erosion Hazards at Neskowin

The Neskowin (a.k.a. Nestucca) littoral cell extends from Pacific City and Cape Kiwanda on the north to Neskowin and Cascade Head on the south. It has become a prime example of a beach out of balance. That is, the normal cycle of winter erosion and summer restoration of sand, with no net long-term loss of sand in the cell, has been disrupted (see Chapter 5 of the *Framework Plan* for more details about this cycle).

Since the late 1990s, the cell has experienced a net loss of sand (through June 2006) estimated to be between 1.3 million and 2.0 million cubic yards.[9] By any measure, the net loss of as much as 2.0 million cubic yards is a dramatic change. The greatest loss of sand in the cell has occurred in its southern part, at Neskowin. The northern part has experienced accretion, increasing the height of the dune along the Nestucca River spit. This build-up, however, is far exceeded by the net loss of sand over the entire littoral cell.

Since 1997, DOGAMI has been monitoring changes – erosion in many places, accretion in others – in Tillamook County's beaches. This monitoring is described at length in the *Framework Plan's* Chapter 6.

For the Neskowin littoral cell, DOGAMI has been monitoring 15 beach profiles (vertical cross sections of the beach) along the 7 miles from Proposal Rock at Neskowin, at the southern end of the cell, to Cape Kiwanda in the north. Detailed data from each of the 15 profiles in what is called the Neskowin Series can be seen on-line at
http://www.nanoos.org/nvs/nvs.php?section=NVS-Products-Beaches-Mapping

The profiles indicate a wide variety of conditions. Several profiles in the northern part of the cell, along the beach at Pacific City and Bob Straub State Park, show significant build-up of sand. In the southern part of the cell, the profiles tell a much different story – one of significant and increasing erosion over the 12 years of observation. Several of the Neskowin profiles show landward recession in excess of 100 feet.

The pattern of erosion and accretion in the Neskowin cell is shown graphically in Figure 3, a summary chart of DOGAMI's observations in recent years.

[9] Jonathan C. Allan and Roger Hart. *Assessing the temporal and spatial variability of coastal change in the Neskowin littoral cell: Developing a comprehensive monitoring program for Oregon beaches*. Portland, Oregon Department of Geology and Mineral Industries, 2007, p. 1.

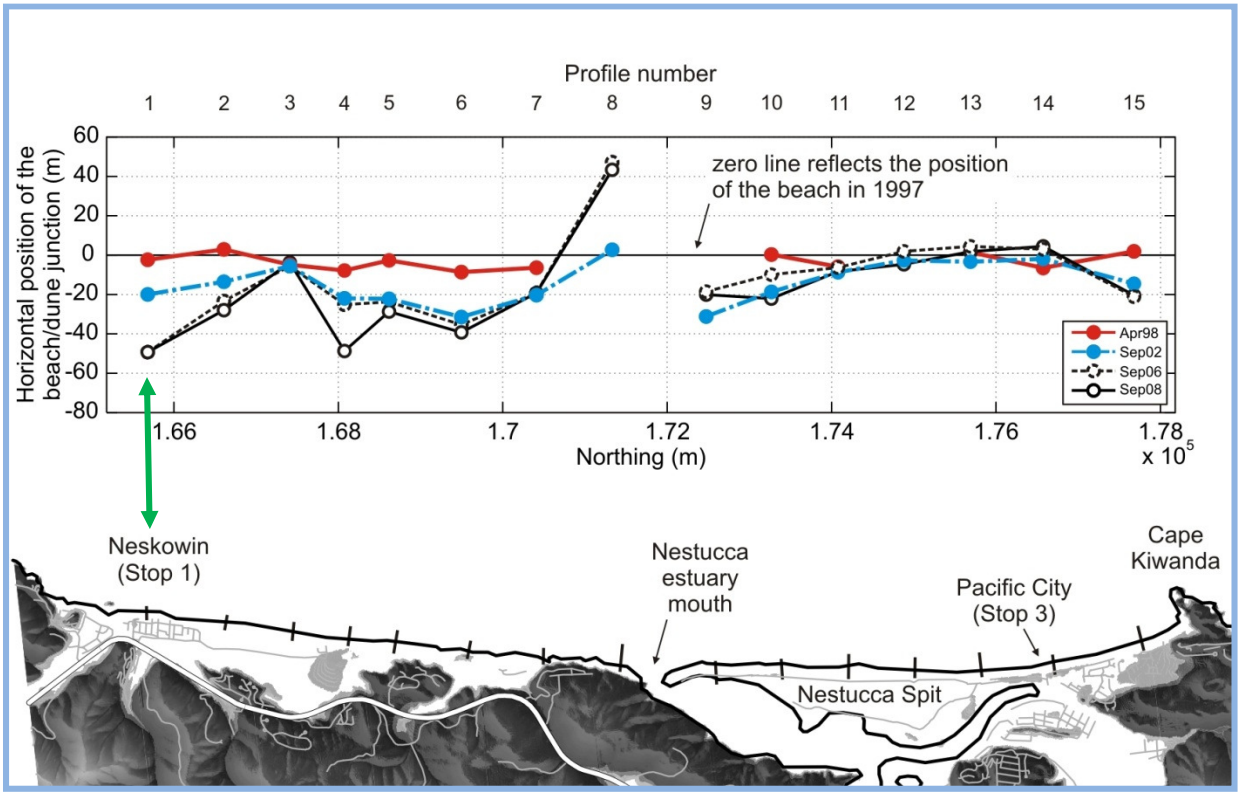


Figure 3: Beach Profiles from Neskowin to Cape Kiwanda, 1998 – 2008 (DOGAMI)

The upper part of the diagram in Figure 3 indicates the horizontal distance in meters that the beach has moved either landward or seaward from the beach's baseline position in 1997. The lower part is a map, with 15 vertical bars, each showing the location of a profile. Profile 1, for example, is shown on the map below as "Neskowin (Stop 1)."

Profile 1 lays near the western the end of McMinnville Avenue, in the central part of the village. Profile 2 is located about roughly 1,000 feet north of Corvallis Avenue. Profile 3 lies about 1,000 feet south of Neskowin North; Profile 4 is about 600 feet north of that subdivision. The remaining profiles are outside the village's community growth boundary.

For each profile, there is a dot showing the position of the beach as observed in the years 1998, 2002, 2006, and 2008. Where a dot appears above the zero line, the beach has moved seaward; i.e., the beach is growing. Among the 15 profiles in the Neskowin littoral cell, only number 8, just south of the Nestucca River mouth, shows any significant growth. Where a dot appears below the zero line, the beach is eroding and retreating landward. Note that in profiles 1, 2 and 4, at central Neskowin and Neskowin North, the beaches retreated as much as 50 meters (164 feet) during the decade of observations.

In 2007, DOGAMI published a detailed analysis of the first ten years of data from their observations at Neskowin.[10] It reported:

> "The beaches remain in a state of net deficit compared to their condition in 1997, with the estimated loss of sand as of June 2006 being on the order of 1 to 1.5 million m^3 (1.3 to 2.0 million yd^3) of sand. Whether the beach recovers fully and how long it takes remain important scientific and management questions, which will be answered as the beaches are monitored." (p. 1)
>
> "[M]uch of the shore between Neskowin and the Nestucca estuary mouth will probably continue to be highly susceptible to major storm erosion events and will likely remain so until sand from the north end of the [littoral] cell has returned to the south." (p. 16)

2.1 Coping with Coastal Erosion

Rapid erosion of the beach and foredune in Neskowin during the late 1990s and early 2000s compelled many owners of shorefront properties to take fast action (Figure 4). For many, the best step – indeed the only step – to protect their property seemed to be installation of riprap revetments.

Figure 4. "High surf and the impact on the riprapped Neskowin shoreline on January 9, 2008." This photo by Armand Thibault appeared in the *Oregonian* article "State monitoring shifting sands on coast," March 1, 2009. The exposed area in the foreground was riprapped, but the revetment was damaged by storm waves and was undergoing repairs at the time the photo was taken.

[10] Allan, Jonathan C., and Roger Hart. *Assessing the temporal and spatial variability of coastal change in the Neskowin littoral cell: Developing a comprehensive monitoring program for Oregon beaches*. Portland, Oregon Department of Geology and Mineral Industries, 2007. 31 pp.

As a result, most shorefront properties in Neskowin now have been riprapped. Under Statewide Planning Goal 18, *Beaches and Dunes*, shorefront protective structures such as riprap generally are permitted only for properties that were developed (i.e., platted) as of January 1, 1977, or that have been granted an exception to Goal 18. Much of Neskowin's shoreline has been granted such an exception. The following three maps (Figures 5-7) show the properties eligible for riprap by virtue either of having been developed by 1977 or of having obtained an exception to Goal 18. The maps also indicate which areas have been riprapped.[11] The maps were developed from interactive mapping in the *Oregon Coastal Atlas*, at http://www.coastalatlas.net

A word of caution: the *Coastal Atlas* is updated periodically, but its maps are not sufficiently accurate to provide precise, up-to-date information for individual properties. Persons wanting to determine whether a specific lot or parcel is eligible for riprap should contact the Oregon Parks and Recreation Department (OPRD), which administers permits for riprap, at http://www.oregon.gov/OPRD/RULES/oceanshores.shtml#Background

Recently, the Oregon Parks and Recreation Department (OPRD) has developed a riprap construction timeline for the Neskowin shoreline (Table 1). The data were derived from analyzing Oregon Department Transportation (ODT) aerial photographs taken in 1967 and 1984 and from Lidar aerial photos taken in 2005. Some riprap may have been obscured or buried under sand when the photos were taken, making accurate identification and analysis difficult. One example are the tax lots immediately north of Mt. Angel street, where buried riprap was exposed in 2010 after significant dune erosion. This riprap does not show up in the 1967 or 1984 aerial photos, and it was probably placed prior to the Beach Bill or was an unpermitted structure placed shortly thereafter.

Until 1999, the Parks Division of the Oregon Department of Transportation (ODOT) had joint jurisdiction over the ocean shore and the Division of State Lands (DSL) issued all of the shoreline protection permits. OPRD now has jurisdiction from extreme low water to the Statutory Vegetation Line (SVL) or the line of vegetation, whichever was further inland. Overall, fifty–five (55) Ocean Shore Alteration Permits have been issued since 1967. In many cases, single permits were issued to multiple properties.

[11] In color prints or on-line, riprap appears as an irregular magenta line just seaward of the properties where it has been installed. On monochrome copies, it appears as a black line. The *Coastal Atlas* data are out of date: several properties shown on the maps as having no riprap do indeed have it now.

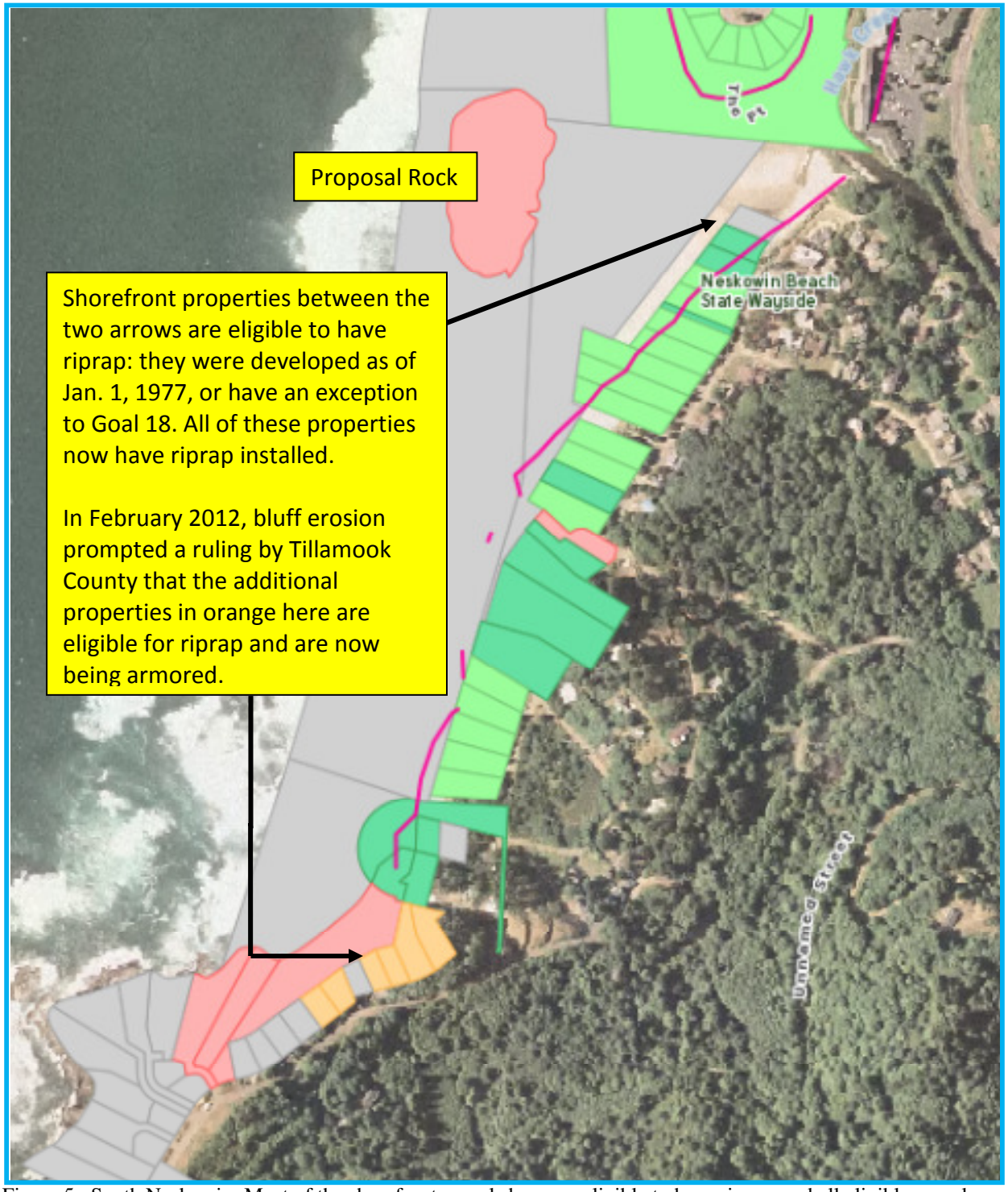


Figure 5. South Neskowin: Most of the shorefront parcels here are eligible to have riprap, and all eligible parcels have riprap. Existing riprap may be repaired, modified, or replaced, but the potential for additional properties to have riprap installed in this part of Neskowin is effectively zero.

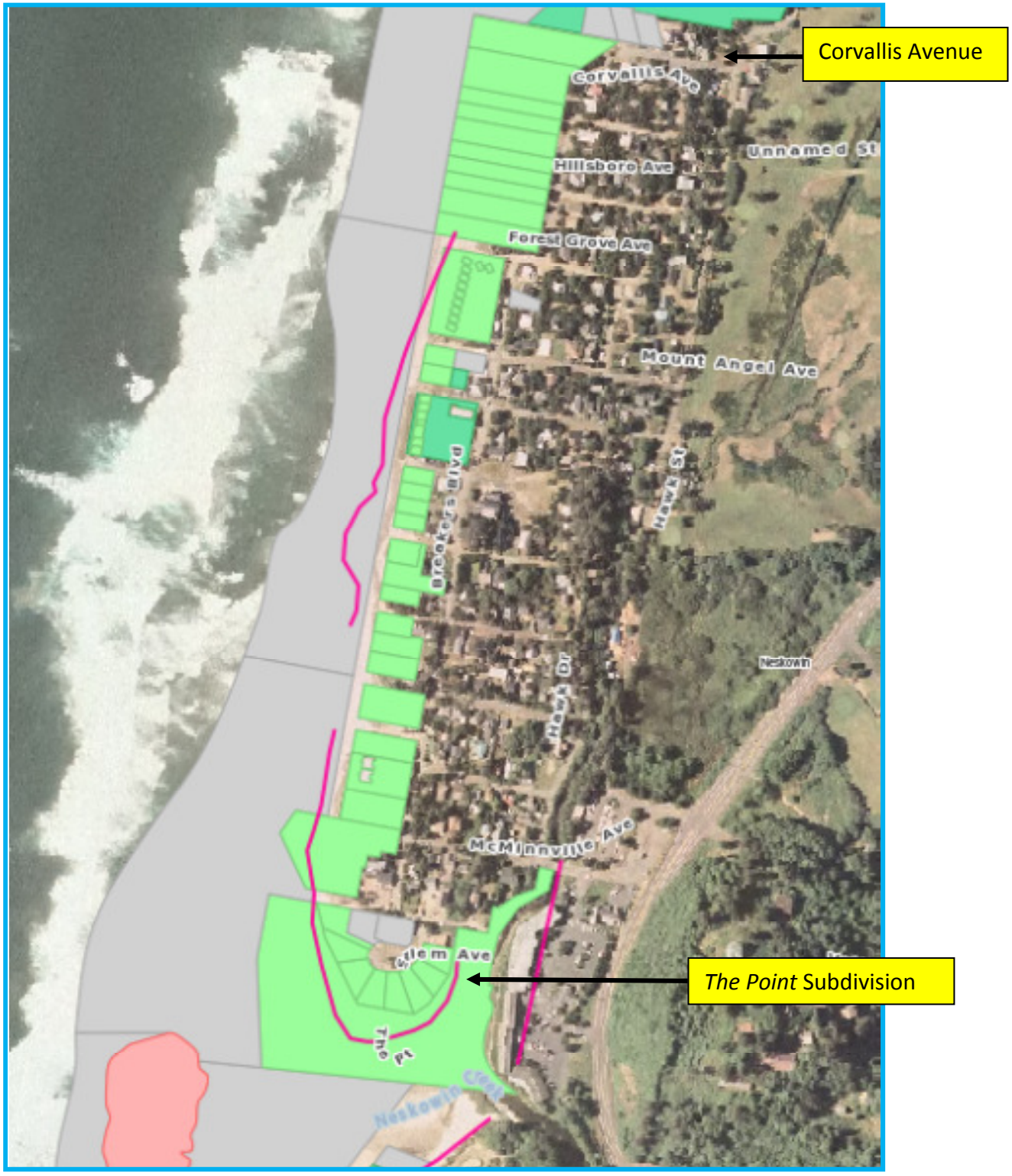


Figure 6. Central Neskowin: All the shorefront properties from The Point (at the bottom of the photo) to Corvallis Avenue at the top are eligible for riprap by virtue of an exception to Goal 18; all have been riprapped.

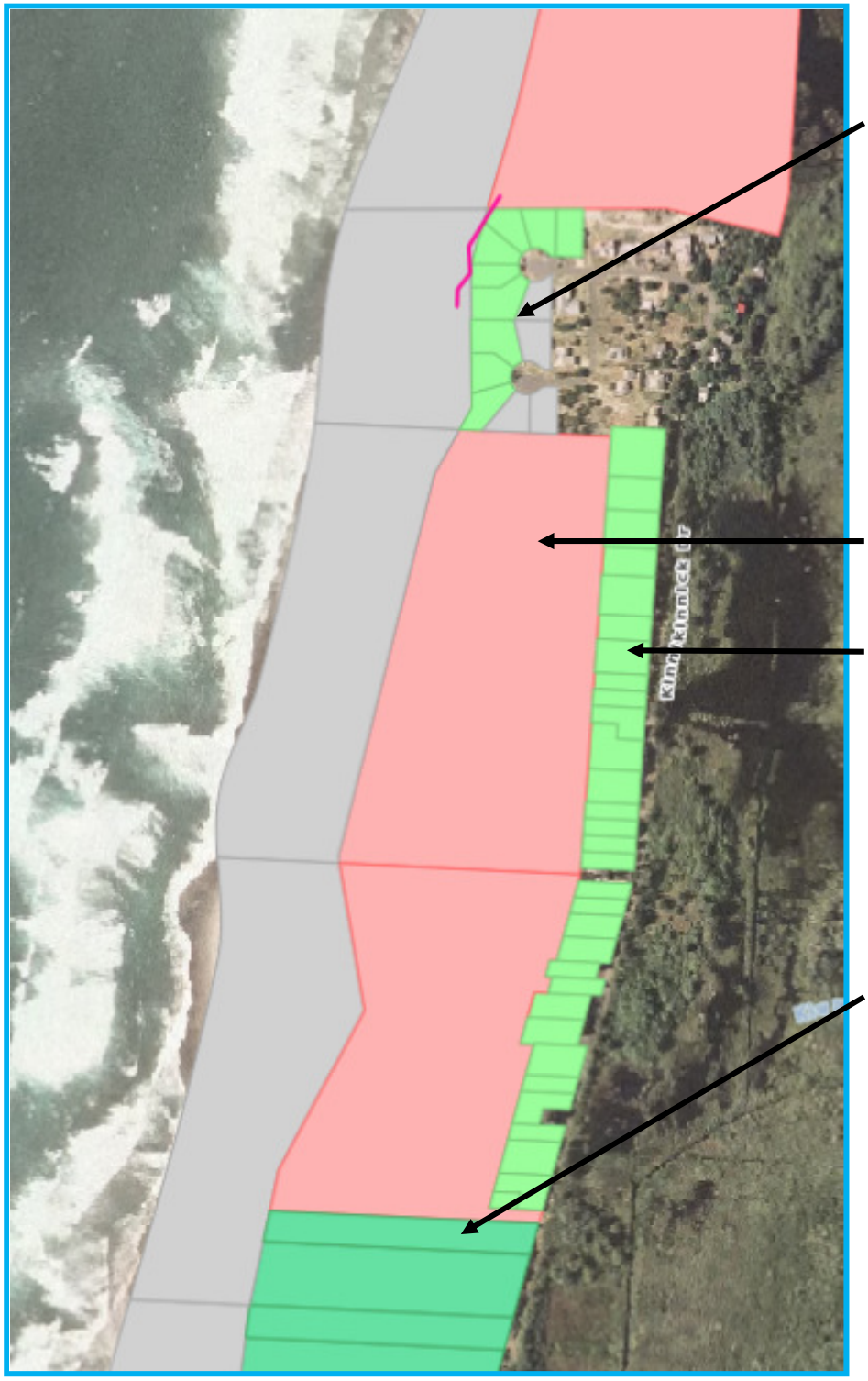


Figure 7. Neskowin North: The shorefront properties in Neskowin North Subdivision are eligible for riprap by virtue of an exception to Goal 18; all have been riprapped. Properties to the north are not eligible.

Two large, undeveloped properties to the south are owned by Tillamook County. They are not eligible for riprap and are not riprapped.

The 31 private residential parcels between the county property and Kinnikinnick Drive are eligible for riprap (per a Goal 18 exception) but have not been riprapped.

Fifteen residential parcels south of the county property and north of Corvallis Avenue (not all are shown on this map) with long east-west boundaries were developed as of Jan. 1, 1977, thus are eligible for riprap. None is currently riprapped. The dwellings on these parcels are sited on their east side, adjoining the road.

Table 1. Neskowin Shoreline Protection Timeline

TIME PERIOD	LOCATION AND TOTAL LENGTH 0F SHORELINE (Feet)		LINEAL FEET OF RIPRAP CONSTRUCTED (Est.)
1967	Cascade Head to Neskowin Creek	(Total 2700)	900
	Neskowin Creek to Corvallis Street	(Total 3600)	150
	Neskowin North	(Total 800)	0
		Total 7,100	**1,050 or 15% of shoreline**
1968 to 1998	Cascade Head to Neskowin Creek	(Total 2700)	0
	Neskowin Creek to Corvallis Street	(Total 3600)	0
	Neskowin North	(Total 800)	0
		Total 7,100	**0 or 0% of shoreline**
1999 to Present	Cascade Head to Neskowin Creek	(Total 2700)	1,800
	Neskowin Creek to Corvallis Street	(Total 3600)	3.450
	Neskowin North	(Total 800)	800
		Total 7,100	**6,050 or 85% of shoreline**

As the maps and data reveal, the great majority of shorefront properties in Neskowin now have riprap in place. Most of it was installed fairly recently and is in good or fair condition. It should not be assumed, however, that the revetments have solved the problem. They are neither a complete nor long-term solution to coastal erosion hazards, for three reasons:

First, revetments such as riprap have a narrow purpose: to protect shoreline property from erosion. They do not prevent erosion of the beach, and in some cases they may locally increase or accelerate it. It is likely, however, that the shoreline riprap of the foredune provides some protection for adjacent and lower-lying properties in the village area of Neskowin. But, as will be described more fully in section 2.3, the village area is also vulnerable to intrusion of ocean waters flooding Hawk Creek during periods of storm surges and high tides. Thus, coastal erosion and related hazards such as flooding from the ocean would remain a problem for the community even if its foredune were armored to the maximum extent possible.

Second, riprap is not as durable as its massive appearance might suggest. A typical stone revetment has a design life of 20-25 years and requires continual maintenance. See *Framework Plan*, Section 7.1, pp. 38-40. Many sections of the revetments at Neskowin have already been replaced or undergone extensive repair.

Third, some wave overtopping of the riprap has occurred, damaging some buildings behind the revetment and resulting in currently-minor intrusion of ocean water into lower-lying areas behind the riprap. The frequency and severity of such overtopping will likely increase, for reasons discussed in Chapter 8 of the *Framework Plan*: "Climatic and Geologic Forces Affecting Erosion."

In February 2012, during a strong winter storm with high rainfall, bluff erosion occurred at the south end of Neskowin, and the affected properties are now being riprapped (Figure 5).

2.2 Raising the Walls

NOTE: [12] This section should be thoroughly revised upon completion of the recently initiated contract with a coastal engineering firm to study the shoreline and beach protection issues in Neskowin and advise the NCHC of their findings and recommendations.

Recent wave overtopping events have led some property owners in Neskowin to consider increasing the heights of their revetments by building protective structures such as vertical seawalls behind the crest of the existing riprap or by extending the height of the riprap itself. Both the feasibility and manner of such construction may require geotechnical engineering. Designs of the structures will depend on site-specific variables such as elevation of the property, dune stability, degree and severity of wave overtopping, dimensions and slope of the riprap, and proximity of any building at the top of the revetment. These vertical extensions have the potential to affect the integrity of adjacent riprap if they are not designed and installed properly.

Increasing a revetment's height can be done by adding additional rock on top and landward of the existing riprap to increase its overall height. This method maintains the position of the existing seaward toe of the riprap but consumes part of a property's oceanfront yard. Most riprap has been installed at angles ranging from 1½:1 to 2:1 (horizontal "run" to vertical "rise"). Therefore, to add three feet to the height of riprap with a slope of 2:1 also would add six feet to the landward extent of the riprap. Any proposals to add or modify permitted riprap revetments that involve more than 50 cubic yards of material require the property owner to apply for a new Ocean Shore Alteration Permit from the Oregon Parks and Recreation Department.

An alternative to extending the riprap itself is to erect a vertical structure such as a seawall atop or landward of the riprap revetment. Suppose, for example, that property with a revetment 21 feet high has experienced some splash overtopping.[13] The owner of the property could attempt to defend against such wave overtopping in the future by erecting a three-foot-high concrete seawall behind the crest of the riprap.

Such riprap caps or vertical seawalls may prompt concerns about aesthetics, views, and emergency vehicle and pedestrian beach access. For example, if every second or third shorefront lot had a three- or four-foot cap wall placed atop the riprap, the shorefront would come to have a crenellated appearance, like battlements on castle walls. The question of how to maintain public beach access points through or over such structures would need to be addressed. And installation of such a wall on one parcel might block the ocean view to the northwest or southwest from adjacent shorefront properties.

[12] Here and at several later places in this draft document, notes are added to describe significant revisions that the NCHC believes are still needed.

[13] See page 28 of the *Framework Plan* for a discussion of splash and greenwater wave overtopping.

One important but often overlooked fact is that riprap can move: the height and width of riprap revetments on many coastal properties, especially at Neskowin, are by no means constant. The toe of some revetments may slide seaward, causing the entire structure to settle and lose height. This already has occurred at some places in Neskowin, where the great depth of sand makes it difficult or impossible for the riprap to be placed on bedrock. Also, riprap requires frequent maintenance and repair, which periodically changes the overall dimensions of the revetment. The potential for changes in the height and width of a revetment thus is something that must be considered when deciding whether to extend its height. The feasibility of such extension will vary from site to site. The services of an engineer may be needed to determine (a) whether such a height extension is feasible, and (b) how it should be designed.

Finally, as was noted above, the problem of coastal erosion at Neskowin (and many other coastal communities, as well) is neither confined to the front line of shorefront properties nor solved by armoring the shore to protect them. Severe and continuing erosion is likely to have significant effects on the entire community. That is not to say that every property will be damaged by severe erosion or flooding. But hazards that directly damage only some properties also are likely to damage streets, sewers, water lines and other infrastructure, impose significant public costs, impair local businesses, and harm natural resources – effects that would be felt throughout the community.

Neskowin's search for the most effective shoreline protective structures continues. NCHC's Active Protection Subcommittee has conducted extensive research on this. The NCHC has tasked the subcommittee to review short-term solutions for better design of shoreline protective structures. It has further requested the subcommittee to review and investigate alterations to these structures or even other innovative options that might provide similar or better protection. The subcommittee also is interested in seeing whether better shoreline protective structure design or other innovative options might better preserve the beach and not just focus on protecting beachfront development (and the community in general).

NCHC's overall charge is to attempt to balance these two concepts, of preserving the beach and protecting property. The group collected a great deal of information in working with DOGAMI, OPRD, OSU and others to move forward. It reached a point, however, where it was deemed prudent to contract with a qualified coastal engineering firm to review the Active Protection Subcommittee's options and explore other options in an effort to identify the most viable engineering ideas and concepts and their likely costs. Thanks to generous contributions from the Neskowin community and additional support from DLCD, the NCHC, through the County, contracted with a well-qualified firm to study the situation at Neskowin and make recommendations for erosion mitigation options based on their professional judgment and community-determined viability. The recommendations will provide guidance for: (1) potential changes to the existing riprap revetments to improve the ability to cope with increasing wave attack; (2) cost estimates for initial repair and maintenance of the existing revetments and for new or innovative structures; and (3) life cycle costs for existing structures projected to 2050. The engineers also will develop coastal models to analyze the effectiveness of armoring (riprap), beach nourishment, and land use planning for protection of the community and maintenance of beach widths.

2.3 Flooding From the Ocean and Vulnerability of the Hawk Creek Bridge

Coastal hazards in Neskowin are not limited to erosion. Strong storm surges, combined with high tides and heavy rainfall can and have resulted in flooding of Hawk Creek in the Village and Sutton Creek in South Beach. The flooding of Hawk Creek along with resultant influx of heavy woody debris from the ocean and beach have, in the past, created the potential for damage to the bridge over Hawk Creek at Salem Avenue and the utility lines that are located under the bridge's roadway. In addition to the utility lines, this bridge is the only public vehicle access to Highway 101 from most of the Village as well as from Neskowin North.

Figures 8 and 9 illustrate that flooding the Village is not a new problem. Part of the flooding in 1964 was from intrusion of ocean water. The 1998-1999 flooding was primarily from intrusion of ocean water combined with high tides and heavy rainfall. Figures 10 and 11 show a 2010 situation where large woody debris was washed in from the ocean and against the Hawk Creek Bridge, threatening it and the utility lines that run underneath its roadbed. The debris was removed by the County in December 2010. If storms increase in intensity in the future as predicted, the potential for damage to the bridge as well as problems on private property from flooding will increase. This would be especially true if a huge storm with heavy rain as well as a strong storm surge from the ocean coincided with an extremely high tide. If sea level continues to rise as predicted, the problem will be exacerbated in future years.

Figure 8. Flooding in Neskowin in 1964 looking west, up Salem Ave.

Figure 9. Flooding of Hawk Creek, with water over the bridge, during the La Nina winter of 1998-1999. Also note damage to the deck of the Hawk Creek Café. (Courtesy of Monte J. Fuller and Fuller Films.)

Figure 10. View from bridge, April 2010, showing debris in Hawk Creek, just downstream from the bridge, with the beach in the background.

Figure 11. Massive pieces of wood, some weighing several tons, being loaded onto a large truck by county road crews.

3. Neskowin's Vulnerability to Coastal Erosion Hazards

How vulnerable is Neskowin to coastal erosion and related hazards, such as ocean flooding? That depends, of course, on what is meant by *vulnerability*. Scientists use the word not only to describe the extent to which a community or place may experience a hazardous event but also that place's ability to withstand or quickly recover from the event. Vulnerability thus is defined to be a combination of three essential factors: *exposure*, *sensitivity*, and *resilience*.[14]

Exposure means the amount of a community's assets – population, buildings, resources, infrastructure – that lie within a hazard-prone area. Exposure is an absolute term typically expressed in units such as people, dollars, or acres. For example, we might say that a community has high exposure because a large number of properties would suffer damage from erosion hazards in a specified period of time.

Sensitivity is a relative term to describe the degree to which a community's assets are exposed to the risk. It is usually expressed as a percentage. For instance, a small community with, say, half of its properties likely to suffer damage from a defined hazard is considered quite sensitive; not because the numbers of properties is large but because such a large portion of the community might suffer damage.

Finally, *resilience* means the capacity of a community to withstand, adapt to, and recover from a hazard event, such as a severe winter storm accompanied by major erosion, landslides, and ocean flooding. Having an adaptation plan such as this and implementing it is one way a community can increase its resilience.

To evaluate the three variables that make up a community's vulnerability to a hazard, we must define what we mean by "hazard." In the case of coastal erosion, the hazard is defined in terms of the total water level (TWL) at that critical point where the beach meets the adjoining dune or bluff. The higher the TWL, the greater the potential for erosion.

As explained earlier in greater detail in the *Framework Plan* (page 29), the total height of the ocean water level at a given beach is the sum of several "wave height factors," such as wave runup, tide, and storm surge. One can create various scenarios by assuming certain combinations of these variables. For example, the "worst-case scenario" that can reasonably be expected would be a huge storm occurring at high tide after sea level has risen substantially. DOGAMI's scientists have created a variety of scenarios and used them to delineate areas at Neskowin subject to high, moderate or low risk.

To estimate water levels, DOGAMI focused on two scenarios: the 50-year storm (a storm of a magnitude that would be expected to occur once in 50-years) and the 100-year storm. The former, of course, is the storm more likely to occur. The 100-year storm, although less likely,

[14] These concepts and terms are described much more fully in the *Framework Plan's* Chapter 9, "Assessing Risk and Vulnerability."

would do greater damage and affect a larger area. Tables 2 and 3 show the factors used to define the two events.

Table 2. Water Level Calculation: Water Height in Feet at Toe of Dune or Riprap		
Wave Factor	**50-Year Storm**	**100-Year Storm**
Mean high tide	7.55	7.55
Monthly mean water level	1.31	1.31
Storm surge	3.28	5.58
Sea level rise	0	1.31
Wave runup*	14.34	17.72
Total Water Level	**26.48 feet**	**33.47 feet**

*Wave runup is estimated using the assumptions shown in the Table 3.

Table 3. Factors for Computing Wave Runup		
Factor	**50-Year Storm**	**100-Year Storm**
Beach slope	4 percent	4 percent
Deep-water significant wave height	47.6 feet	52.5 feet
Wave period	17 seconds	20 seconds
Deep-water wave length	1,481 feet	2,050 feet

The calculations in Tables 2 and 3 were performed by NCHC members, based upon data provided to the NCHC by DOGAMI's Jonathan Allan, for the committee meeting of April 29, 2010.

3.1 DOGAMI Maps

Using scenarios for "design events" such as the storms described above, DOGAMI has defined and mapped coastal erosion hazard zones along the two main types of beaches found in Tillamook County, dune-backed and bluff-backed.[15] Dune-backed beaches typically erode more rapidly, in direct proportion to severity of storms and wave runup. In contrast, erosion of bluff-backed beaches is most directly related to geological make-up of the bluff. The four types of hazard zones are summarized in Table 4. Subsequent land-use recommendations in this sub-plan document combine the "Active Hazard," "High Risk," and "Moderate Risk" zones shown in Table 4 into one "regulatory trigger" zone. The land-use recommendations (detailed later in section 5.2) do not pertain to the "Low Risk" zone. DOGAMI's maps of all four coastal erosion

[15] DOGAMI's analysis for the Tillamook County coast is published as DOGAMI Open File Report (OFR) 0-01-03, *Evaluation of Coastal Erosion Hazard Zones Along Dune and Bluff Backed Shorelines in Tillamook, Oregon: Cascade Head to Cape Falcon*, by J.C. Allan and G.R. Priest, 2001.

hazard zones in the Neskowin area are shown in Attachment 10. The regulatory trigger zone used by the NCHC in making its land use recommendations is shown in Figure 12.

Table 4. Beach Erosion Hazard Zones in Tillamook County[16]

Dune-Backed Beaches			
Zone	**General Location of Zone**	**Zone Width**	**Design Event**
Active Hazard	Sandy beach and foredune face	Width of beach plus dune face*	Significant erosion or accretion occurring now
High Risk	250-280 ft landward of dune-beach junction	250-280 ft	**Large storm:** Wave heights to 47.6 ft; above-avg. high tide; storm surge 3.3 ft
Moderate Risk	Next 415-460 ft landward of high-risk zone	415-460 ft	**Severe Storm:** Wave heights to 52.5 ft plus sea level rise of 1.3 ft
Low Risk	Next 460-510 ft landward of moderate-risk zone	460-510 ft	**Extreme Event**: Severe storm plus 3.3 ft subsidence from CSZ earthquake
Bluff-Backed Beaches			
Zone	**General Location of Zone**	**Zone Width**	**Design Event**
Active Hazard	Sandy beach; bluff toe; bluff face to top edge	Width of beach plus bluff face*	Significant erosion or accretion occurring now
High Risk	First 20-30 ft landward of bluff top edge	20-30 ft**	Gradual erosion at low mean rate over 60 yr period; bluff talus at ideal angle of repose
Moderate Risk	Next 40 to 250 ft land-ward of high-risk zone	40-250 ft**	Block failures, retreat to angle of repose; erosion over 60-100 yr period
Low Risk	Next 60-490 ft landward of moderate-risk zone	60-490 ft**	Erosion over 60-100 yr period; maximum slope failure; erosion to ideal angle of repose

* The active hazard zone is typically west of the beach/dune interface except in those areas without riprap.

** Width of zone varies widely with composition of material in bluff

This table summarizes information from Jonathan C. Allan and George R. Priest's *Evaluation of coastal erosion hazard zones along dune and bluff backed shorelines in Tillamook County, Oregon: Technical report to Tillamook County*, Portland, Oregon Department of Geology and Mineral Industries, 2001. 93 pp.

[16] The Active, High, and Moderate Risk Zones identified by Allan and Priest are combined into one Hazard Zone for the land-use recommendations of the Neskowin Coastal Hazards Committee detailed in Section 5.2.

Figure 12. DOGAMI Maps (2) of Coastal Erosion Hazard Zones in Neskowin as modified by the NCHC.[17]

The following two pages are modified DOGAMI maps of hazard zones in the Neskowin area, from "Neskowin," Appendix E, page 91, DOGAMI Open File Report (OFR) 0-01-03, *Evaluation of Coastal Erosion Hazard Zones Along Dune and Bluff-Backed Shorelines in Tillamook, Oregon: Cascade Head to Cape Falcon*, by J.C. Allan and G.R. Priest, 2001.

The modification to the maps consists of combining the Active Hazard, High Risk, and Moderate Risk zones identified in OFR 0-01-03 into one Hazard Zone, colored blue for dune-backed beaches and purple for bluff-backed beaches.

The first map starts about 1,200 feet north of Neskowin North and ends just south of Mt. Angel Street. The second map starts about 1,000 feet north of Corvallis Street and extends south to just beyond the historic beach area.

[17] The original DOGAMI maps are shown in Attachment 10.


Coastal Erosion Hazard Zones
Moderate-HighDune Erosion Hazard
Bluff Erosion Hazard
N
W
E
S
500 250 0 500 1,000 Feet
Coastal Erosion Hazard Zones obtained from DOGAMI Open File Report O-01-03
Evaluation of Coastal Erosion Hazard Zones Along the Dune and Bluff Backed Shorelines in Tillamook County, Oregon, Cascade Head to Cape Falcon
by Jonathan C. Allan and George R. Priest, 2001


Coastal Erosion Hazard Zones
Moderate-HighDune Erosion Hazard
Bluff Erosion Hazard
N
W
E
S
500 250 0 500 1,000 Feet
Coastal Erosion Hazard Zones obtained from DOGAMI Open File Report O-01-03
Evaluation of Coastal Erosion Hazard Zones Along the Dune and Bluff Backed Shorelines in Tillamook County, Oregon, Cascade Head to Cape Falcon
by Jonathan C. Allan and George R. Priest, 2001

Tillamook County currently is proposing to adopt DOGAMI OFR 0-01-03 (including the map in Figure 12) for the county's entire coast. DOGAMI's maps and the related data and analysis will be used in determining which areas of Neskowin are at significant risk from erosion hazards. For the present, these are the official maps on which Tillamook County and Neskowin will base their policies and ordinances regarding coastal erosion hazards.

For the Neskowin area, however, Oregon State University has expanded on the DOGAMI maps to incorporate estimates of probabilities that various types of coastal hazards may occur. This work by OSU is described in Attachment 11. **The OSU maps constitute a pilot project, done especially for the Neskowin area**, not the entire county. The OSU project deals only with dune-backed beaches and assumes that the riprap is not present. As part of this recently completed pilot project, the OSU maps have not had peer review or been officially adopted by any agency. They are, however, valuable in helping the County and the community better estimate the risk faced by various areas in Neskowin.

Attachment 11 describes the OSU work in detail. The OSU maps and analysis suggest the following:

- The "design event" is a total water level with a one-percent probability. This is a severe event that, like the "100-year flood," has a one-in-a-hundred chance of occurring in a specified time period (the present to 2050 for purposes of this sub-plan).
- If such an event occurs in the next few decades (i.e., by 2050), areas along the village's shoreline have the "highest risk for erosion." There is a 98 percent confidence level (near certainty) that hazardous erosion would occur here. These are shown in the golden-brown band on maps in Attachment 11.
- Areas immediately east (landward) of that high-risk area also might experience hazardous erosion. Properties in much of Neskowin face some risk, ranging from just under 98 percent odds of erosion to as little as 2 percent. The farther west (seaward) its location, the closer the odds of a property's erosion come to the 98 percent confidence level.

To reiterate, while the OSU project yields useful insights, only official DOGAMI maps and related data and analysis are used in this plan to estimate which areas of Neskowin are at significant risk from erosion hazards.

3.2 Estimating Vulnerability to Coastal Erosion Hazards

Researchers from DOGAMI and OSU have used erosion maps and data to determine the *exposure* and *sensitivity* of coastal communities in Oregon to coastal erosion.[18] Tables 13 and 14 cover the communities from the northern border to the south as far as Yachats. The chart on the left, showing the number of residents living in the active, high, or moderate erosion zones, is one measure of a community's exposure to erosion hazards. The chart on the right, showing the percentage of a community's residents living in the active, high, or moderate erosion zones, indicates a community's sensitivity to coastal erosion.

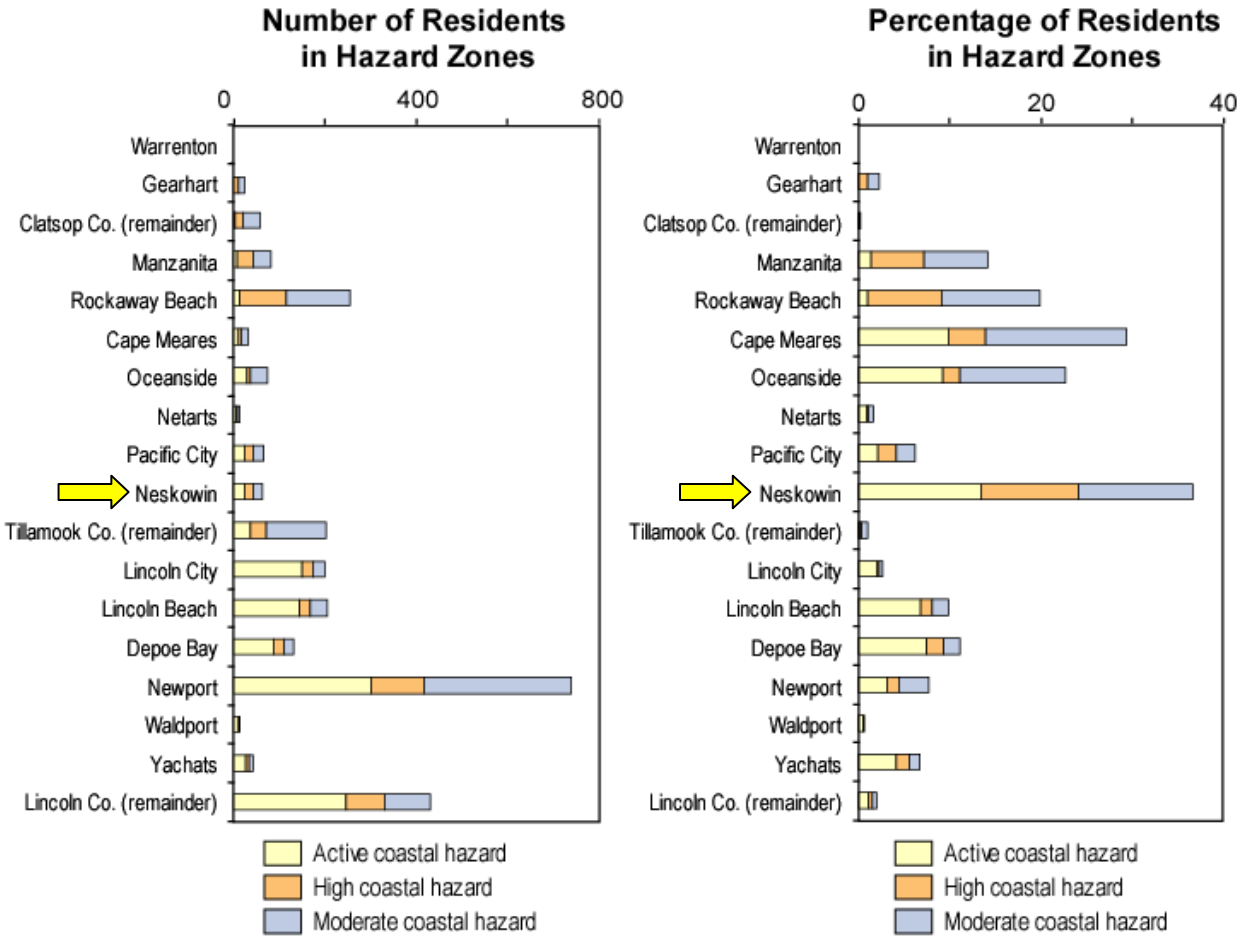


Figure 13. *Exposure* and *sensitivity* of coastal communities in Oregon to coastal erosion.

Note that Neskowin has much in common with the other Tillamook County communities of Manzanita, Rockaway Beach, Cape Meares, and Oceanside. All are small communities that do not have large numbers of people living in the three most hazardous erosion zones. By that measure, then, they may be considered to have only moderate exposure to erosion hazards. But, because a large *percentage* of their residents reside in the three erosion zones, the

[18] These charts are based on DOGAMI's data and maps showing recent coastal erosion. They are not based on the OSU computer models and maps described in Section 3.2 on the preceding pages.

communities do have a high sensitivity to such hazards – and Neskowin is the most sensitive of all.

Another way to assess such vulnerability is to consider the extent of a community's developed land that lies within the erosion zones (Figure 14). The data show that the same five Tillamook County communities are quite vulnerable to erosion hazards. They also reveal that rural areas of the county have significant amounts of developed land in erosion-prone areas.

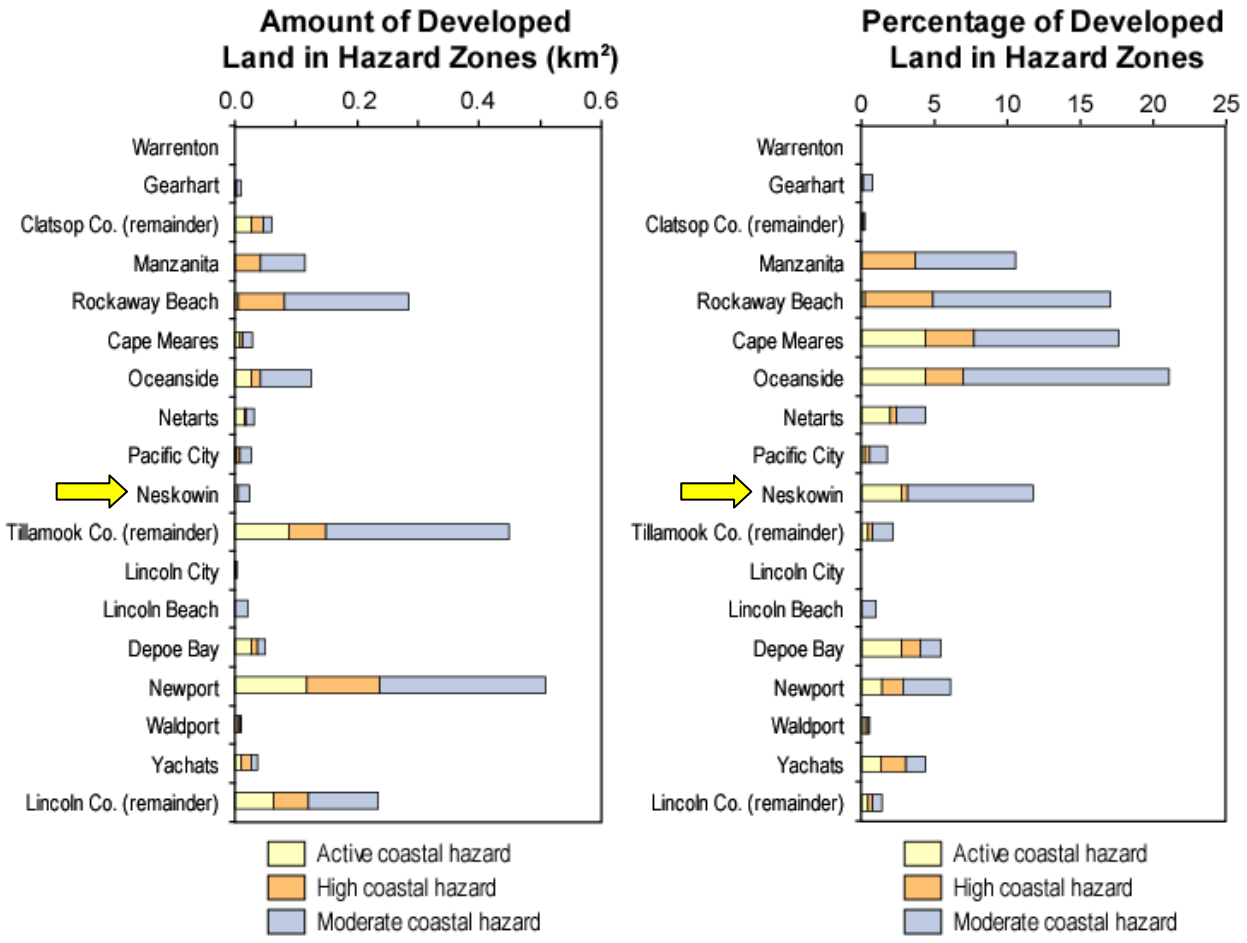


Figure 14. Amount and percentage of developed land on the Oregon coast that is in hazard zones.

Again, the small communities of Manzanita, Rockaway Beach, Cape Meares, Oceanside, and Neskowin are revealed to have only moderate *exposure* to coastal erosion in terms of the absolute number of acres of developed land in the active, high, or moderate erosion zones. But because they all have a high percentage of developed land in erosion-prone areas, they are *sensitive* to the hazard – and thus should be considered vulnerable.

3.3 Lifelines

Neskowin is especially vulnerable to coastal erosion and related hazards, such as flooding from the ocean and tsunamis, because of its severe lack of "lifelines." Lifelines, as described on pages 98-99 of the *Framework Plan*, are linear utility or infrastructure networks or segments thereof that are essential to public health and safety during and after a hazard event. The most critical lifelines for Neskowin and other coastal communities are east-west collector streets from the beach to Highway 101. During hazardous events, these collectors – *if* they are not flooded or otherwise damaged — enable vehicles and pedestrians to escape to safer areas. Neskowin's lifelines are few in number and highly vulnerable. For most of the village and all of Neskowin North, the only public vehicular escape route from vulnerable areas along the beach is along Salem Avenue, across the Hawk Creek Bridge, to Highway 101. For *all* of the South Neskowin, the key escape route is South Beach Drive, across the gated bridge over Neskowin Creek, to Highway 101.

Both of these lifelines are narrow two-lane streets. Both pass through low-lying areas vulnerable to flooding. Both have critical "pinch-points" where damage to or destruction of a bridge would restrict or eliminate the lifeline. A private road exists between the golf course and the State Wayside, and the property owner has stated that this could be used for emergency evacuation. But it is currently impassible by vehicles due to vegetative growth and is liable to be seriously flooded in any serious event that knocks out the Hawk Creek Bridge.

While Salem Avenue is the only lifeline route available to vehicles leaving the central and northern parts of Neskowin, pedestrians may have another option: a "Tsunami Trail" that extends east from Hawk Street across the southern end of the Neskowin Marsh Unit of the Nestucca Bay National Wildlife Refuge toward Highway 101 and higher ground (Attachment 6). The western end of the trail is designated by a tsunami evacuation sign on the shoulder of Hawk Street. The US Fish and Wildlife Service (USFWS), the management agency for the Refuge, says that they plan to continue maintaining the trail for public access (Attachment 4, letter of April 28, 2011, from Rob Lowe, USFWS, to Tillamook County). Unfortunately, the trail's potential as an effective lifeline is highly questionable. Much of the area it crosses is a wetland that is often inundated. The trail thus is likely to be underwater at the very time it is needed most.

4. Hazard Alleviation Techniques (HATs)

Neskowin's vulnerability to coastal erosion hazards raises an obvious question: What measures can we take to reduce or eliminate impacts of hazardous events like beach erosion or flooding? Such measures are referred to as *hazard alleviation techniques* or HATs. Think of them as the tools that make up our toolkit for adapting to coastal hazards.

An extensive array of such tools is available. They are described in Chapter 11 of the county's *Framework Plan*. But, as with any tool box, not all tools in the box are equally useful for any given situation. Some HATs that might be useful on, for example, a sheltered bay or barrier island in the southeastern United States are not suitable for use in Neskowin, which is exposed to direct attack from the powerful waves of the northeastern Pacific Ocean. We observe the same variability when comparing one property to another: riprap may be appropriate for a particular dune-backed beachfront lot but of little value for a bluff-backed lot only a few hundred feet away. We thus cannot prescribe one or even several HATs that will work in all situations. Rather, we must eliminate HATs that seem generally unsuitable for Neskowin, evaluate the remainder, and focus on those most likely to be of value.

The information in Table 5 starts us on that course. It lists all the tools generally known to have been of use in adapting to coastal erosion hazards in the United States and in several other countries. It then designates those that seem suitable, unsuitable, and possibilities for future use in Neskowin.

Of the 40 HATs shown in the table, 10 were readily found to be "Not Suitable" for Neskowin. In some cases, these rejected HATS are simply are the wrong tool. They would not alleviate erosion damage in an active wave environment. In other cases, the HAT in question is inappropriate because it is too costly, State law prohibits it use on the Oregon coast, or it would significantly reduce or eliminate public access to beaches.

Table 5. General Suitability of Main Hazard Alleviation Techniques (HATs)

S = Suitable for at least some sites or areas
N = Not likely to be suitable for any sites or areas
M = May be useful or necessary in the future

1. Hard (Structural) HATs		
Revetment (Riprap)	**S**	Riprap revetments are widely used in Neskowin
Bulkhead	**N**	Minimal use in Neskowin; effective only for a few special situations
Seawall	**N**	Minimal use in Neskowin; more costly than riprap
Sand bypass	**N**	Not applicable; mainly useful on types of beaches found on US east coast
Sill (for "perched beach")	**N**	Not applicable; mainly useful on types of beaches found on US east coast
Groin	**N**	May have regulatory problems; expensive; major barrier to public access
Jetty	**N**	Not applicable to Neskowin; used only at mouths of navigable waterways
Artificial reef	**N**	Not suitable: very high costs; doubtful effectiveness
Breakwater	**N**	Probably not suitable: very high costs; doubtful effectiveness
Reef breakwater	**N**	Probably not suitable: very high costs; doubtful effectiveness
2. Soft (Nonstructural) HATs		
Beach nourishment	**M**	Not yet used in Neskowin, but could prove effective; costly; source of sand uncertain
Dune management	**M**	Difficult to use with a depleted sand base; requires Dune Management Plan
Dune stabilization	**M**	Some potential in northern part of village, along with dune management
Buffer dune	**N**	Probably not feasible in Neskowin's active wave environment
Dynamic riprap	**N**	Used at Cape Lookout, but not feasible at Neskowin; would eliminate sandy beach
3. Development HATs		
Abandon structure	**S**	May be only alternative for certain properties at extreme risk
Elevate structure	**S**	Feasible for some existing structures; could be required of some new structures
Make structure movable	**S**	Feasible for some existing structures; could be required of some new structures
Relocate structure	**S**	Feasible for some existing structures at extreme risk
Relocate community	**M**	Contingency plan could be developed for extreme events or unforeseen changes
Relocate infrastructure	**S**	Feasible (and perhaps necessary) in some at-risk areas
Control runoff and drainage	**S**	Low-cost, practical HAT for most bluff-backed sites and some other sites
Modify structure	**S**	On some sites, structural reinforcement or modification may alleviate erosion hazard
4. Policy and Planning HATs		
Compensatory mitigation	**M**	Potential source of revenue for erosion-control measures; not now used in Oregon
Conservation easement	**M**	Could be applied to at-risk sites or areas, in conjunction with other measures
Floor elevation COD (*Condition of Development*)	**S**	Now done through FEMA; higher standards could be adopted for sites or areas at risk from ocean flooding
Require geologic reconnaissance (COD)	**N**	Proposed by some as an alternative to full-fledged geotech reports; geologists have expressed doubts about effectiveness and propriety of superficial geological evaluations
Require geotech report (COD)	**S**	Important HAT for reducing erosion and flooding risks for future development; already required for development of some types in Tillamook County
Indemnification (COD)	**S**	Important HAT for reducing public's liability for private risk-taking
Land div. standards (COD)	**S**	Current land division standards could be increased for at-risk sites and areas
Liability waiver (COD)	**S**	Important HAT for reducing public's liability for private risk-taking
Safe-site requirement (COD)	**S**	Useful land-division requirement to ensure proper siting of future development
Floodplain management	**S**	Now done through FEMA; higher standards could be adopted for at-risk areas
Hazard-area overlay zone	**S**	Important HAT for reducing erosion and flooding risks for future development
Prohibition of development	**S**	Development of some sites at high risk from coastal hazards could be barred.
Public notice and review	**S**	Essential part of any community or county action; can be time-consuming and costly
Public education	**S**	Important part of any community or county action; can be time-consuming and costly
Purchase of development rights	**M**	Used to establish conservation easements; costly
Setback	**S**	Setbacks from dune or bluff scarps could be required of future development
Transfer of development rights	**M**	Could be useful with abandonment or relocation HATs; require changes in state law

One must be careful, however, not to imply greater precision in Table 5 than actually exists. A thorough analysis and comparison of all these HATs and their suitability for Neskowin would require detailed studies from engineers, geologists, planners, and other specialists. Such detailed analysis is far beyond the scope of this plan. The entries in the table therefore should not be considered definitive solutions. Rather, they summarize ideas and opinions of community members, County officials, and planners who gleaned information from a variety of sources:

- two years of readings and research;
- discussions with experts from key state agencies such as DOGAMI;
- advice from officials at agencies such as the U. S. Army Corps of Engineers;[19]
- three well-attended public workshops in Neskowin;
- monthly meetings of the NCHC;
- periodic meetings of special subcommittees formed by the NCHC.

Thus, the information in Table 5 is a preliminary guide, not a prescription. The task of using such preliminary information to make informed policy choices is explained in the next chapter.

The most notable (and disappointing) characteristic of the HATs in Table 5 is a lack of immediate benefits. Only a few of the suitable or potentially suitable HATs can be put into place and begin reducing risk within a year. Most are planning and policy measures that will apply mainly to new development and thus reduce risk quite gradually, over several decades. If Neskowin had a large amount of vacant, buildable land on its shorefront, the likely effects of new planning and policy measures would be more significant. But even a casual glance at the hazard maps shows few vacant lots in the at-risk areas. With such little potential for new development in these crucial areas, new hazard alleviation ordinance provisions will affect only a small fraction of the properties.

In short, there is no single solution to the coastal erosion hazards facing Neskowin. Instead, the hazards must be managed with a combination of measures, most of which will bring results slowly and incrementally.

[19] See Attachment 8, *Neskowin Coastal Hazards Active Protection Sub-Committee Report From the Meeting on January 14, 2011 with the U. S. Corps of Engineers*

5. Implementation Strategies

The preceding chapter outlines the universe of possibilities, presenting a brief description of all the HATs that could conceivably be used to mitigate or adapt to coastal erosion hazards. It then winnows those that clearly seem inappropriate or inapplicable for Neskowin. But that initial winnowing is only a first step. The next step is the essence of planning: to compare and evaluate likely options and then decide which ones would likely be most effective.

To consider such policy choices, the NCHC divided the labor among two groups: the *Active Protection Subcommittee* and the *Land-Use Subcommittee*. A third group, the *Implementation Subcommittee*, worked on developing ways to carry out the policy choices proposed by the two other subcommittees. The subcommittees have regularly reported their findings at the monthly NCHC meetings, and these reports have been carefully reviewed by the full committee.

5.1 The Active Protection Subcommittee's Recommendations

The active protection group analyzed the "hard" (structural) and "soft" (non-structural) HATs summarized in sections 1 and 2 of the "HATs table" in Table 5. In 2011, the subcommittee presented its research during a public meeting in Neskowin on the Spring Break weekend and a public workshop on the Memorial Day weekend. During the Memorial Day session, the subcommittee surveyed the attendees to ask their opinion of the active protection measures. The results are summarized in Table 6 and Figure 15. Note the strong vote favoring protection for the Hawk Creek Bridge.

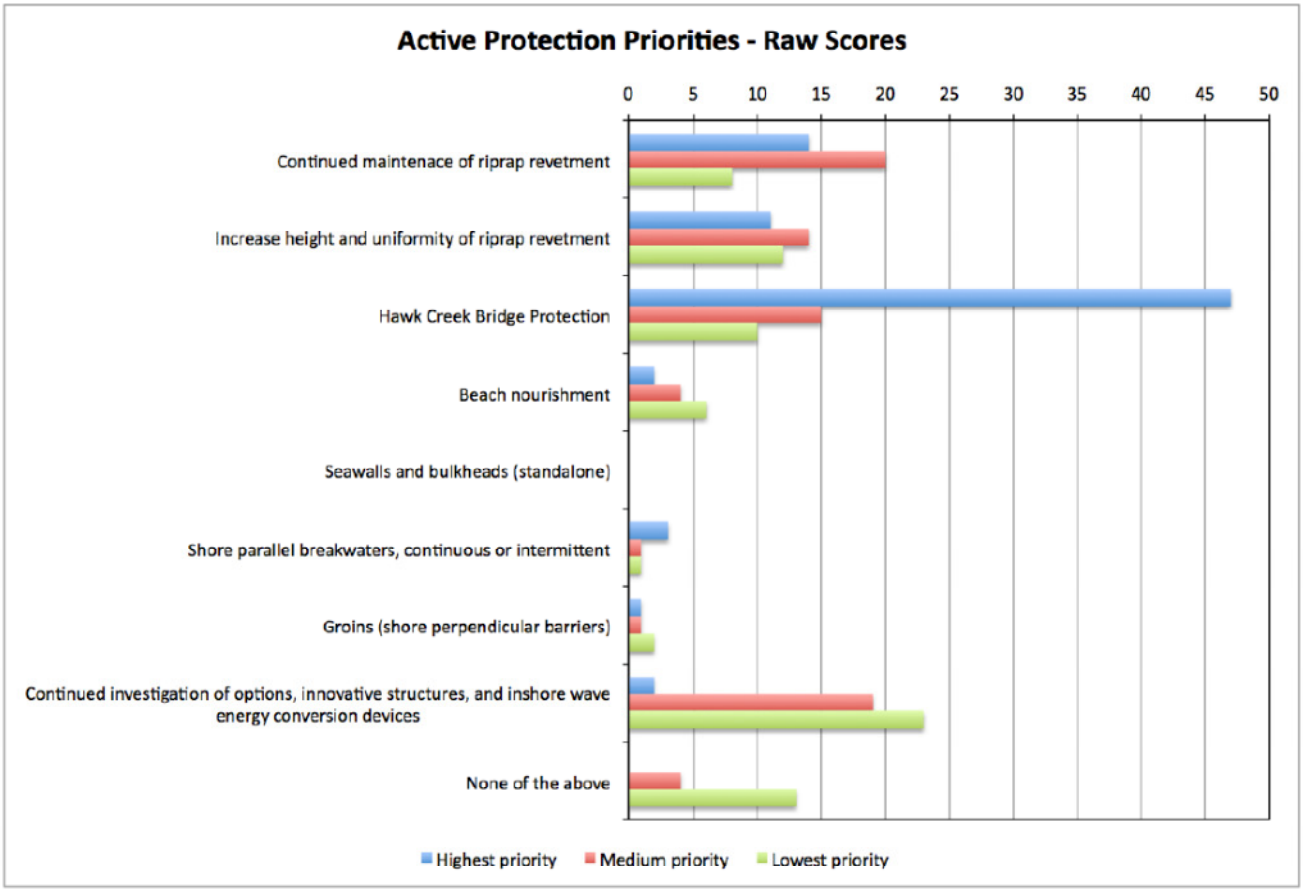
Table 6. Results of Public Survey of May 29, 2011: Preferences Regarding Active Protection Measures				
Short-Term Options	(1) First Choice	(2) Medium priority	(3) Lower Priority	(4) Total (unweighted)
Continue to maintain riprap revetment	14	20	8	**42**
Increase height and uniformity of riprap revetment	11	14	12	**37**
Protect Hawk Creek Bridge	47	15	10	**72**
Long-Term Options				
Beach nourishment	2	4	6	**12**
Seawalls and bulkheads (standalone)	0	0	0	**0**
Breakwaters, continuous or intermittent (offshore barriers parallel to shore)	3	1	1	**5**
Groins (barriers perpendicular to shore)	1	1	2	**4**
Continued investigation of options, innovative structures, and inshore wave-energy conversion devices	2	19	23	**44**
"None of the above"	0	4	13	**17**
TOTALS	**80**	**78**	**75**	**233**

The Active Protection Subcommittee then used its research and the public input to prioritize various HATs for use in Neskowin. It placed a high priority on these three "short-term" measures:

- Continue maintenance of riprap revetments;
- Increase the height and uniformity of riprap revetments;
- Find ways to increase protection for Hawk Creek Bridge.

To clarify, Active Protection Subcommittee looked at measures that might be taken in the short term, including tasks that would have long-term impacts.

Figure 15. Graph Showing Results of Public Survey of May 29, 2011, For Active Protection Measures.



The subcommittee concluded that the remaining active-protection measures – beach nourishment; seawalls and bulkheads; breakwaters; and groins – probably would not be effective or feasible for Neskowin. The group agreed, however, that it would be useful for the community to continue investigating other active-protection options, innovative structures, and inshore wave-energy conversion devices. See Attachment 9 for a summary of the group's findings.

5.2 The Land Use Subcommittee's Recommendations

While the Active Protection Subcommittee focused on engineering measures, the Land Use Subcommittee directed its attention to other long-term measures. These are the HATs summarized in Sections 3 and 4 of Table 5. Most of them involve new or amended plan and code provisions that would affect future development. For example, suppose the County development code was amended to increase the distance buildings must be set back from the shoreline. Code amendments would apply only to new construction and thus would increase community resilience to coastal hazards only gradually, over a period of many years. During the 2011 Memorial Day meeting, the committee surveyed the attendees to ask their opinion of the land use options. The results are summarized in Table 7.

After many meetings and considerable research, the Land Use Subcommittee proposed the strategies and actions set forth below. They focus on which of the long-term hazard alleviation techniques (HATs) should be used for Neskowin and on how they should be implemented.

1. **Federal Emergency management Agency (FEMA) Floodplain Provisions**
   a. The County currently has a significant set of requirements to address flooding. For example, the County currently regulates floor elevation, or the elevation that the first habitable floor must be above, well above the state minimum 1 foot above the base flood elevation (BFE) and requires floor elevation to be 3 feet above BFE. The base flood elevation (BFE) is the extent or level of flooding that the FEMA analysis indicates would occur based on a one (1) percent change of occurring in any given year. It is also called a "100 year flood" and it is a significant flooding event. The subcommittee does not recommend modifications at this time.
   b. FEMA remapping of flood hazards will occur within the next two years and the County will be required by FEMA to adopt the new analysis and associated Flood Insurance Rate Maps (FIRM's).
   c. Related to elevation of structures as indicated above, the subcommittee indicates that, given the existing building height requirements and the potential for increasing BFE's, restrictions on building heights may seriously limit future building.

2. **Special Building Techniques**
   a. The subcommittee reviewed a variety of special building techniques most of which are already being utilized by the County. Special building techniques addressing coastal hazards currently implemented in Tillamook County include:
      - Tillamook County, through the Oregon Structural Specialty Code requires construction techniques to protect against strong winds events (or wind loading); most coastal sites require the highest code standards (110 mph, Exposure D).

      - Tillamook County through Oregon Structural Specialty Code requires Seismic Design Category D2 standards, which are the highest design standards for seismic safety applicable in Oregon.

- Velocity Flood Zone ("V-Zone") standards (contained in both County code and state building code), are applicable to structures in designated coastal flood hazard areas. These standards require that the elevation of the lowest floor be at least three feet above the base flood elevation, that open piling or column-type foundations be used, and that the structure be engineered to withstand predicted hydraulic loading (wave impacts) from the base flood event.

Note that the County has limited ability to modify these requirements, which are established by the State of Oregon.

Table 7. Results of Public Survey of May 29, 2011: Preferences Regarding Land Use Options

	(1) First Choice	(2) Medium priority	(3) Lower Priority	(4) Total (unweighted)
Strengthen floor elevations/floodplain rules	4	3	2	**9**
Strengthen Geotechnical Report Standards	3	5	0	**8**
Special Building Techniques	5	6	1	**12**
Indemnification/Liability Waiver	0	3	1	**4**
Setback from High Hazard	4	4	8	**16**
Safest Site Requirements	3	1	2	**6**
Land Division Standards	3	8	12	**23**
Hazard Area Overlay Zone	2	1	6	**9**
Prohibition of Development	29	9	3	**41**
Strengthen Public Notice/Review	0	7	6	**13**
Strengthen Public Education	2	3	3	**8**
Conservation Easements	1	3	2	**6**
Control Runoff and Drainage	8	10	7	**25**
Elevate Existing Structures	0	1	3	**4**
Make Structures Movable	1	2	1	**4**
Relocate Structure	3	3	1	**7**
"None of the above"	6	5	7	**18**
TOTALS	**74**	**74**	**65**	**213**

b. There are no current standards or requirements addressing moveable building design. The County may wish to explore this concept in certain designated hazard zones; standards may address both building design (e.g. wood-frame construction only; no slab-on-grade foundations) and building site access. For example, the County could require houses in a high risk area to be built on a stem wall foundation which would a house mover to relocate the structure if coastal erosion threatened to destroy it. The County might also require a road access large enough to move the structure out of harm's way. The full NCHC has not made any recommendations at this time for moveable building design.

3. Public Notification, Geologic Reports, and Regulatory Review

a. The subcommittee recommends that the County review its hazard requirement procedures to clarify what is required and make sure procedures and processes are clearly outlined in the applicable land use code provisions.

b. The subcommittee recommends that the County utilize additional requirements for coastal development (e.g., Coastal Processes and Hazards Working Group, or CPHWG, requirements for new development on oceanfront properties). These requirements are found in Attachment 12. They include additional requirements for geologic reports done in ocean front locations to insure that reports are adequate for these areas.

4. Indemnification and Liability Waivers

a. Indemnification involves a requirement for permit applicants in designated hazard areas to indemnify and defend the County in any action for damages related to hazard area development brought by a third party. Indemnification has been proposed in some jurisdictions, but significant questions have been raised regarding the legal effectiveness of such a requirement. The subcommittee does not recommend that the County develop indemnification requirements.

b. A liability waiver requires a permit applicant to hold the County harmless in the event permitted development is damaged by natural hazards. This requirement has been implemented in some jurisdictions, and the County may wish to explore applicable examples and research the relevant experience of jurisdictions using it. The subcommittee recommends that the County explore this HAT.

c. Neither indemnification nor liability waivers actually reduce risk of damage from natural hazards, but they can serve to reduce the risk of the public incurring costs associated with this damage. They also may provide some disincentives to proposing development in higher-risk areas of a site.

5. Setback Requirements

Currently the County administers an oceanfront setback line (OSL) as directed by Section 3.085(4)(A)(c) of the County zoning ordinance. A significant reason for the OSL is to protect views by establishing a fairly uniform line that development would need to stay behind. The County could more fully consider other things besides view protection within the OSL regulations in order to establish a safer setback from hazards. The County could consider the following:

a) The County could integrate FEMA velocity flooding information into development of a revised oceanfront setback area.[20] One example might be that the County could direct that no development be authorized in a velocity flooding area, or if the entire property is located in a velocity flooding area the house must be located as far inland as possible;
b) The County should clarifying within existing zoning code provisions the existing restrictions to additional seaward development on developed parcels within foredune/deflation plain areas. Statewide Planning Goal 18 and related County policy prohibits development on beaches, active foredunes, other foredunes subject to ocean undercutting and wave overtopping and deflation plain areas subject to ocean flooding. Additional development seaward of existing development is not authorized in these areas.
c) The County could review other options related to amending the OSL, including potentially utilizing the new FEMA V-Zone analysis in some way.
d) The County could also consider, for bluff-backed shorelines, a standard setback to bluff edges for new construction. On approach could be based on a 50+ annual erosion rate (plus buffer distance). This option would require a geologist to identify an annual erosion rate. The annual erosion rate would then be multiplied by the number of years (e.g., 50) to get a minimum setback. The County could also include a "buffer" distance beyond this potential minimum erosion distance to be used in the setback calculation. This approach could include a minimum setback and should apply a larger setback if recommended by the associated geologic hazard report.

6. Hazard Area Overlay Zone

DOGAMI has developed Coastal Erosion Hazard Zone (CEHZ) maps for Tillamook County. Following are subcommittee recommendations related to this hazard information:

a. The County should adopt the DOGAMI Hazard Risk Zone Maps, modified to a single "regulatory trigger" hazard zone that combines DOGAMI's active hazard, high risk, and moderate risk zones and disregards the low risk zone as an initial step in developing appropriate zoning regulations in areas of significant risk from coastal erosion hazards.
b. The Neskowin Community Sub-Plan should include the modified Neskowin area CEHZ maps shown in Figure 12. The County should restructure the County hazard regulations to incorporate and reference these maps. The key sections of the County's zoning provisions, as currently constituted, are Section 3.085 and Section 4.070.
c. The County should consider specific regulations related to these hazard zones. Many of the hazard alleviation techniques discussed within this section (Section 5.2) could utilize this hazard map information.

7. Safe-Site Requirement/Land Division Standards (also Prohibition of Development)

These potential hazard alleviation techniques (HAT's) all include various concepts related to directing new development away from higher-risk hazard areas. Currently the County does not have any substantive requirements related to safest-site location or limiting land divisions within hazard areas. The subcommittee recommends that the County look into these issues as indicated below.

[20] Maps of velocity-flooding zones are being prepared by DOGAMI and will be completed soon.

a. **Safest Site requirement:** The County should consider adding a "safest site" standard to both Section 3.085 (Beaches and Dune Overlay Zone) and Section 4.070 (Development Requirements for Geologic Hazard Areas). This standard would specify that proposed development on parcels within hazard areas must be located within an area most suitable for development as determined by a qualified professional as part of a geologic report. It would also be subject to standards within Section 4.070 of the County zoning ordinance.
b. **Land Division Standards**: The County should consider adding standards within its land division ordinance that:
    - Limits creation of parcels to those which include a building site located outside the hazard risk zone; and
    - Prohibits adding to the number of existing housing units (including ADUs) on a developed parcel that is within the hazard zone, and
    - Prohibits the creation of additional multifamily dwelling units (including ADUs) within the hazard zone, and
    - Requires location of all new infrastructure (e.g., roads, water and sewer lines) to be landward of the hazard zone, whenever possible.

8. Public Education

We believe that citizens who educate themselves regarding existing and potentially increasing coastal hazards will make better choices regarding proposed development near those hazards. Although "public education" is not generally thought of as a regulatory function of local government, we suggest that the County consider the following concepts:

a. Develop a comprehensive plan policy or policies indicating that increasing coastal hazards will affect citizens more and more in the future and that public education on these hazards is critical to help protect citizens of the County. Further, these policies should indicate that County officials should prepare and provide materials and develop opportunities to notify and inform key audiences.
b. Within the County's zoning code, develop a disclosure standard which would require, as part of any development permit within applicable hazard zones, a disclosure form to be filed with the County (potentially within the deed record for the parcel) to indicate such things as potential hazard risk zone(s) on the subject parcel, known geologic reports for the parcel, and other known geologic risks on the parcel.

9. Conservation Easements

State law (ORS 271.725) authorizes the County to acquire conservation easements by purchase or donation. Generally, such easements limit the permissible use and development of the land subject to the easement. An easement in an area subject to coastal hazards could prohibit high-risk or other inappropriate development. Conservation easements could provide an alternative, voluntary mechanism to limit or prohibit development in high-risk hazard areas. Given the low likelihood that the County could devote any significant funding to the acquisition of conservation easements, action on this HAT should be limited to a general plan policy supporting the voluntary use of conservation easements in areas subject to coastal hazards. The County also could promote tax incentives currently available to owners who place

easements on their property. In addition, the zoning code could provide development incentives for allowing a portion of a property to be placed within a conservation easement. These development incentives could include things such as relaxation of normal setbacks, increased density on the remaining portion of parcels, and greater allowable building heights.

10. Runoff and Drainage Controls

It is clear that improper drainage and runoff from development can contribute significantly to coastal erosion. The County's current zoning code addresses runoff and drainage but only in a cursory way. Substantive requirements, if any, would come via a required geologic report in a case-by-case manner. We recommend that the County:

a. Develop a comprehensive set of standards designed to reduce runoff and drainage that contribute to coastal erosion.
b. Include within these standards a requirement that conformance with those standards be considered by the qualified professional who prepares the site-specific geologic report.
c. In developing these standards, the County should consider recently developed standards in other coastal communities. The subcommittee is recommending adoption of the Astoria standards (Attachment 13), modified for Tillamook County and Neskowin-specific conditions.

11. Relocation of Structures within Existing Lots or Parcels

a. The committee recommends that the County implement zoning code standards to provide incentives for the relocation of structures from higher to lower risk areas. Such incentives would include relaxation of normal setbacks, lot coverage or similar dimensional standards.
b. The County should also explore the use of a threshold for "substantial improvements" and/or "substantial damage" to existing structures in high-hazard areas. Such a threshold would act as a trigger requiring the relocation of structures in high-risk hazard areas to a safer part of the parcel when such structures are substantially expanded and/or restored. County flooding provisions have similar requirements in some circumstances in place currently. For example, if the threshold was 50% and a structure was damaged to a point greater than 50 % of its value, or a property owner proposed improvements to the structure greater than 50% of its value, then the structure would need to be relocated to a safer part of the parcel before improvements could be made. This standard could be incorporated into the "safe site" provision discussed above, if adopted.

Table 8 summarizes the above recommendations.

Table 8. Land Use Hazard Alleviation Techniques (HATs) Recommendations				
	No Change Required	Comprehensive Plan Change [21]	Ordinance Change	Notes
1. FEMA Floodplain Provisions	X			
2. Special Building Techniques	X			
3B. Hazard Procedure Review			X	
3C. CPHWG Requirements			X	
4. Liability Waiver		X	X	Legal Review Required
5C. OSL Standards		X	X	
5D. Bluff Edge Setbacks		X	X	
6A. Countywide Adoption of Hazard Overlay Zones		X		
6B. Sub-plan Zoning by Hazard Overlay Zones			X	
7. Safe Site Requirements			X	
8A. Public Education Policy		X		
8B. Disclosure Standards	X			
9. Conservation Easements		X		
10. Runoff & Drainage Control			X	
11. Relocation of Structures			X	

[21] *The Tillamook County Comprehensive Plan is a legal guide for making decisions about the built and natural environment. It is intended to be a vision for our future. This Plan reflects both county and statewide land use goals and is a guide to development, taking into consideration opportunities and problems particular to our county.*

The County Zoning and Land Use Ordinance provides a set of rules by which the Comprehensive Plan can be realized. Within the County, the unincorporated communities have their own Community Plans, which are adopted as part of the County's Comprehensive plan and reflect the goals and zoning which are particular to each of those communities.

5.3 Strategies for HATs That May Prove Suitable or Necessary ("Contingency HATs")

The six HATs discussed below are measures that *could* prove to be useful or necessary someday in the event of sudden, extreme or unexpected changes in conditions related to coastal erosion. The subcommittee describes them as "contingency HATs" because we do not recommend employing any of them under current conditions but recognize that one or more of them might come to be considered feasible in the future. For example, an unexpectedly rapid increase in relative sea level and in the height of deep-water storm wave heights might cause such severe erosion that some parts of the community would need to be relocated. This is not something we expect, but it is a contingency for which we should be prepared. Toward that end, we recommend steps to explore these options further. Land Use Subcommittee recommendations for each are shown in italics at the end of each section below.

PURCHASE OF DEVELOPMENT RIGHTS (PDR)

PDR may be a suitable hazard alleviation technique for certain at-risk properties in Neskowin. With this HAT, a public agency or non-governmental organization would buy the rights to develop private properties that are at great risk or that enhance the community's resilience by remaining undeveloped. With PDR, the purchasing agency or non-profit entity pays the private landowner to establish a conservation easement, which bars future development of the property. The easement runs with the land, and thus carries on in perpetuity, even as the land is transferred from one owner to another. The best-known example of PDR is the world-wide program run by The Nature Conservancy.

PDR has proved to be quite an effective method of protecting natural and cultural resources. As might be expected, the chief limitation of this HAT is its cost: the price of development rights for a shorefront property typically is quite high. *The implementation strategy here, then, is threefold: (1) Identify undeveloped properties in Neskowin where PDR would be an effective means of reducing risk from coastal erosion hazards; (2) encourage key agencies and NGOs to purchase the rights to develop such properties; and (3) negotiate with landowners and buyers to establish effective conservation easements using the PDR process.*

TRANSFER OF DEVELOPMENT RIGHTS (TDR)

TDR is a complex process in which the owner of a "receiving property" may buy development rights from a "sending property." The owner of the sending property thus gets reimbursed for a lost right to develop, while the owner of the receiving property gains a right to develop more intensively on his or her property. For example, a local government or the state might prohibit the owner of a vacant high-risk beachfront parcel from building there but compensate the owner by awarding him or her rights to develop an upland parcel (perhaps farm or forest land) more intensively than otherwise would be allowed under current zoning.

TDR is perhaps best known for its use in implementing the Tahoe regional plan in California and Nevada. In Oregon, it has been used to implement a regional plan in southern Deschutes County, in the La Pine area. TDR has not been used much elsewhere in Oregon, but that may change, with the passage in 2009 of two new laws intended to encourage its use. Senate Bill 763 enables local governments to develop and adopt TDR programs, while House Bill 2228 established a pilot program to employ TDR as one method of protecting farm and forest lands.[22] The new laws are ambiguous

[22] See DLCD's web page on this new legislation at http://www.oregon.gov/LCD/tdr_pilot_program.shtml

on the extent to which they enable TDR to be used for land *not* zoned for farming or forestry. We have raised this issue with the Department of Land Conservation and Development and explained how TDR might be appropriate for some of Neskowin's at-risk residential lands. We also have requested that the agency initiate rule-making if that is necessary to enable such use of TDR. If, however, the new laws do indeed prohibit use of TDR for residentially zoned lands, only the legislature could change that: the state agency (LCDC) cannot use its rule-making authority to amend a statute.

An implementation strategy for TDR thus would consist of three main steps:

- *Determine whether TDR would be an effective risk-management technique for any at-risk properties in Neskowin.*
- *Either clarify that use of TDR is permissible for "sending areas" in residential zones, or pursue rule-making or legislation to authorize such use of TDR.*
- *Identify noncoastal lands in Tillamook County that would be appropriate as TDR "receiving areas."*

ABANDONMENT OF BUILDINGS

To abandon a structure that has been damaged or destroyed or that is in imminent danger from coastal hazards is, of course, a last resort — an action taken only when all other measures have failed. It is a HAT only in the sense that risk to human life may be reduced by having a building's occupants leave it to seek a safer place. It is not an option the community wants to pursue. It does, however, have two significant policy implications that should be considered if there is any likelihood that buildings might have to be abandoned.

The first is simply the question of where the former occupants of abandoned buildings might go. This should not be confused with the matter of where persons *temporarily* displaced by a natural hazard may seek shelter. It is, instead, the longer-term issue of where and how persons or businesses permanently displaced by a storm or flooding may find a new place to live or work. The state or community could ease such transitions by providing relocation assistance.

The second policy issue revolves around hazards (and perhaps legal issues) resulting from abandoned structures. For example, if a beachfront home is badly damaged by ocean flooding, leaving hazardous debris on a public beach and a dilapidated structure in danger of collapse, who bears responsibility for removing those hazards? Further, if the property has a riprap structure, who assumes responsibility for maintaining it, since the failure of riprap on one property endangers other properties on either side and behind?

To determine whether such issues might become significant in Neskowin, the community may follow a two-step strategy:

- *Determine the number of owner-occupied dwellings and businesses in areas of greatest risk from coastal erosion hazards.*
- *Determine what public programs or resources are available to facilitate relocation of such structures and to reduce or eliminate hazards to the public from such structures.*

One concept that may be of use here is that of a "de-commissioning plan." Such plans often are required for certain large industrial and energy-generation facilities. The plans specify how a facility and its site will be managed in the event of a plant closure. Typically, the plan specifies that the facility's owner is responsible to restore the site and eliminate any hazardous conditions. Often the

builder or owner of such a plant is required to maintain a performance bond in the amount necessary to cover de-commissioning costs. Such plans offer two main benefits: they ensure that (a) plant closure is an orderly process that addresses all significant issues and (b) the public does not get left "holding the bag" for costs incurred when the plant owner abandons the facility. Using this same idea, a coastal community might require a similar sort of agreement from anyone who proposes to build in a high-risk area where natural hazards might someday force the building to be abandoned.

RELOCATION OF INFRASTRUCTURE

In adaptation planning, public attention often is focused most intently on protection of private property, especially dwellings. But a community's vulnerability is by no means determined solely by the extent to which private structures are exposed to or protected from coastal hazards. Vulnerability also is very much a function of how public infrastructure such as roads, bridges, sewers, and water lines are designed and placed. By relocating or reinforcing key infrastructure, a community can greatly increase its capacity to withstand hazardous events.

This is especially significant for Neskowin because many of its utilities are concentrated in one highly vulnerable place: the Hawk Creek Bridge. Major water and sewer lines are suspended under the bridge. Damage to or destruction of the bridge thus would not only eliminate vehicle and pedestrian access to much of the village but also would leave many buildings without sewer or water services.

An implementation strategy for Neskowin to deal with infrastructure relocation would consist of two main steps:

- *Identify key service systems or facilities that are vulnerable to coastal erosion hazards.*
- *Work with system and facility managers to determine how such infrastructure can be made less vulnerable by relocating those parts of it most exposed to hazardous events and conditions.*

COMPENSATORY MITIGATION

One of the most critical questions regarding any hazard alleviation technique is "How will this be paid for?" The main methods of funding – federal grants, state assistance, local improvement districts, etc. – are summarized in Chapter 12 of the *Framework Plan.* Often, availability of federal or state funding determines which HATs can – or cannot – be employed. Thus, a small community may have little choice in determining which HATs to use or how to use them.

One funding technique that may give small communities more choice and greater control is the use of a compensatory mitigation fee. This is a charge leveed on property owners to compensate for certain impacts of their development on the community. It does not appear to have been used in Oregon. We find it mentioned in the state of Hawaii's *Coastal Erosion Management Plan* with no explanation of its use or effectiveness. In that state, where the armoring of many miles of coastline has caused massive erosion of beaches, the revenue from the fee is to be used for the expensive and continuing process of "beach nourishment" (replenishment of sand). Hawaii's *Coastal Erosion Management Plan* describes the fee thus:

> **Compensatory Mitigation** If environmental impacts cannot be minimized, the concept of compensatory mitigation can be employed where the landowner contributes to the state or

county an amount related to the costs to develop or replenish similar beach resources elsewhere.[23]

Using such fees, a community could build a "hazard alleviation fund." This would be similar to the reserves created by private homeowners' associations, which collect monthly fees from members, and then use the money for structural maintenance — to replace roofing and siding, for example. Money from the hazard alleviation fund could then be used to for whatever HAT seems most appropriate.

Whether compensatory mitigation can be used in Oregon and how effective it might be are questions that remain unanswered. *If Neskowin or Tillamook County proposes to use such a funding method, the first step toward implementation would be to conduct a feasibility study to answer questions such as these:*

- *Is compensatory mitigation funding authorized under Oregon law?*
- *Are there successful examples of such funding that could be emulated?*
- *Is such a system likely to generate enough revenue to be an effective source of funding?*

RELOCATION OF COMMUNITY

The county should explore the feasibility of and methods for relocating the entire community or substantial portions of it. Among the questions that need to be answered are these:

a. What conditions or hazard events should be regarded as sufficient to trigger a relocation effort? Should the threshold for action be *prospective*, triggered by conditions such as a rapid and unforeseen increase in sea level, or *reactive,* undertaken only in response to a hazard event such as catastrophic erosion and flooding associated with a subduction-zone earthquake?
b. Since Neskowin is primarily a community of second homes, where the majority of dwellings are not occupied by year-round residents and where proximity to the beach is the primary attribute for which many such homes are bought and used, is relocation to an upland area some distance from the beach either feasible or desirable?
c. What nearby upland areas, such as state-owned or federal lands, might be suitable for relocation?
d. To what extent can TDR and PDR be used to establish such an alternative location?
e. What are the likely costs to relocate all or most of the community, and are such costs proportional to the expected benefits?
f. What state or federal programs or agencies might be available to provide funding or technical assistance for relocation?

5.4 Further Work To Be Done

The strategies proposed in this chapter are preliminary. The NCHC anticipates doing further work on them to provide greater detail and to more precisely identify steps necessary to accomplish the concepts outlined above. This probably will entail amendments to this sub-plan, which could be implemented by the County and could provide the detail needed for the implementation chapter of this sub-plan. It is anticipated that County staff will take the lead in presenting such proposed amendments for review by citizen committees and hearing bodies, ultimately bringing about adoption by the Tillamook County's Board of Commissioners.

[23] Hawaii Department of Land and Natural Resources, *Coastal Erosion Management Plan – COEMAP,* 2000, p. 25, at http://hawaii.gov/dlnr/occl/documents-forms/policies-plans/coemap.pdf/view

6. Conclusion

Completion of this plan does not mark the end of Neskowin's efforts to prepare for and adapt to the hazards associated with coastal erosion. Quite the contrary: This plan is a blueprint for the future. It describes (in Chapter 5) actions and activities to be taken that will help make Neskowin less vulnerable to such hazards. Some of those actions and activities have been initiated, but much remains to be done.

Although much work lies ahead, Neskowin and Tillamook County have already taken significant steps toward hazard adaptation. In the 2-year process of developing this sub-plan, much was accomplished, thereby making Neskowin a more resilient community:

- Public awareness of the hazards has been greatly increased. Three well-attended public meetings, several mailings to community members, and internet postings of the monthly NCHC meetings all have worked to increase the amount of hazard information available to residents and businesses in Neskowin. The NCHC also prepared and distributed a suggested reading list of works on coastal erosion and posted information on the community association's Web site. It can safely be said that most people who live and work in Neskowin are now much better informed about the hazards associated with coastal erosion and thus are better able to adapt to them.
- With Tillamook County's preparation of the *Framework Plan*, the community now has a concise, objective source of information about forces and factors that influence erosion hazards on our coast and on a variety of techniques for alleviating those hazards.
- The nature and extent of coastal erosion in the community are being scientifically and systematically measured. The resulting data have enabled DOGAMI and OSU to prepare maps that identify hazardous areas with much greater precision than was available even a decade ago.
- Both the county and the community have formed strong alliances with key state and federal agencies such as DOGAMI, OPRD, DLCD, OSU and USGS. The community knows where and how to get technical assistance, funding and emergency services for dealing with hazard events in the future.
- The community has a successful network of well-informed volunteers that continue to work with Tillamook County and key agencies to reduce Neskowin's vulnerability to coastal hazards.
- Neskowin worked with OPRD to conduct a community-wide survey of riprap revetments. The survey provided a lot-by-lot summary of the condition and extent of these rock structures, identifying places where repairs are or soon will be needed. The NCHC, through the County, and thanks to contributions from the community and DLCD, has recently contracted with a coastal engineering firm to study the situation at Neskowin and make recommendations for erosion mitigation options based on their professional judgment and community-determined viability. The work will be completed before the end of 2012.

- Tillamook County and Neskowin have worked together closely to develop a set of strategies, expressed in this sub-plan, for alleviating or adapting to coastal erosion hazards.

GLOSSARY

NOTE: This is the start of a glossary to define/explain terms thought to be unfamiliar to general readers. It is based partly on Voight, Brian. 1998. Glossary of coastal terminology. Washington Department of Ecology. Updated April 26, 2006.
http://www.ecy.wa.gov/programs/sea/swces/products/glossary.htm

Angle of repose: Related to slope stability, it is the maximum degree of slope at which a section of hillside is stable.

Littoral cell: A section of ocean shoreline that lies between two headlands or capes.

Mean high tide: The average or mean level of the high tide, taken over a period of time. The variability of the height of the tide is caused by a variety of astronomical, atmospheric, and oceanographic forces.

Ocean flooding: Intrusion of ocean water into low-lying shoreline areas that are normally dry.

Riprap: A revetment (facing for protection of an embankment) of rocks to protect embankments exposed to wave action from erosion, scour, or sloughing and, thus, protect structures behind them.

Storm surge: An increase in the water surface level caused by strong onshore winds and low atmospheric pressures associated with a significant storm event.

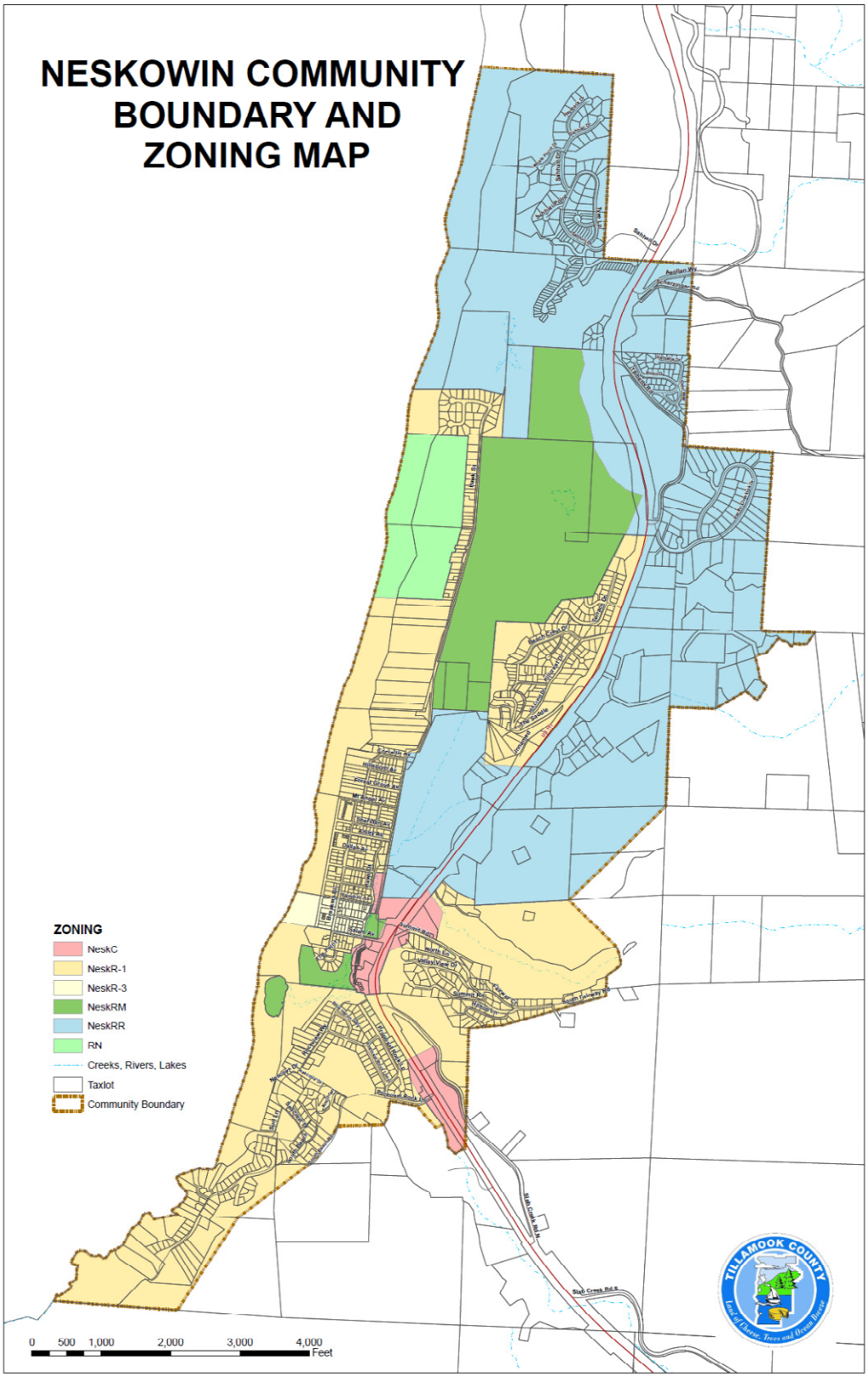
Sea level rise: An increase in mean sea level that is expected to occur over time. It is usually considered a consequence of climate change.

Wave runup: The rush of water up a beach or structure (such as riprap) on the breaking of a wave. The amount of run-up is the vertical height above still-water level that the rush of water reaches. The height of the wave run-up is determined by the slope of the beach or structure, the wave height in deep water, the wave length (time between waves), and deep water wave length (the distance between waves in deep water).

LIST OF ATTACHMENTS

NOTE: The maps included as attachments need some additional information and revisions to make them more user-friendly. Specifically, some need legend information and all should be referenced so that readers interested in studying the details know where to find larger, high resolution copies either on the Web or in hard copy form.

Attachment 1: Neskowin Community Plan Map



Attachment 2: Map of Neskowin Community Growth Boundary and Tax Lots

Attachment 3: Letter to Neskowin Landowners Describing the Erosion Hazard and Formation of the NCHC, and Inviting "Feedback and Ideas"

To: Residents of Neskowin
From: Neskowin Coastal Hazards Committee
Date: December 14, 2009

We write this letter to you on behalf of your state, county and some of your community citizens to bring attention to a potentially serious situation in the Neskowin area. It is important that you are all aware of the threat from coastal erosion, flooding, and inundation hazards. These forces could impact the beach, ocean-front properties, and the village behind it.

Neskowin has experienced significant erosion of its beaches in recent years. Ongoing research by the Oregon Department of Geology and Mineral Industries suggests that Neskowin could experience even more negative impacts in the future. Jonathan Allan with the Department, presented research recently that indicates:

1. Ocean winter wave heights have increased significantly during the past decade, and are the highest they have been in the past three decades.
2. Significantly stronger wave events are happening earlier in the Fall/Winter and not subsiding until later in the Winter/Spring, effectively lengthening the period of winter erosion.
3. The Neskowin beach/dune continues to erode and is currently not replenishing itself.
4. Because the volume of sand contained in the beaches and dune is much lower than was present in the mid-1990s (for example the dune face north of Proposal Rock has eroded landward ~150 ft. since 1997). Should Neskowin experience storms today with intensities comparable to those of the late 1990s, combined with high tides, there is a strong probability that the community could experience significant damage to its shorefront.

There have been several community meetings in Neskowin to discuss available facts on what has been happening and to consider both short and long term solutions. County Commissioner Mark Labhart is now chairing a committee of local citizens and county and state government representatives to address this issue.
The mission of the Neskowin Coastal Hazards Committee is to: Recommend to state and county agencies and officials ways to maintain the beach and protect the village through short term and long term strategies; and explore ways to plan for and adapt to the potential future changes in the Neskowin coastal area.

Neskowin Coastal Hazards Committee

The objectives of the Committee are to:

1. Become more knowledgeable about past and current dimensions of the situation and study expert projections for the future.
2. Provide information to alert Neskowin beach users to potential dangers of coastal hazards.
3. Investigate options (short and long term) for maintaining the beach and preserving the village.

4. Publish Committee findings and advocate actions likely to be most effective in fulfilling our mission.
5. Help garner support and resources necessary to implement agreed upon actions.

The Committee will keep the community informed as we learn more information and make plans to move forward on recommendations. Any actions to protect and preserve Neskowin will need community support and will not happen without it.

In the meantime, the Committee encourages residents to stay informed about potentially threatening events by monitoring official sources of weather forecasts and warnings. The National Weather Service (NWS) provides forecasts and warnings for extreme weather and high surf. This information is found at the NWS website (http://www.wrh.noaa.gov/pqr/) and is broadcast on NOAA weather radios. Private companies, such as The Weather Channel, also provide phone based on NWS warnings for extreme weather.

The Committee welcomes feedback and ideas as we develop options for consideration by the community. If there are residents or property owners interested in, or have questions for, the Committee please contact Commissioner Mark Labhart or a local Committee member.

Sincerely yours,
Neskowin Coastal Hazards Committee

Community members: Leslie Gordon, Gale Ousele, Pete Owston, Alex Sifford, Guy Sievert, Charlie Walker, Jeff Walton

Tillamook County members: Mark Labhart (Commissioner), Gerald Parker (Planning Director)

State agency members: Jonathan Allan (DOGAMI), Laren Wooley (DLCD) Tony Stein (Oregon State Parks), Patrick Corcoran (Oregon Sea Grant)

Attachment 4: Correspondence between Tillamook County, USACE and USFWS Regarding Hawk Creek Bridge and the Tsunami Escape Trail

Tillamook County

Tillamook County Commissioners
201 Laurel Avenue
Tillamook, Oregon 97141
Charles Hurliman, Tim Josi, Mark Labhart
Phone 503-842-3403
Fax 503-842-1384
TTY Oregon Relay Service

Land of Cheese, Trees and Ocean Breeze

April 22, 2011

Kevin Moynahan
Chief, Regulatory Branch
333 SW First Ave.
Portland, OR 97204

Roy Lowe
USF&W Service
2127 SE Marine Science Drive
Newport OR 97365

Dear Mr. Moynahan & Mr. Lowe:

The purpose of this letter from the Tillamook County Board of Commissioners is to respectively ask for Corps technical and planning assistance regarding the Hawk Creek Bridge in the unincorporated community of Neskowin.

While you may not be the exact Corps person to consider this matter, you were able to sit in on the meeting the Neskowin Coastal Hazards Committee (NCHC) had with representatives of the Corps several months ago in Portland. You were the highest ranking Corps official in the room. Thus, this letter to you. We would appreciate it if would please forward this letter onto whomever would be the appropriate person.

Attached in the email document to you is a letter the Tillamook County Board of Commissioners received from representatives of the Neskowin Coastal Hazards Committee. The Committee is made up of Neskowin residents, representatives from State Parks, Dept. of Land Conservation & Development, Tillamook County and the Nestucca Fire Dist. The Committee was formed by the Tillamook County Board of Commissioners about a year ago with the mission to explore ways to maintain the beach and protect the community through short and long term strategies. It is also to recommend to state and county agencies ways to maintain the beach and protect the community. The group is also exploring ways to plan for and adapt to the potential future long-term changes in the Neskowin area.

In the attached letter from the NCHC, they have requested the Board of Commissioners ask the Corps for technical & planning assistance regarding the situation with the county's Hawk Creek Bridge in Neskowin. The Board agreed & also asks that the Corps and USF&W work with the NCHC to additionally explore a Tsunami alternate evacuation route through USF&W property north of the county's Hawk Creek Bridge.

In the way of background and as discussed with you and other representatives from the Corps at our Portland meeting, the Hawk Creek Bridge is a small two lane county bridge that is the only access into and out of the main residential area of Neskowin. The bridge also has water and sewer lines hanging on it. The bridge is not built to current earthquake standards. It has on numerous occasions been overtopped by ocean wave action. It most recently and in years past been struck by large ocean debris including root wads and beach logs. The County most recently removed several large root wads from in front of the bridge and adjacent to the Hawk Creek Café. It is our belief that the bridge will not withstand a subduction zone earthquake and subsequent Tsunami which could trap several hundred people on the wrong side of the creek. Evacuation across the creek on foot would be difficult at best during an event. Neskowin has a large elderly population. The bridge is also at risk of wave action every winter.

We would ask if the Corps has staff that they could designate to help this small unincorporated community with options as to what to do about this bridge as we believe you have significant expertise in this area. In addition with this letter we are asking Roy Lowe with the USF&W to work with the NCHC and the Corps to explore a second evacuation route using the "old road" across USF&W property to be used for a Tsunami evacuation route in order to help residents evacuate the Tsunami inundation zone.

The county has very little financial contribution it can make to this effort as we are currently reducing staffing in our road dept, not doing any paving this year and trying to find dollars just to fill potholes throughout the county.

We know that the Corps is also financially strapped given the current state of the federal budget but we believe given the current situation in Japan, we as a community of government need to take steps to address what we believe is a very serious situation to the community of Neskowin.
We look forward to your reply.

Very truly yours,

Tim Josi
Vice-Chair

Mark Labhart
Commissioner

Liane Welch, Tillamook Co. Public Works
NCHC

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Oregon Coast National Wildlife Refuge Complex
2127 SE Marine Science Drive
Newport, OR 97365

April 28, 2011

Mr. Mark Labhart, Commissiner
Tillamook County Board of Commissoners
201 Laurel Avenue
Tillamook, Oregon 97141

Dear Commissioner Labhart:

Thank you for your letter of April 22, 2011, signed by you and Commissioner Josi regarding the Neskowin Coastal Hazards Committee (NCHC) and their current planning process to protect lives and property within the Neskowin community. We would be glad to work with the NCHC on a Tsunami escape route that would involve refuge lands. Prior to your April 22nd letter we had not been requested to do so. I attended the Neskowin Community meeting on March 26, 2011, which I thought was a very good overview of the situation, natural processes at work and the direction of the NCHC.

We acquired the former Snell property that contains the "old road" across Neskowin Marsh in February 2002. We have allowed use of this trail to continue although we have not advertised it for public use. At some point in the past an unknown individual or agency posted a Tsunami Escape Route sign at the west end of the trail without seeking permission or notifying us. To my knowledge this is not an official designation.

We realize this trail would serve as a vital escape route in the advent of a nearby subduction zone earthquake and resultant tsunami. We are currently preparing a Comprehensive Conservation Plan (CCP) for Nestucca Bay National Wildlife Refuge (NWR). Neskowin Marsh is a unit of Nestucca Bay NWR. On November 30, 2010, we held a public Open House Scoping meeting in Pacific City to initiate the CCP process. During the presentation portion of that meeting I acknowledged the importance of the Tsunami Escape Trail and our intent to keep this route open. We will host another public meeting next fall to discuss the draft alternatives for the CCP, but I can tell you now that the continued existence of the Tsunami Escape Trail is in all of the alternatives we are working on. Our CCP for Nestucca Bay NWR and two other refuges on the Oregon Coast will be completed in 2012.

We have concerns that the old roadbed may impede natural hydrologic flows out of the marsh and into Meadow Creek. We hope to study this in the future and correct the situation if it is determined to be impacting the marsh. Any potential alteration of the roadbed/trail would take into consideration the need for an escape route.

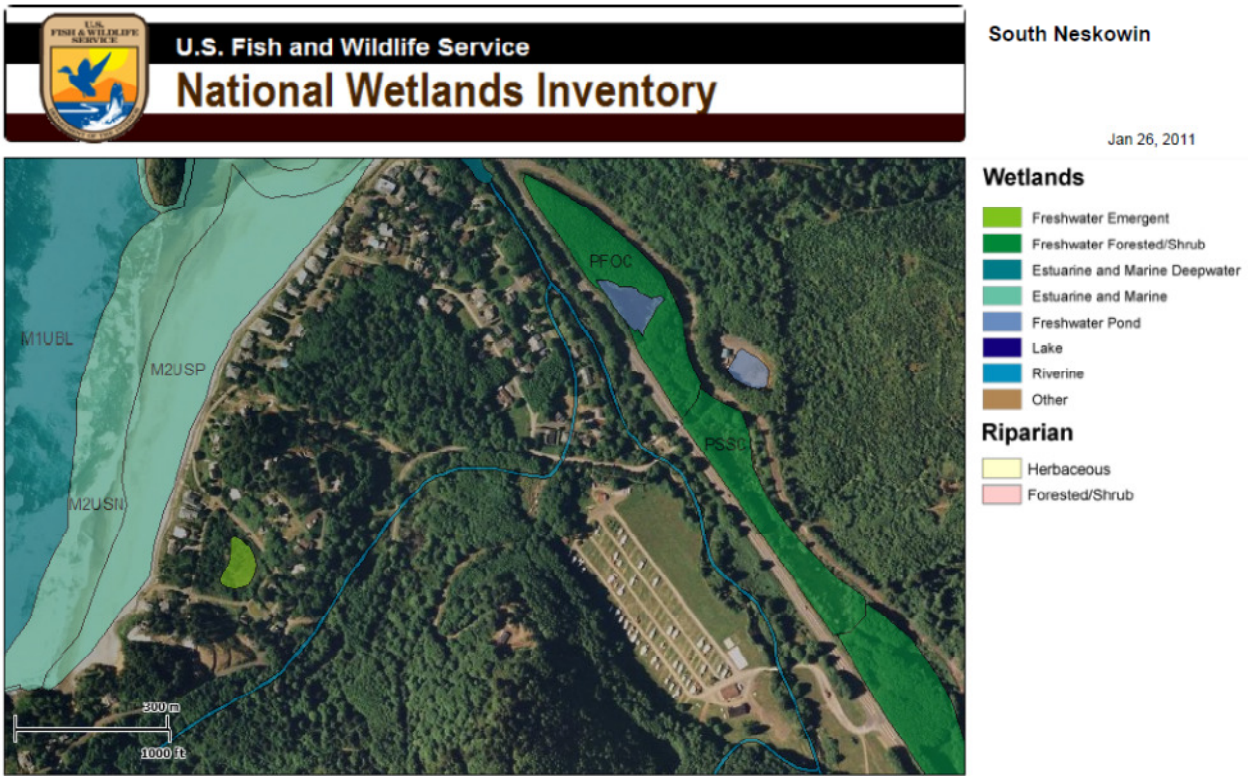
TAKE PRIDE IN AMERICA

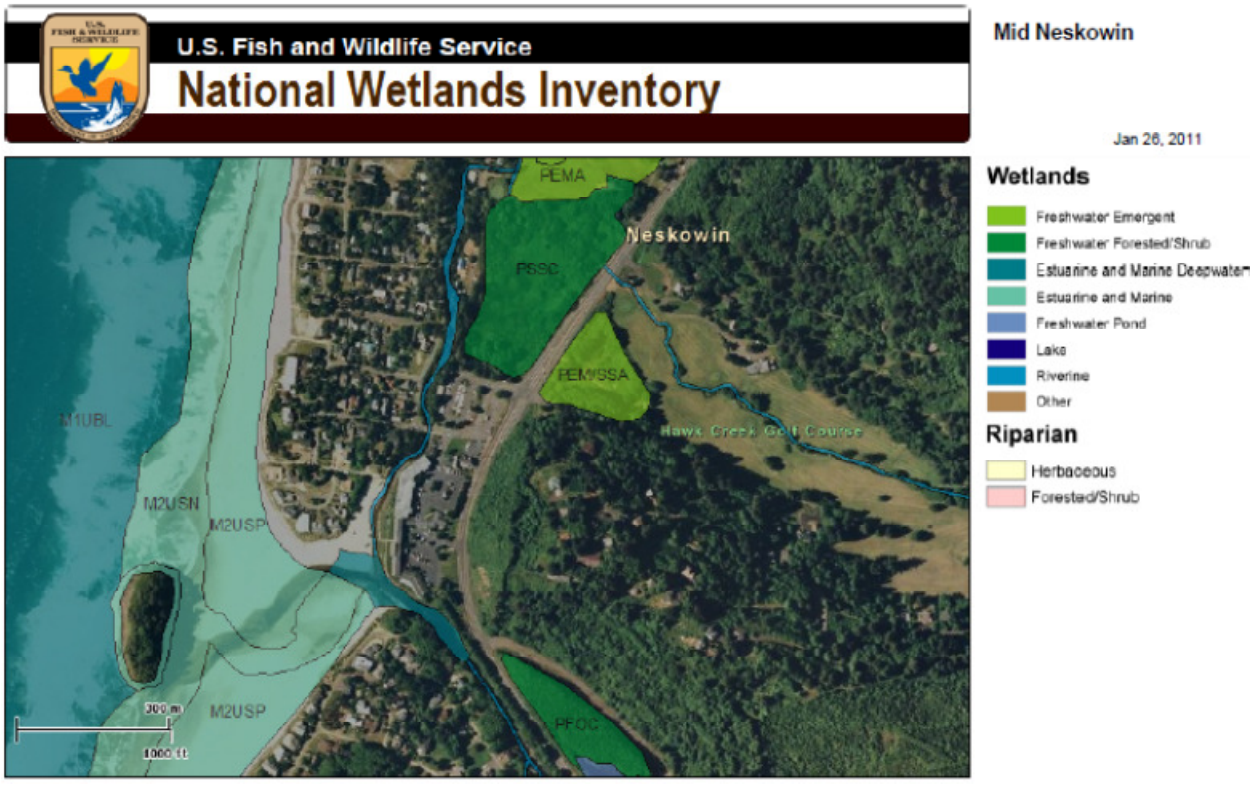
Thank you again for your letter and your concern.

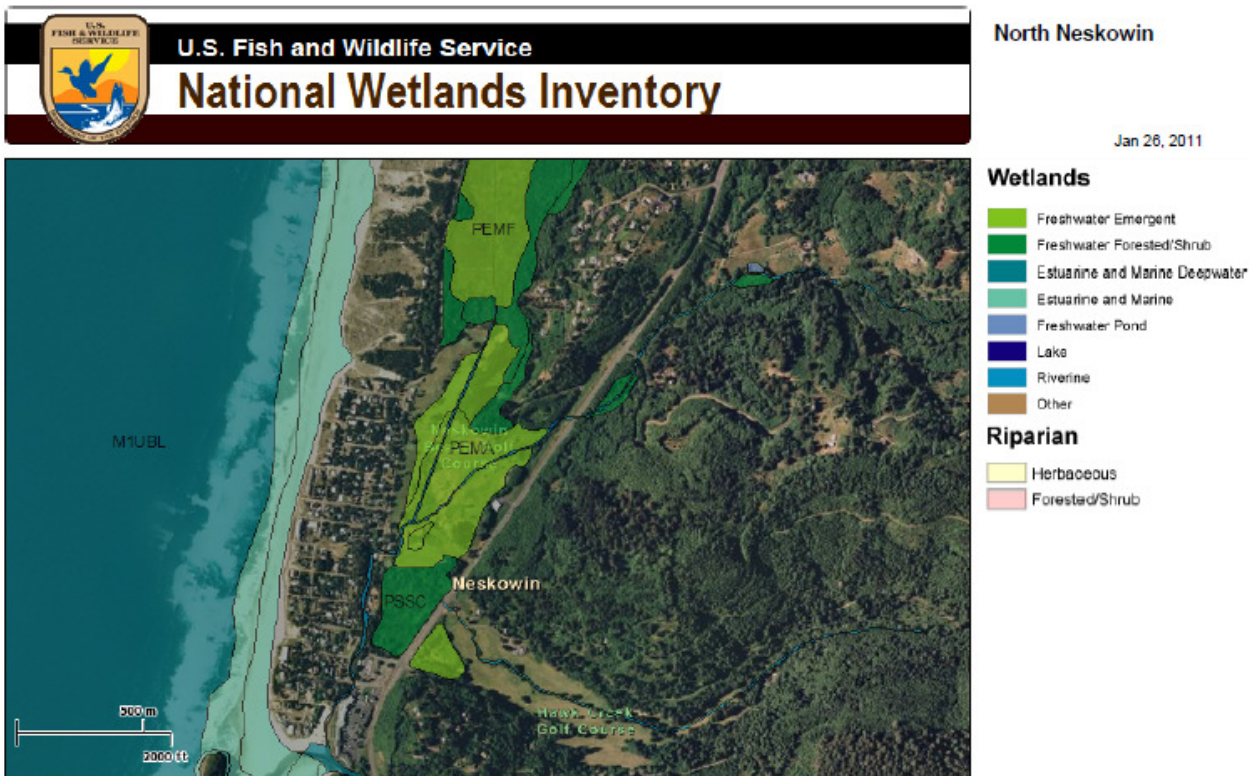
Sincerely,

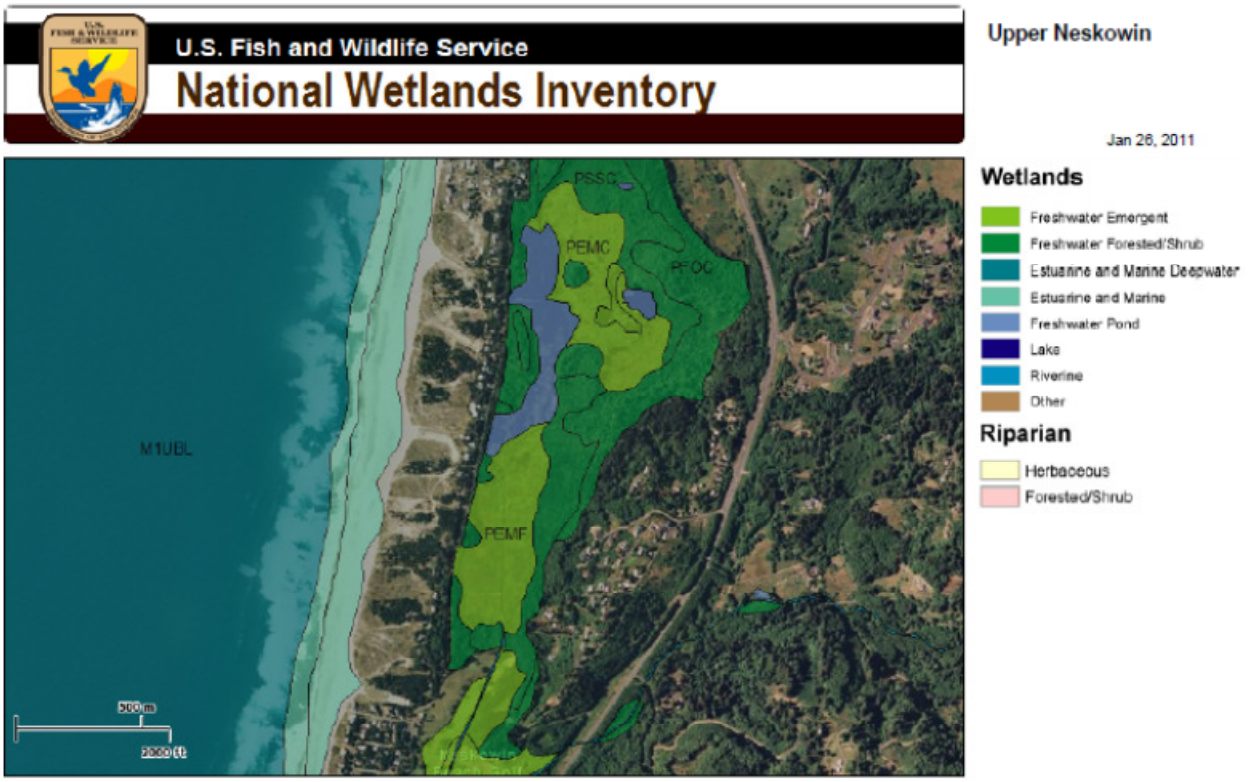
Roy W. Lowe
Project Leader

Attachment 5: National Wetlands Inventory, Four USFWS Maps of Significant Wetlands in Neskowin (South, Mid, North and Upper Neskowin)

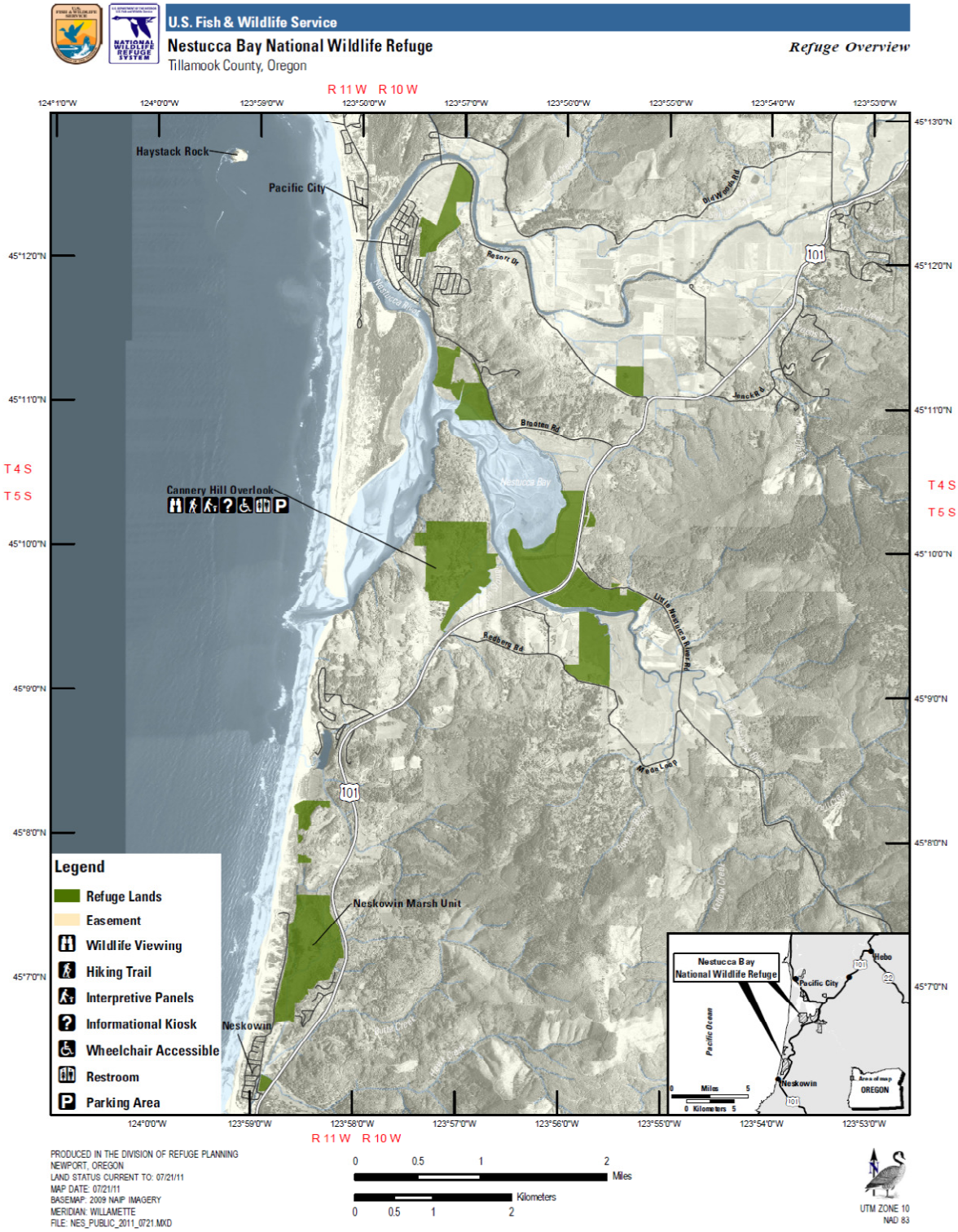





U.S. Fish and Wildlife Service
National Wetlands Inventory
North Neskowin
Jan 26, 2011
Wetlands
Freshwater Emergent
Freshwater Forested/Shrub
Estuarine and Marine Deepwater
Estuarine and Marine
Freshwater Pond
Lake
Riverine
Other
Riparian
Herbaceous
Forested/Shrub
PEMF
M1UBL
PEMA
PSSC
Neskowin
500 m
2000 ft


U.S. Fish and Wildlife Service
National Wetlands Inventory
Upper Neskowin
Jan 26, 2011
Wetlands
Freshwater Emergent
Freshwater Forested/Shrub
Estuarine and Marine Deepwater
Estuarine and Marine
Freshwater Pond
Lake
Riverine
Other
Riparian
Herbaceous
Forested/Shrub
PSSC
PEMC
PFOC
M1UBL
PEMF
500 m
2000 ft

Attachment 6: Map of USFWS's Nestucca Bay National Wildlife Refuge, including Neskowin Units



Attachment 7: Minutes of Community Update: NCHC Community Meeting, May 29, 2011

The mission of the Neskowin Coastal Hazards Committee (NCHC) is to—in priority order--plan ways to maintain the beach and protect the community through short term and long term strategies; recommend to state and county agencies and officials ways to maintain the beach and protect the community; and explore ways to plan for and adapt to the potential future changes in the Neskowin coastal area.

The Neskowin Coastal Hazards Committee (NCHC) completed their second public meeting on May 29th with about 90 members of the community present. The purpose of this meeting was to ask the community for their sense of priority on the following four issues the Committee is talking about.

1. Short Term Options for Active Protection
2. Long Term Options for Active Protection
3. Land use Options
4. Preserve the Beach or Protect the Property

The 90 people present weighed in through a voting process after a briefing on the items. On behalf to the NCHC, we thank you for your attendance and consideration. As a group, we are encouraged by your participation. These votes were advisory to the NCHC for consideration as they continue their work on a wide range of issues. Here is what we learned:

Short and Long-Term Options for Active Protection These include engineering and structural approaches to protect the beach and community from the impact of ocean waves, surges, and flooding.

The community members present felt very strongly that the **highest short-term option should be the protecting the Hawk Creek bridge** as it is a key ingress/egress out of the community and contains sewer and water lines.

After that clear priority, votes tended to cluster in equal priority around three options: **continuing maintenance of the current riprap, increasing riprap height and uniformity,** and continuing to **investigate options to protect the beach and community.** The last item includes but not limited to innovative structures and near-shore devices that might reduce wave intensity.

Land Use Options These are legal incentives and regulations to protect property from the impact of ocean waves, surges, and flooding. Seventeen different options were presented to the community for consideration.

The community zeroed in on **identifying coastal hazard areas** and; **exploring possible restrictions in these high hazard areas** as the top two land use options. The Land Use

Committee will continue its work in July and August and ask for more community input at our next public meeting in September.

Preserve the Beach-Protect Property

The Committee wanted to know what those present felt should be the higher priority as they consider the range of options presented: preserve the beach or protect property? The citizens present were asked to vote on a scale of one to six with one being preserve the beach and six being protect property. The votes were nearly evenly split, indicating they **want to protect both the beach and property**.

What next?

1. The committee wanted to first get the word out to the community about what we heard from those present at the May 29th meeting. This update serves that purpose. Please share it with your friends and neighbors.

2. Our agenda for the September meeting will be refined over the summer, and sent out well in advance of the Labor Day weekend meeting. It will include sharing the latest information and recent developments, as well as soliciting input from you.

3. There are meetings in late June with the Corps of Engineers, US Fish & wildlife, the County, and the Fire District, on possible bridge options.

4. We are contacting marine engineers about options for continued maintenance, height and uniformity of the riprap revetments, and near shore options to reduce force of waves on the beach.

The Neskowin Coastal Hazards Committee is made up of local community members, county and state agencies. If you have any input or comments, please contact our Committee Chair, Commissioner Mark Labhart. He can be reached at 503-842-3403 or email him at mlabhart@co.tillamook.or.us

Attachment 8: Neskowin Coastal Hazards Active Protection Subcommittee Report From the Meeting on January 14, 2011 with the Corps of Engineers

On January 14, the subcommittee (Bill Busch, Dave Kraybill, Pete Owston, Guy Sievert, Charlie Walker, Mark Labhart, Kristen Maze) met with the U.S. Army Corps of Engineers (USACE) at their office in Portland. Six representatives from the Corps met with us, and they provided a great deal of useful information. The key discussion points are mentioned below.

USACE Regulatory Jurisdiction

Two representatives from the Corps Regulatory group attended the meeting; and gave us a chart that illustrates their regulatory jurisdiction (see attached). In short, there are three relevant sections: 1) Section 103 (Rivers and Harbors Act), governing ocean discharge of dredged material; 2) Section 404 (Clean Water Act, see attached), disposal of dredged or fill material; and 3) Section 10 (Rivers and Harbors Act), all structures and work in navigable waters. In tidal or fresh waters, Section 10 would govern any structures or work placed on the beach or out in the water; such as onshore and offshore breakwaters, etc. In tidal waters, Section 404 would apply to jetties, beach nourishment projects, and perhaps riprap, depending on the elevation of the riprap. In fresh water, Section 404 would cover fill, utility lines, outfall structures, road crossings, etc. The USACE jurisdiction also extends out 3 miles from the coastline.

Structures would require permits from the USACE. Permits in Oregon are reviewed, approved, and issued out of the Portland office. The structural design is to be prepared by the proponent (applicant). "Nationwide" permits, governing up to a half an acre of work, are required to be issued within 60 days. However, they typically also have to be reviewed by the US Fish and Wildlife Service (USFWS), which has up to 135 days. The USFWS is not meeting this timeline regularly, resulting in a delay in approval. In addition, public hearings and lawsuits are often a part of the process, further extending the timeline. Individual permits, for projects larger in scope, are usually more complex, requiring a public review, and take at least 120 days.

USACE responsibility in protecting communities from shoreline retreat and other coastal hazards

USACE has no responsibility in protecting private property. Thus it would not provide any technical or funding assistance with the existing riprap structures (or proposed new structures) that protect private property all along the Neskowin oceanfront. However, USACE has responsibility in protecting county and state infrastructure (like roads and bridges), sewer treatment plants, etc.

A discussion then ensued about the Hawk Creek Bridge. The bridge is the only means of access to the village area of Neskowin, as well as carrying water and sewer lines into the village. The Corps suggested that they could assist with remedying the community's exposure to the potential loss of this bridge from tidal action and/or storm surge events (see below).

USACE engineering design and/or construction assistance

For those infrastructure elements that USACE identified as falling under their responsibility, the Corps has two programs: 1) Support for others (IIS); and 2) Planning assistance for states. The first program provides help for other government agencies, like Tillamook County. In planning assistance for states, the Corps would match local funding sources 50-50% for engineering studies. Once USACE decides that a project meets their requirements, the project is placed in the queue. The typical duration before funding can be obtained is 2 years.

USACE experience with beach nourishment projects

One of the participants from the Corps attending the meeting (Lynda Charles) had recently transferred from Florida. Florida has extensive experience with beach nourishment projects, which are funded by the state itself. In Florida, the design of beach nourishment projects places sand on the beach to a height higher than the height of the waves.

On the West Coast, USACE, in maintaining navigable waters, as is their responsibility, looks to use dredged materials for beach nourishment efforts. However, they suggest that the cost of transporting the dredged materials any significant distance is "prohibitive." On the Columbia River, they have experience in dredging materials onto a ship and then pumping the material onto the local shore.

USACE experience with offshore or near shore breakwater structures

On the West Coast, the Corps has extensive experience with jetties. Their experience has been that structures in the water are costly to construct, and require continuing maintenance. They cited the Tillamook jetty, where 100 feet of jetty cost $31 million. Offshore reefs, created by placing objects in the ocean below the mean water level, were also discussed. Their experience has been that the impact of the reefs are hard to predict; in one case cited, the reef blocked onshore transport of sand to the beach and actually made beach erosion even worse.

USACE experience with flood control projects

The representatives of the Corps at the meeting said they have 16 years of experience in flood control projects that involve ocean waves surging up coastal streams. The process of approving a project starts with a letter from the proponent to the USACE. The Corps then reviews the request, and, if approved, it is placed into the queue. They can provide modeling and design assistance (although the design is the responsibility of the proponent). They recommended that the request be a definable problem, like the Hawk Creek Bridge.

USACE experience with stat-of-the art shoreline, near-shore, or offshore protection solutions

The Corps representatives reported that there is a research group within the Corps, the USACE Waterways Experiment Station in Vicksburg, MS. Thus, proposed design solutions can be modeled in detail at sites like the facility in Vicksburg or the wave tank at Oregon State University in Corvallis.

USACE opinion on the adequacy of the existing and continuous riprap revetment

In the meeting we were told, from the experience of one of the Corps staff members who visited the Neskowin site, that the riprap at Neskowin is one of the best constructed riprap structures. In addition, it is their opinion that the best active protection scheme is to keep structures as far away from the ocean as possible, like our riprap revetment. Offshore or near shore structures do not perform as well under the wave conditions of our coast. In addition, they recommend that the first line of defense not be a vertical seawall (because the waves hit such a structure with their full energy and result in scour at the base of such walls). In meeting future shoreline protection requirements, they recommended that the riprap revetment be reinforced at the top and back with a seawall, taking into consideration a means of channeling the water that overtops the structure away from the wall and riprap. They also recommend that, for future maintenance and replacement of the riprap, to place layers of geotech fabric under the riprap and at the toe of the riprap.

Beverly Beach Project

Lynda Charles of the Corps provided to us a conceptual alternatives report for the Beverly Beach project. This project, in which the Corps was involved, was to rebuild a bridge on Highway 101 six miles north of Newport and to provide protection for the bridge and the highway from erosion caused by ocean waves. The report considered many of the same options that we have been considering: riprap revetment, seawall, beach nourishment, cobble revetment, sub aerial rock reef, and submerged rock reef. For this project the relative construction costs were as follows:

1) Riprap revetment at bluff toe $4.8 million
2) Seawall at bluff toe $3.9 million
3) Seawall at mid-beach $15.5 million
4) Beach nourishment (4 mm) $15.6 million
5) Cobble revetment $3.7 million
6) Sub aerial rock reef $34.7 million
7) Submerged rock reef $16.8 million

With respect to beach nourishment, the relative cost depends on the use of dredge material from nearby Yaquina Bay. If materials from a different source not as close to the project were to be used, the project cost would more than double. To be effective, the berm for the beach nourishment project was designed to be 16.4 feet high and 82 feet wide. The design lengths for the sub aerial and submerged rock reefs were 500 feet and 750 feet, respectively.

In the report, no option was chosen for among the alternatives.

Attachment 9: Summary of Active Protection Subcommittee Findings

Soft Protection Options

- Dynamic Revetments
- Dune Management
- Beach Nourishment

Hard Protection Options

- Jetties
- Groins
- Continuous Shore Parallel Breakwaters
- Intermittent Shore Parallel Breakwaters
- Seawalls and Bulkheads
- Riprap Revetments

Off-the-Beach Options

- Hawk Creek Bridge Protection Options
- Dune Management in the back dune area (covered in the soft protection options)

Dynamic Revetments

- Revetment made from cobbles and less steep than riprap (example: Cape Lookout)
- **PRO**: May be useful as an allowed exception in areas not eligible for riprap (between Corvallis Avenue and Neskowin North); relatively lower construction cost
- **CON**: Severe storms can mobilize the cobbles leaving the community vulnerable; More regular maintenance required; cobbles will eventually scatter all over the beach; expensive to purchase and transport material
- **CURRENT COMMITTEE ASSESSMENT**: A less adequate solution than riprap except for those areas where riprap is not permitted

Dune Management

- Use of beach grass, sand fences, and (perhaps) dune grading to encourage dune growth
- **PRO**: Useful in areas where the dunes are directly subject to wave action (between Corvallis Avenue and Neskowin North); inexpensive
- **CON**: Not suitable in areas like Neskowin where there is inadequate sand to rebuild the dunes
- **CURRENT COMMITTEE ASSESSMENT**: Insufficient sand available on the beach to be an adequate solution for Neskowin

Beach Nourishment

- Addition of sand to the beach to dissipate wave energy and to add to the dune to increase its volume
- **PRO**: Beach becomes higher and wider; easily constructed and maintained

- **CON**: To be effective, a great deal of sand would have to be added, and regularly replenished – thus expensive; no local source of sand; could require the addition of groins or breakwaters to keep the sand in Neskowin
- **CURRENT COMMITTEE ASSESSMENT**: May not be suitable without the addition of other structures; an expensive solution for Neskowin

Jetties

- Shore-perpendicular structures designed for harbor or inlet protection (examples: Newport and Tillamook)
- **PRO**: Effective in maintaining a navigable channel
- **CON**: Very expensive; downdrift erosion
- **CURRENT COMMITTEE ASSESSMENT**: Not relevant at Neskowin

Groins

- Shore-perpendicular structures designed to trap sand and stabilize the beach
- **PRO**: Traps sand moved along the beach by longshore current and wind
- **CON**: Expensive; normally used on sand-rich beaches; not effective on beaches with rip currents, steep beach slopes, and cross-shore transport; downdrift erosion
- **CURRENT COMMITTEE ASSESSMENT**: Likely not effective at Neskowin

Continuous Shore-Parallel Breakwaters

- Shore-parallel structures, either above or below the mean water line, designed to reduce wave energy
- PRO: Beach width might be increased; wave energy is reduced in areas behind the structure
- CON: Expensive to build and maintain; likely to require additional beach nourishment; difficult to predict impact on beach erosion
- CURRENT COMMITTEE ASSESSMENT: Expensive for the situation at Neskowin (as much as $370 million per mile to construct)

Intermittent Shore-Parallel Breakwaters

- Intermittent shore-parallel structures above the mean water line, designed to reduce wave energy
- **PRO**: Beach width might be increased; wave energy is reduced in areas behind the structure
- **CON**: Expensive to build and maintain; may increase erosion on either side of the structure; would require a feasibility study, including a quantitative analysis
- **CURRENT COMMITTEE ASSESSMENT**: Expensive for the situation at Neskowin

Seawalls and Bulkheads

- Vertical, self-supporting structures made of concrete or steel sheet piling
- **PRO**: Useful for protecting the community behind it
- **CON**: Expensive to build and maintain; likely to increase erosion on the beach due to the reflection of waves back onto the beach; scour at the toe
- **CURRENT COMMITTEE ASSESSMENT**: Not considered suitable for the Neskowin oceanfront due to likely increased beach erosion

Riprap Revetments

- Steeply sloping structure made from large rocks placed behind the beach; currently in place for most of the beachfront at Neskowin
- **PRO**: Useful in protecting the community behind it
- **CON**: Expensive to build and maintain; not high enough currently in all locations to prevent wave overtopping; potential for scour at the toe; subject to isolated failures
- **CURRENT COMMITTEE ASSESSMENT**: If properly constructed and adequately maintained, suitable for protecting the community under most circumstances in the medium term (10-20 years)

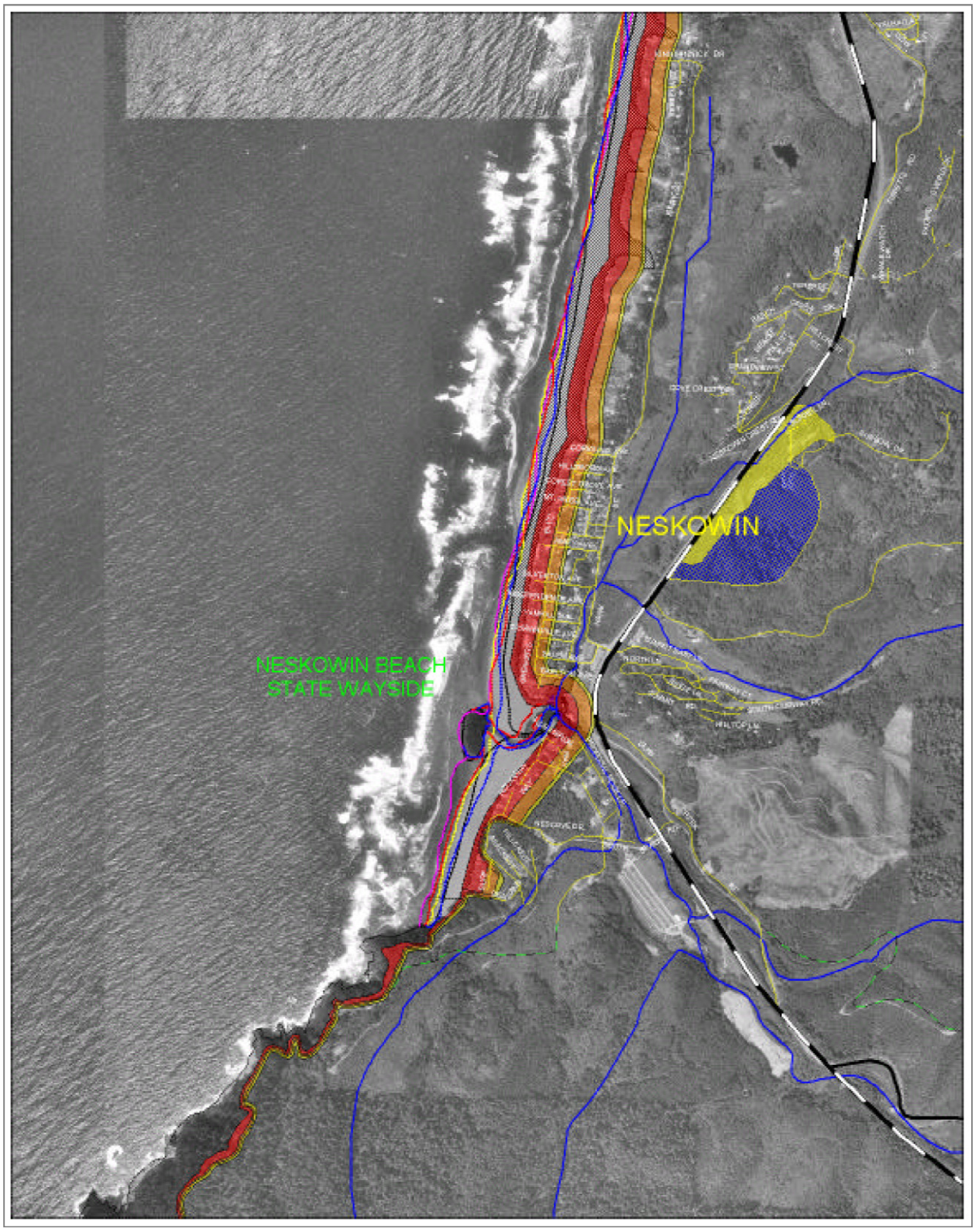
Hawk Creek Bridge Protection Options

- The Hawk Creek Bridge and the attached water and sewer lines are vulnerable to wave and tide action up the creek
- **PRO**: Protection necessary to better protect the bridge and prevent isolation of the village; funding for design and construction potentially available from USACE.
- **CON**: Cost might be high; at this time, no proposed solution
- **CURRENT COMMITTEE ASSESSMENT**: Recommend the county and USACE immediately begin a feasibility study and planning process

Options Requiring Further Study or Action

- Continued maintenance of the Riprap Revetment
- Investigate raising the height of the Riprap Revetment and making it more uniform
- Hawk Creek Bridge Protection
- Investigate new innovative options that reduce wave energy

Attachment 10: DOGAMI Map of Coastal Erosion Hazard Zones in the Neskowin Area, from "Neskowin," Appendix E, p. 91, of DOGAMI Open File Report (OFR) 0-01-03, *Evaluation of Coastal Erosion Hazard Zones Along Dune and Bluff Backed Shorelines in Tillamook, Oregon: Cascade Head to Cape Falcon*, by J.C. Allan and G.R. Priest, 2001.



Attachment 11: OSU Maps: Estimating Probabilities in a Changing Environment

The information and maps from DOGAMI identify zones that would be subject to erosion if certain design events occur. But what is the probability that such events will occur? Estimating such probabilities is made especially difficult by the dynamism of the coastal environment. As noted in the preceding chapter, several key factors such as global sea level and peak deep-water wave height off the Oregon coast have been changing and continue to change.

Researchers at Oregon State University's Department of Geosciences therefore began working on a method that considers such changes when estimating the probability of various design events. In a special project that focused on conditions at Neskowin, the OSU researchers developed a new probabilistic methodology to predict coastal erosion hazards. The results of that methodology are described in an unpublished master's thesis by student Heather Baron: "Incorporating Climate Change Uncertainty into a Probabilistic Methodology for Evaluating Future Coastal Change[24] Hazards and Community Exposure" (May 2011).[25]

The OSU methodology uses computer modeling to analyze an array of 1,800 scenarios. Each scenario expresses the total water level (TWL) that could be expected if a certain combination of conditions occurs. Such a combination constitutes a "design event." OSU's methodology thus expands on DOGAMI's data by introducing a large range of variables and estimating the probability of erosion potential from multiple design events over several different time periods.

OSU's computer modeling enables different combinations of assumptions about future conditions to be analyzed. The model can assess an array of values for key variables such as sea level rise, deep-water ocean wave heights, and beach characteristics such as slope. The results help researchers to estimate the probability that a given area of the shore will experience erosion under a defined combination of circumstances during a specified period.[26] Such probability is expressed in statistical terms as a "confidence level." A confidence level of 98 percent, for example, implies very high probability that, under the specified conditions, the area in question would experience hazardous erosion. In contrast, a confidence level of 50 percent is essentially a statement that the probability of erosion occurring is 50-50: it might happen, it might not.

OSU's work produced some four dozen maps of coastal erosion hazards along Neskowin's shoreline, showing at-risk areas for various time periods and based on different assumptions about variables such as sea level rise. This sub-plan focuses on four of those maps to help determine those areas of the community most likely to experience significant erosion hazards during the period from 2011 to 2050. OSU's pilot project analysis thus has been a great help in further locating and understanding erosion risks initially described in DOGAMI OFR 0-01-03.

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[24] Because this is a plan for adapting to hazards associated with coastal erosion and flooding, the Neskowin Sub-Plan typically speaks of "coastal *erosion* hazards." But design events such as a large winter storm may cause severe erosion to a beach in one place while widening it another. The scientific literature therefore sometimes speaks of "coastal *change* hazards," a term broad enough to include both erosion and accretion.

[25] Ms. Baron's faculty advisor, Peter Ruggiero, reviewed and commented on the first draft of this framework plan and worked closely with the Neskowin Coastal Hazards Committee during the writing of the *Framework Plan*.

[26] The target years used in OSU's model were 2009, 2030, 2050, and 2100.

Together, the four OSU maps and their legends tell us the following:

- The "design event" is a total water level with a one-percent probability. This is a severe event that, like the so-called "hundred-year flood," has a one-in-a-hundred chance of occurring in a specified time period (the present to 2050 for purposes of this sub-plan).
- If such an event occurs in the next few decades (i.e., by 2050), areas shown in the golden-brown[27] band running along the village's shoreline have the "highest risk for erosion." There is a 98 percent confidence level (near certainty) that hazardous erosion would occur here.
- An area immediately east (landward) of that high-risk area also might experience hazardous erosion. The probability of that depends on how far seaward a given property lies. If the property adjoins the area marked "Highest Risk for Erosion," there is a significant chance – approaching the 98 percent confidence level – that the property would erode. For a different property, at the landward edge of the area designated "Other Significant Risk," there is a much smaller chance of erosion. Properties in between the seaward and landward edges of the "Other Significant Risk Area" thus all face some risk, ranging from just under 98 percent odds of erosion to as little as 2 percent. The farther seaward its location, the closer the odds of a property's erosion come to the 98 percent confidence level.
- The line marked "Mean of Erosion Predictions" indicates the statistical center of the "Other Significant Risk Area." A place on this line is somewhat likely to experience erosion. The confidence level of such erosion occurring here is midway between the 98 and the 2 percent levels.

The four OSU erosion-hazard maps are shown on the following pages. Each shows a portion of Neskowin. The first map is the southernmost, with each subsequent map showing the next area to the north. The maps overlap slightly.

[27] If printed on a monochrome printer, the area appears as a medium gray.

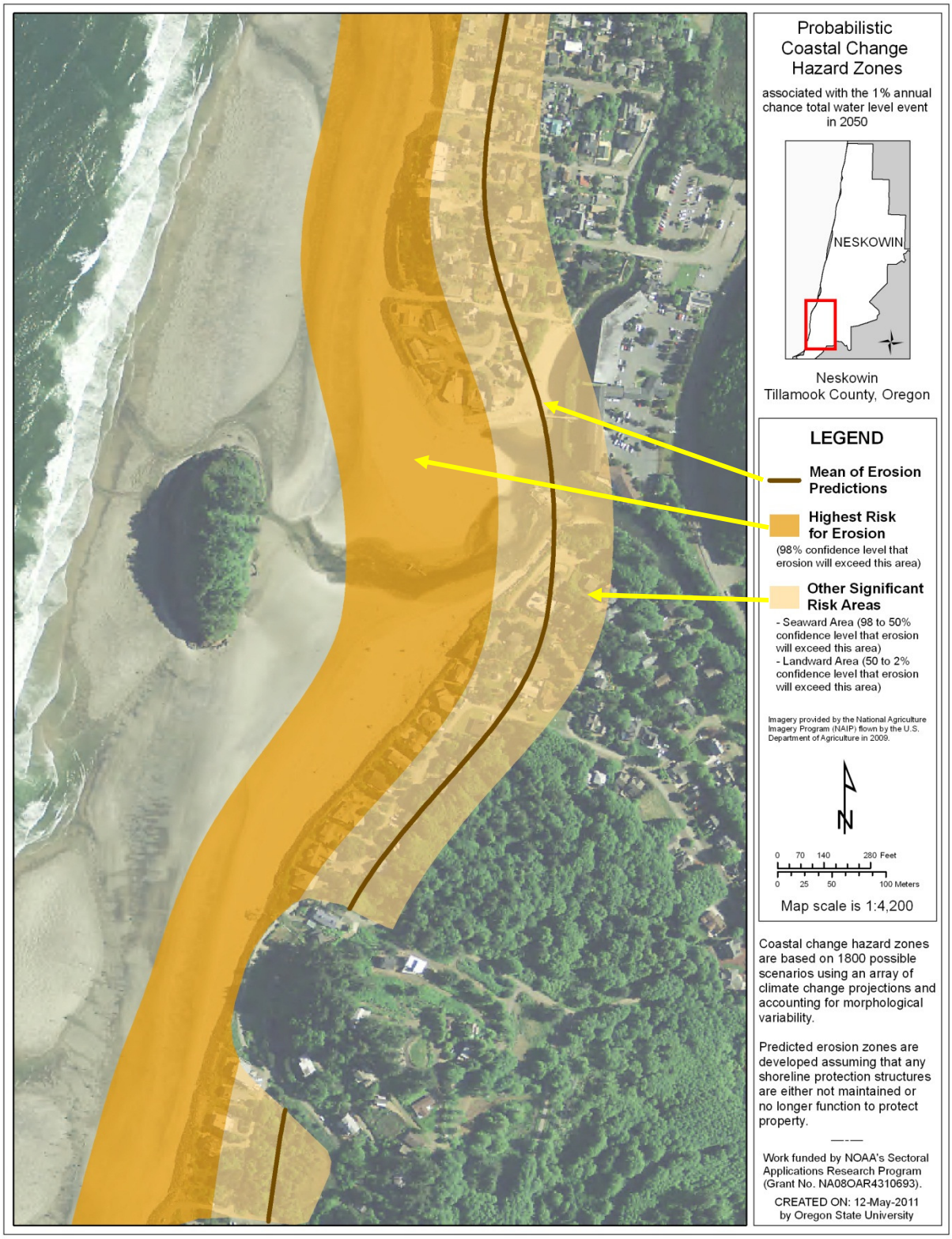

Figure 11a, Areas at Risk of Significant Erosion by 2050, Southern Neskowin

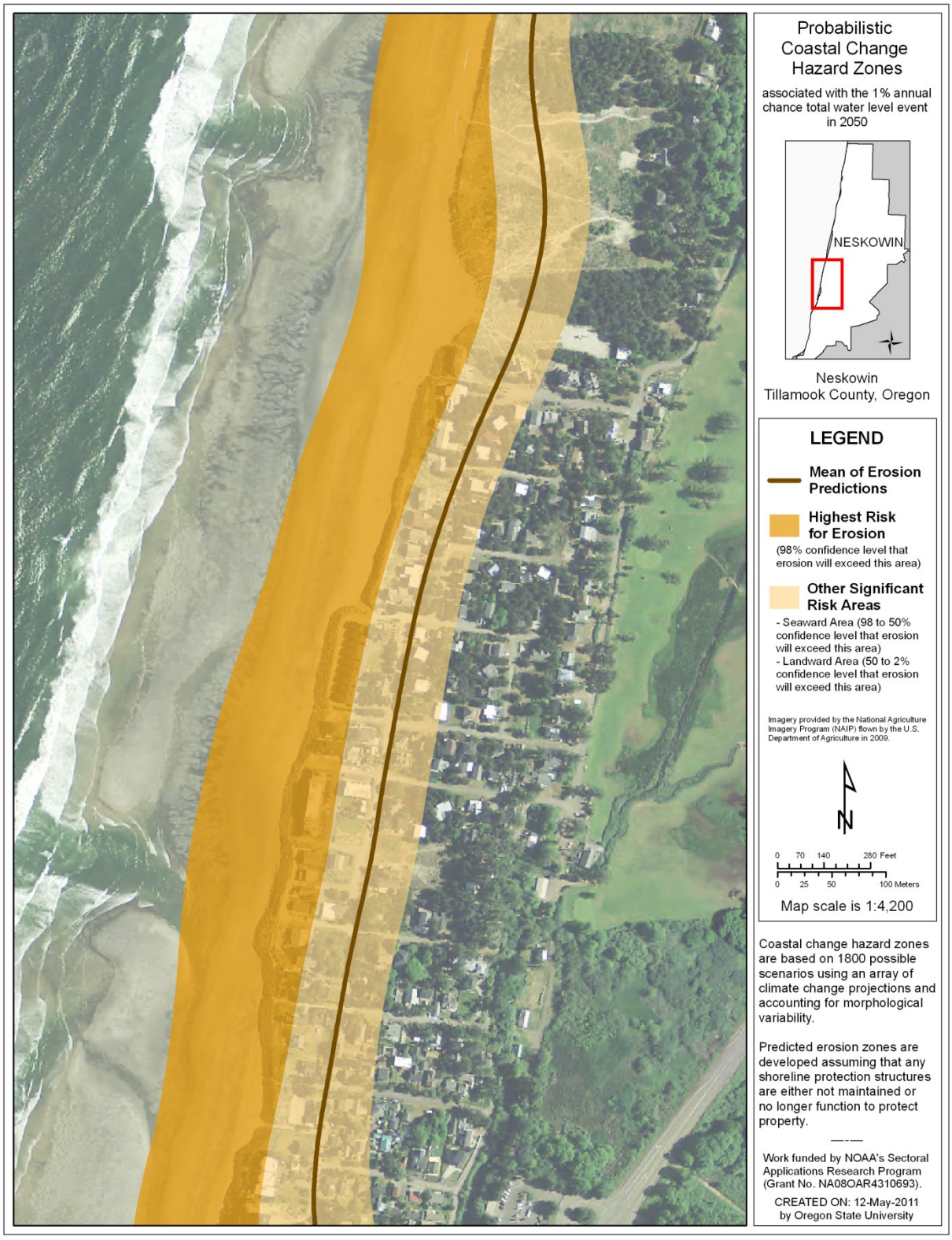

Figure 11b, Areas at Risk of Significant Erosion by 2050, Central Neskowin

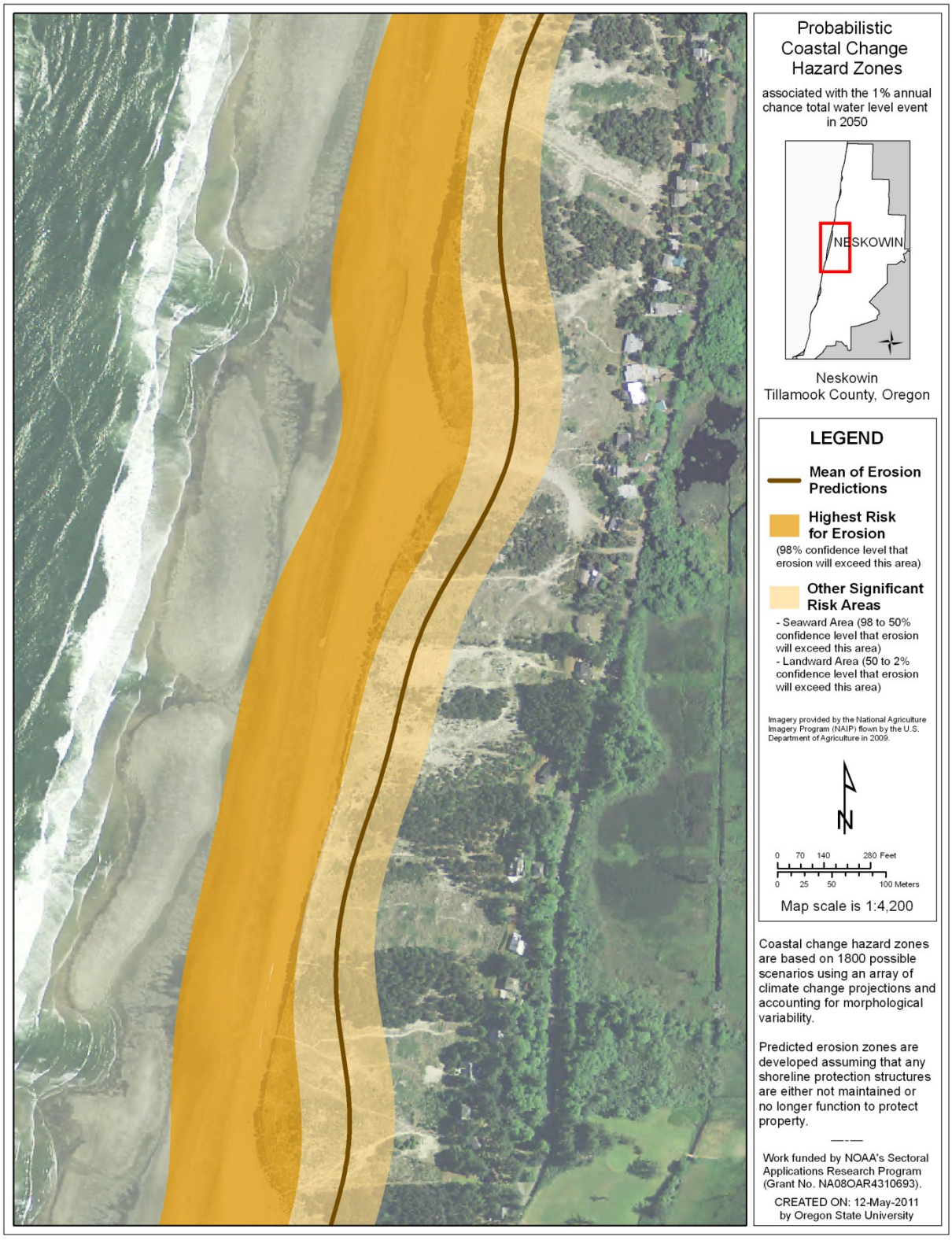

Figure 11c, Areas at Risk of Significant Erosion by 2050, North-Central Neskowin

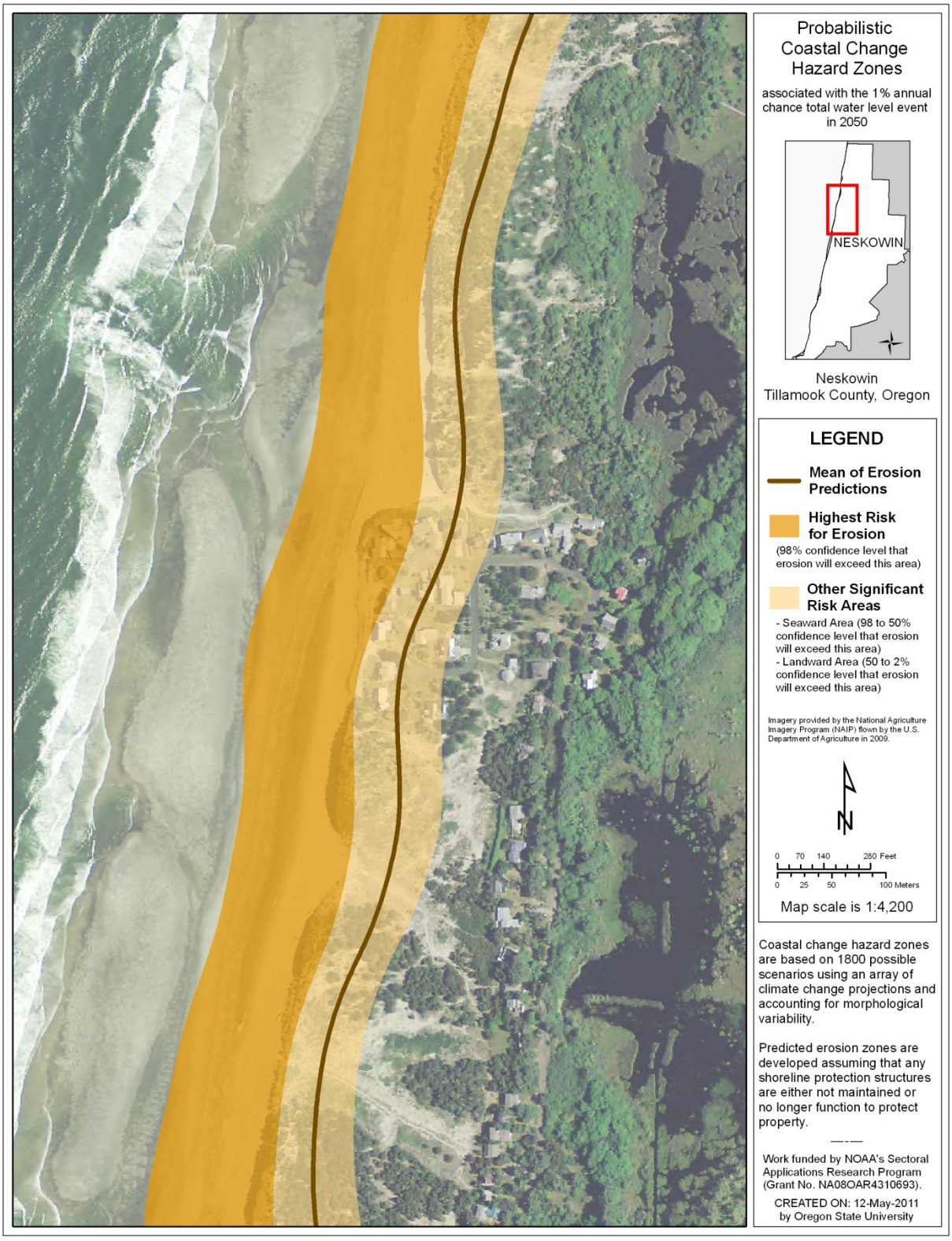

Figure 11d, Areas at Risk of Significant Erosion by 2050, Northern Neskowin

Estimating Structures at Risk

Using the erosion-risk data and maps for Neskowin, OSU researcher Heather Baron prepared the following charts to show the extent of risk to the community's homes, businesses and roads. Note that the two charts on the left indicate risk based on a **100-percent event — lesser erosion and flooding** from a total water level that could be expected to occur almost yearly. The charts on the right indicate risk associated with the much **more severe 1-percent event** – erosion and flooding from a total water level with a one-percent probability of occurrence.

Because the planning period for Neskowin's sub-plan is from the present to 2050 and because its focus is on erosion risks from a one-percent event, the data of most interest to us in these charts are those shown beneath the two yellow arrows on the charts to the right below.

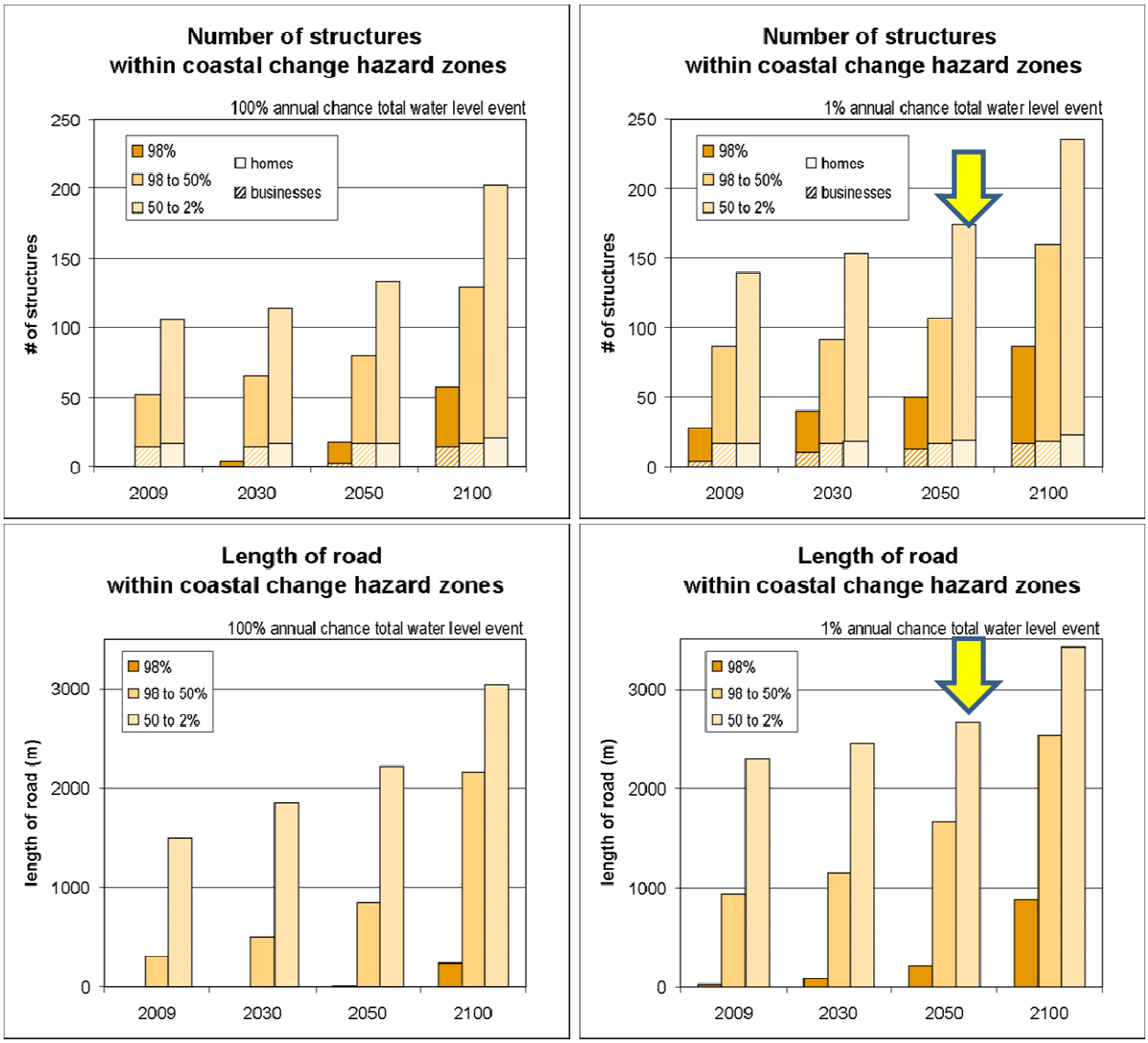

Figure 11e, Neskowin Risk Estimates

The highlighted data in the charts reveal that approximately 50 structures (mainly dwellings) are at very high risk (98 percent probability) from erosion hazards associated with a one-

percent event occurring by 2050. More than 100 structures are at significant risk (probability in the range of 98 to 50 percent), and about 170 are at some risk.[28]

The charts indicate that only a few hundred meters of streets can be considered at very high risk. The length of streets facing significant or at least some risk is much greater, rising to approximately 2,700 meters (8,856 feet).

[28] Neskowin has about 400 dwellings in all. Approximately three-quarters of them are second homes, while roughly a quarter of them are occupied year-round.

Attachment 12: Geological Report Guidelines for New Development on Oceanfront Properties

Produced by the Coastal Processes and Hazards Working Group and Oregon Coastal Management Program staff (including DLCD, DOGAMI, and OPRD), this is a list of geologic factors, analyses and recommendations which should be included in geologic reports for new development on oceanfront property, as well as property close enough to the ocean to be influenced by coastal geomorphology and ocean-caused erosion.

These guidelines can be used as a supplement to the "Appendix B" Guidelines for Preparing Engineering Geologic Reports in Oregon. They are meant to be a resource for local government review and ordinance updates, geologic and engineering consultants, and those interested in coastal property.

A. Site Description

1. The history of the site and surrounding areas, such as previous riprap or dune grading permits, erosion events, exposed trees on the beach, or other relevant local knowledge of the site.

2. Topography, including elevations and slopes on the property itself.

3. Vegetation cover.

4. Subsurface materials – the nature of the rocks and soils.

5. Conditions of the seaward front of the property, particularly for sites having a sea cliff.

6. Presence of drift logs or other flotsam on or within the property.

7. Description of streams or other drainage that might influence erosion or locally reduce the level of the beach.

8. Proximity of nearby headlands which might block the longshore movement of beach sediments, thereby affecting the level of the beach in front of the property.

9. Description of any shore protection structures that may exist on the property or on nearby properties.

10. Presence of pathways or stairs from the property to the beach.

11. Existing human impacts on the site, particularly that might alter the resistance to wave attack.

B. Description of the Fronting Beach

1. Average widths of the beach during the summer and winter.

2. Median grain size of beach sediment.

3. Average beach slopes during the summer and winter.

4. Elevations above mean sea level of the beach at the seaward edge of the property during summer and winter.

5. Presence of rip currents and rip embayments that can locally reduce the elevation of the fronting beach.

6. Presence of rock outcrops and sea stacks, both offshore or within the beach zone.

7. Information regarding the depth of beach sand down to bedrock at the seaward edge of the property.

C. Analyses of Erosion and Flooding Potential

1. Analysis of DOGAMI beach monitoring data available for the site.

2. Analysis of human activities affecting shoreline erosion.

3. Analysis of possible mass wasting, including weathering processes, landsliding or slumping.

4. Calculation of wave runup beyond mean water elevation that might result in erosion of the sea cliff or foredune (see Stockdon, 1996).

5. Evaluation of frequency that erosion-inducing processes could occur, considering the most extreme potential conditions of unusually high water levels together with severe storm wave energy.

6. For dune-backed shoreline, use established geometric model to assess the potential distance of property erosion, and compare the results with direct evidence obtained during site visit, aerial photo analysis, *or analysis of DOGAMI beach monitoring data*.

7. For bluff backed shorelines, use a combination of published reports, *such as DOGAMI bluff and dune hazard risk zone studies*, aerial photo analysis, and field work, to assess the potential distance of property erosion.

8. Description of potential for sea level rise, estimated for local area by combining local tectonic subsidence or uplift with global rates of predicted sea level rise.

D. Assessment of Potential Reactions to Erosion Episodes

1. Determination of legal restrictions of shoreline protective structures (Goal 18 prohibition, local conditional use requirements, priority for non-structural erosion control methods).

2. Assessment of potential reactions to erosion events, addressing the need for future erosion control measures, building relocation, or building foundation and utility repairs.

E. Recommendations

1. Use results from the above analyses to establish setbacks, building techniques, or other mitigation to ensure an acceptable level of safety and compliance with all local requirements.

2. Recommend a plan for preservation of vegetation and existing grade within the setback area, if appropriate.

3. Include a consideration of a local variance process to reduce the building setback on the side of the property opposite the ocean, if this reduction helps to lessen the risk of erosion, bluff failure or other hazard.

4. Recommend methods to control and direct water drainage away from the ocean (e.g. to an approved storm water system), or if not possible, to direct water in such a way so as to not cause erosion or visual impacts.

References:

Allan, J.C. and Hart, R., (in review). Assessing the Temporal and Spatial Variability of Coastal Change in the Neskowin Littoral Cell: Developing a Comprehensive Monitoring Program for Oregon Beaches, Oregon Department of Geology and Mineral Industries, Portland, Oregon.

Allan, J. C. and Komar, P. D. (2005). Morphologies of Beaches and Dunes on the Oregon Coast, with Tests of the Geometric Dune-Erosion Model. Open file report O-05-08, Oregon Department of Geology and Mineral Industries, Portland, Oregon.

Allan, J. C., Komar, P. D. and Priest, G. R. (2003). Shoreline variability on the high-energy Oregon coast and its usefulness in erosion-hazard assessments. In: Byrnes, M. R., Crowell, M. and Fowler, C. (Editors), Shoreline mapping and change analysis: Technical considerations and management implications. Journal of Coastal Research, pp. 83-105.

Komar Paul D., 1993, Guidelines for the Preparation of Technical Reports to the Impacts of Coastal Erosion, Report to the Oregon Department of Land Conservation and Development.

Ruggiero, P., Komar, P. D., McDougal, W. G., Marra, J. J. and Beach, R. A., 2001, Wave runup, extreme water levels and the erosion of properties backing beaches: Journal of Coastal Research, 17(2), p 407-419.

Shoreland Solutions 1994, Appraisal of Chronic Hazard Alleviation Techniques, DLCD.

Stockdon, H. F., Holman, R. A., Howd, P. A. and Sallenger, A. H., 2006, Empirical parameterization of setup, swash, and runup: Coastal Engineering, 53, p 573-588.

Attachment 13: City of Astoria Development Code for Regulation of Erosion Control and Stormwater Management

3.300. REGULATION OF EROSION CONTROL AND STORMWATER MANAGEMENT.

A. Purpose.

The purpose of this ordinance is to:

1. Minimize impacts associated with excavation and grading,

2. Minimize the erosion of land during clearing, excavation, grading, construction and post-construction activities,

3. Prevent the transport of sediment and other soil borne pollutants into the Columbia River estuary and its tributaries, wetlands and riparian areas,

4. Prevent the transport of sediment onto adjacent property and into City rights of way and storm systems,

5. Prevent the unnecessary clearing, excavation, and stripping of land; and

6. To reduce the amount of soil exposure during construction.

B. Definitions.

The following definitions shall apply for this ordinance:

1. Clearing: Any activity that removes vegetative cover while leaving the root system intact.

2. Erosion: Movement of soil by water or wind.

3. Excavation: Removal of topsoil, gravel, sand, rock or any other type of soil material.

4. Fill: Placement of topsoil, gravel, sand, rock or any other type of soil material.

5. Fill, Structural: Fill that is intended to support structures.

6. Grading: Any combination of excavation and/or fill activities.

7. Regulated Activities: The clearing, grading, excavation, filling, or stripping of land, and post construction activities.

8. Sedimentation: Deposition of soil moved by water or wind from its site of origin.

9. Stripping: Removal of vegetation and roots.

10. Tracking: Movement of soil from a disturbed area onto streets, sidewalks, or adjacent property by vehicle tracks or tires.

11. Undeveloped Site: A lot or parcel of land with no permanent structure such as a dwelling or commercial building or other permanent man made structure.

(Section 3.300 added by Ordinance 04-08, 10-4-04)

3.305. PERMITS.

A. Permit Required.

Persons proposing to clear, grade, excavate, strip, or fill land (regulated activities) shall obtain a permit before commencing any of the following activities unless exempted elsewhere by this ordinance:

1. Any proposed clearing, grading, filling, stripping, or excavating (regulated activity) within 100 feet of a river, bay, stream, watercourse or wetland; or

2. Any proposed regulated activity located more than one hundred feet from a river, bay, stream, watercourse or wetland that exceeds an area of 2,000 square feet; or

3. Any proposed clearing, grading, filling, stripping, or excavating (regulated activity) within 100 feet of a known geologic hazard as indicated on the City's "Areas of High Water and Past Slides" map; or

4. Any proposed clearing, grading, filling, stripping, or excavating (regulated activity) if any portion of the site has a slope of 35% or greater; or

5. The proposed cumulative volume of excavation and fill exceeds ten cubic yards in a 12 month period; or

6. Excavation or fill in excess of one (1) foot deep.

B. Permits in Conjunction with Building Permits.

A grading permit for regulated activities in conjunction with a structure requiring a building permit shall be reviewed and issued as part of the City's building permit process using the standards herein.

C. Permits in Conjunction with a Partition or Subdivision.

A grading permit for regulated activities in conjunction with a partition or subdivision shall be reviewed and issued in conjunction with the partition or subdivision process using the standards herein. New subdivisions or housing developments should cause minimal earth disturbance and removal of trees.

D. Exceptions.

The following activities are exempted from the requirements of this ordinance:

1. Residential landscaping and gardening activities up to 1,000 square feet;

2. Forest management activities in an area zoned Land Reserve (LR) for forest management.

3. Utility construction by public or private utility agencies, involving less than 20 cubic yards of excavation or fill.

4. Emergency repair work by a utility agency. After the emergency repairs are completed, the site shall be subject to the requirements of this ordinance.

E. Permit Review and Approval.

Permits shall be obtained from the Engineering Department. All permits shall be reviewed and approved by both the Engineering Department and Community Development Department for compliance with this Ordinance and other City codes and building codes.

F. Permit Fees.

Permit fees shall be established by City Resolution.

(Section 3.305 added by Ordinance 04-08, 10-4-04)

3.310. INFORMATION REQUIRED.

The following information is required for permits:

A. Site Plan.

A site plan, drawn to an appropriate scale with sufficient dimensions, showing the property line locations, roads, areas where clearing, grading, excavating, stripping, or filling is to occur, the area where existing vegetative cover will be retained, the location of any springs, streams or wetland areas on or immediately adjacent to the property,

the general direction of slopes with slope arrows showing direction of water flow on existing slopes and graded slopes, construction access, the location of the proposed development, and the location of soil stock piles, if any.

B. Erosion Control Methods.

The type and location of proposed erosion and sedimentation control measures, both short term and post construction.

C. Stormwater Management Methods.

The type and location of proposed stormwater management from roofs, parking and other impervious surfaces. Stormwater calculations prepared by a Registered Professional Engineer may be required by the City Engineer as part of the permit application.

D. Grading Plan in Steep Areas.

The City shall require a grading plan prepared by a Registered Professional Engineer and/or Registered Engineering Geologist where the disturbed area has an average slope of 35% or greater, the disturbed area is located in known geologic hazard area, or is part of a partition or subdivision. Such grading plan shall, at a minimum, include the following additional information:

1. Existing and proposed contours of the property at two foot contour intervals;

2. Location of existing structures and buildings, including those within 25 feet of the development site on adjacent property;

3. Design details for proposed retaining walls;

4. The direction of drainage flow and detailed plans and locations of all surface and subsurface drainage devices to be constructed.

E. Sedimentation and Erosion Control Plan.

The City shall require that the sedimentation and erosion control plan be prepared by a Registered Professional Engineer where the disturbed area is greater than 20,000 square feet, or the disturbed area has an average slope of 35% or greater.

F. Development Plan.

The City shall require a development plan for the site where the disturbed area is greater than 2,000 square feet to assure the least amount of earth disturbance as necessary, and to assure that the development is consistent with zoning and other City

regulations. Such development plan shall, at a minimum, include the following additional information:

1. Site plan as described above;

2. Location of existing and proposed structures;

3. Location of existing and proposed parking, access and egress;

4. Location and square footage of proposed landscaped areas.

G. Ground and Surface Water Diversion Plan.

If property construction will result in alterations of natural hydrology such that damage to neighboring properties will occur, the City shall require that any known ground or surface water be diverted to an alternate natural path or to a man-made system to prevent any damage to other properties that may be affected by the water.

(Section 3.310 added by Ordinance 04-08, 10-4-04)

3.315. GRADING STANDARDS.

A. Cuts.

The following Grading Standards shall be required for cuts:

1. The design shall minimize the need for cuts. The proposed grading plan shall be designed to blend with the existing topography as much as possible without the use of retaining walls.

2. Long, steep cut and fill slopes shall be avoided.

3. The slope of cut surfaces shall not be steeper than is necessary for the intended use and shall not be steeper than two horizontal to one vertical (2:1) unless an engineering geology report determines that a cut at a steeper slope will be reasonable stable and not create a hazard to public or private property.

4. Cuts shall not remove the toe of any slope where a known potential or historic land slide exists as determined by the City Engineer.

5. Cuts shall be set back a minimum of five (5) feet from property lines so as to minimize danger and disturbance to adjoining property.

6. Retaining walls shall be constructed in accordance with the Structural Specialty Codes as adopted by the City.

B. Fills.

The following Grading Standards shall be required for fills:

1. The design shall minimize the need for fills.

2. The slope of fill surfaces shall not be steeper than two horizontal to one vertical (2:1) unless an engineering geology report determines that a steeper slope will be reasonably stable and not create a hazard to public or private property. Fill slopes shall not be constructed on natural slopes steeper than two horizontal to one vertical.

3. Fills shall be set back from property lines a minimum of five (5) feet so as to minimize impact on adjoining property. Retaining walls shall be required by the City where the City Engineer deems it necessary.

4. The ground surface shall be prepared to receive fill by removing vegetation, inappropriate fill, topsoil, and other unsuitable materials, and shall be scarified to provide a bond with the new fill.

5. Any structural fill shall be designed by a Registered Professional Engineer, in accordance with standard engineering practices.

6. Fill material shall be broken into pieces no larger than 12 inches to assure proper compaction.

7. The following items are unsuitable materials and shall not be used for fill:

   a. Roofing material, fiberglass, metals, asphalt, or large slabs of concrete, and other man-made construction debris inappropriate for fill

   b. Stumps, organic materials, and other natural debris inappropriate for fill

8. A compaction report shall be required for any area with fill prior to any construction on the site.

C. Drainage.

The following Grading Standards shall be required for drainage:

1. Proposed grading, cuts or fills shall not alter drainage patterns so that additional stormwater is directed onto adjoining property.

2. All cut and fill slopes shall be provided with subsurface drainage as necessary for stability.

D. Streets.

Refer to the Astoria "Street Design Standards" on file in the office of the City Engineer.

(Section 3.315 added by Ordinance 04-08, 10-4-04)

3.320. EROSION AND SEDIMENTATION CONTROL STANDARDS.

A. Authority.

Review and approval of grading permits for regulated activities shall be based on the conformance of the development plans with the standards of this section. Conditions of approval may be imposed to assure that the development plan meets the standards. The City Engineer shall require modifications to the erosion and sedimentation control plan at any time if the plan is ineffective in preventing the discharge of sediment to City streets and storm drains, surface waters, wetlands, or adjacent property.

B. Department of Environmental Quality (DEQ) Standards.

The current DEQ "Best Management Practices for Stormwater Discharges Associated with Construction Activities" document is incorporated as part of this document by reference.

C. General Erosion and Sedimentation Control Standards.

1. Natural vegetation shall be retained and protected wherever possible.

2. Stream and wetland areas shall only be disturbed in accordance with US Army Corps of Engineers and Oregon Division of State Lands permits, as well as riparian preservation requirements in Astoria Development Code Article 4, "Columbia River Estuary and Shoreland Regional Standards".

3. Sedimentation barriers, as described in the DEQ "Best Management Practices for Stormwater Discharges Associated with Construction Activities" document shall be placed to control sedimentation from entering the river, bay, streams, wetlands, adjacent property or City streets and storm sewers. The barriers shall be installed prior to site clearance or grading activities.

4. The City Engineer or Building Official may require areas to be temporarily stabilized with straw mulch, sod, mat or blanket in combination with seeding, or other acceptable sediment control method. Prior to the completion of

construction, such areas shall be permanently stabilized by seeding or other vegetative ground cover.

5. Stormwater catch basins, inlets or culverts shall be protected by sediment traps or filter barriers such as “bio bags”.

6. Soil storage piles or fill shall be located so as to minimize the potential for sedimentation of streams, wetlands, adjacent property or City streets or storm sewers. The City Engineer or Building Official may require temporary stabilization of soil storage piles or fill.

7. Temporary sedimentation control, not in conjunction with a structure, shall be required in any situation where the City Engineer or Building Official determine that sedimentation or erosion may affect streams, wetlands, adjacent property, City streets or storm sewers.

8. Erosion and sedimentation control measures shall be continually maintained during the period of land disturbance and site development in a manner that ensures adequate performance. Soil that has been transported by any means to a street or any area where stormwater flows to a storm drain or surface water, shall be cleaned up to prevent transport to the drain or surface water. All temporary erosion and sedimentation control measures shall remain in place until the disturbed area is stabilized with permanent vegetation.

9. The City shall require a graveled construction road or access of sufficient length, depth, width, and rock size to prevent sedimentation from being tracked onto City streets.

10. Sediment trapped by sediment control methods shall be redistributed on-site, removed, or permanently stabilized to prevent further erosion and sedimentation.

11. The City Engineer shall require the cleanup of any streets, catch basins or storm sewers affected by regulated activities on a site at the expense of the person responsible for those regulated activities. Measurable amounts of sediment that leave the site shall be cleaned up and placed back on the site or disposed of in an approved manner.

12. Under no conditions shall soil on sidewalks, streets, or equipment be washed or hosed into storm sewers, drainage ways, streams or other water bodies.

13. The City shall make periodic inspections to ascertain that erosion and sediment control measures as proposed have been implemented and are being effectively maintained. The City Engineer or the Building Official are authorized to place an

immediate "stop work" order on any project that does not meet the standards imposed in this ordinance.

(Section 3.320 added by Ordinance 04-08, 10-4-04)

3.325. STORMWATER MANAGEMENT STANDARDS.

Projects that are 40,000 square feet (land area) or larger shall install a stormwater management system as part of the landscaping requirements. Such a system shall be designed by a Registered Professional Engineer and/or Registered Landscape Architect and shall be capable of meeting the standards in the DEQ "Best Management Practices for Stormwater Discharges Associated with Construction Activities", or other guidelines acceptable to the City Engineer.

(Section 3.325 added by Ordinance 04-08, 10-4-04)

3.330. ENFORCEMENT.

A. Final Inspection.

The City shall review all regulated activities one year after completion and/or installation of permanent vegetation to assure that any erosion control or regulated activity measures installed continue to meet the standard imposed in this ordinance. The applicant shall be responsible for continued maintenance until the City Engineer and Building Official has approved a final inspection on the project.

B. Responsible Party and/or Change of Ownership.

The applicant shall be responsible for the work to be performed in accordance with the approved plans and specifications in conformance with the provisions of this code. In the event of a change of ownership prior to the Final Inspection, the applicant shall enter into a Performance Agreement with the City and proposed new property owner. The Performance Agreement shall, at minimum, identify the party responsible for completion of the project until a Final Inspection has been approved by the City.

C. Continued Maintenance.

If an erosion control or regulated activity measure system fails due to lack of maintenance or breakage, and there are impacts to adjacent property owners, or downstream water quality or quantity as a result of the failure, the City shall perform the maintenance or repair and charge the current property owner for the required repairs.

D. Penalties.

In addition to any other method of enforcement available to the City, including City Code Section 1.010, the provisions of this ordinance may be enforced by the issuance of citations by duly appointed officers of the City pursuant to Astoria City Code Section 6.135.

E. Additional Costs.

Where the City Engineer, Community Development Director, or Building Official deem it necessary, in the interest of public health, safety, or welfare, to incur additional costs such as, but not limited to, the hiring of independent geotechnical experts or other technical expertise, or costs to complete or correct work not completed by the applicant during the course of the project, such costs shall be borne by the applicant. Such costs shall not exceed actual costs.

F. Performance Bond.

The City Engineer or Community Development Director may require that the applicant furnish to the City a performance bond up to, and not to exceed, the value of the cost of the required improvements in order to assure that the conditions imposed are completed in accordance with the plan and specifications as approved by the City Engineer or Community Development Director and that the standards established in granting the permit are observed.

G. Time Limit on Permit.

Authorization of a permit shall be void after 180 days unless substantial construction or use pursuant thereto has taken place. However, the City Engineer or Building Official may, at their discretion, extend authorization for an additional 180 day period upon written request by the applicant and a determination that the conditions of the project or permit application have not changed sufficient to warrant review of a new permit application.

(Section 3.330 added by Ordinance 04-08, 10-4-04)