Grays Harbor County

2011 – 2016 Hazard Mitigation Plan



Grays Harbor County

Hazard Mitigation Plan



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EXECUTIVE SUMMARY

The *Grays Harbor County Hazard Mitigation Plan* sets goals, objectives, and mitigation actions for reducing the risk of eight hazards facing Grays Harbor County over the next five years (2011 through 2016).

These hazards include:

- Floods
- Earthquakes
- Severe Storms
- Tsunamis

- Hazardous Materials Incidents
- Landslides
- Volcanoes
- Wildland Fires

The matrix below summarizes the six Hazard Mitigation Goals and accompanying Hazard Mitigation Objectives for prevention, property protection, public education and awareness, structural projects, emergency services, and natural resource protection.

Hazard Mitigation Plan Goals	Hazard Mitigation Objectives
Prevention Goal	Prevention Objectives
A well-established Grays Harbor County hazard	1.1 Emphasize preventative measures that eliminate
mitigation program will reduce the risks associated with	or reduce hazard impacts in all County plans,
natural and human caused hazards.	regulations, and programs
This program will rely on an atmosphere of cooperation among the private sector, county government, and state and federal agencies to promote mitigation planning and coordination of achieving objectives. Grays Harbor County will build the necessary institutional capacity for an effective hazard mitigation program and will secure public and private financial resources for investment in hazard mitigation planning, implementation actions, and post disaster recovery.	 Promote partnerships between the county, state and federal agencies, the Confederated Tribes of the Chehalis, and the Quinault Indian Nation to pursue joint hazard mitigation efforts Develop a coordinated mitigation approach with all the incorporated cities in Grays Harbor County Assure plans are in place to reduce the public health impacts of a disaster event Prevent land development in extreme hazard prone areas Minimize disruption of utility and transportation systems Identify resources to provide ongoing program support and funding for hazard mitigation programs and projects
Property Protection Goal	Property Protection Objectives
Grays Harbor County will seek to reduce the impact of	2.1 Promote the use of appropriate hazard resistant
hazards on the built environment whenever possible. It	design, construction, and maintenance for all
will place particular emphasis on actively safeguarding	structures, both public and private
critical facilities in hazard prone areas to protect public	2.2 Support programs that assist homeowners and
health and safety.	businesses establish hazard mitigation measures
	on their property

Hazard Mitigation Plan Goals	lazard Mitigati	on Objectives
	2.3 Develop l	hazard resistant protective measures
	for critica	I facilities and lifelines
	2.4 Encourag	e the retrofit of critical facilities in
	hazard ar	eas to protect public health and safety
	2.5 Protect v	aluable historic and cultural resources
Public Education and Awareness Goals	Public Educatio	n and Awareness Objectives
Grays Harbor County citizens, businesses, and visitors	3.1 Make ava	ilable programs and information to
will be informed, prepared for, and recognize what	assist res	idents, schools, businesses, and visitors
actions to take during and after a hazard event.	prepare f	or and recognize what actions to take
	during an	d after a hazard event
	3.2 Increase	awareness of mitigation actions that
	reduce th	ne impact of hazards
	3.3 Develop	cooperative education and awareness
	programs	s with schools and non-profit and
	private o	rganizations that provide disaster
	programs	5
	3.4 Dissemin	ate information to the public about
	specific e	mergency action plans and procedures
Structural Project Goals	Structural Proje	ct Objectives
Support development of suitable structural projects	4.1 Prioritize	and secure funding for all structural
that significantly reduce the impact of a hazard when	projects i	dentified in existing plans
no other option is feasible.	4.2 Identify a	nd prioritize the need for new
	structura	l projects to increase protection of life,
	property,	and the natural environment
Emergency Services Goals	Emergency Serv	vices Objectives
Grays Harbor County will have sufficient expertise and	5.1 Provide f	or a well-trained group of professional
resources for emergency preparedness, response, and	and volur	nteer emergency personnel with the
recovery to reduce the loss of life and property damage	capability	to effectively respond to hazard
due to hazard events. It will have a reliable	events	
communication system that will coordinate action	5.2 Assure ef	fective coordination with all local,
between emergency responders, the public, and media	state, and	d federal agencies during a hazard
outlets before, during, and after a hazard event.	event	
Furthermore, disaster events will not significantly	5.3 Maintain	a secure, dedicated emergency
disrupt county emergency operations and services.	communi	cation system with built in redundancy
	5.4 Minimize	disruption to public facilities and
	services o	during a hazard event
	5.5 Make she	elter available to people, businesses,
	and anim	als displaced by hazard events

Hazard Mitigation Plan Goals	Hazard Mitigation Objectives
Natural Resource Protection Goals	Natural Resource Protection Objectives
Grays Harbor County will promote natural resource	6.1 Conserve and rehabilitate natural systems to
protection that protects life and public safety.	serve hazard mitigation functions
	6.2 Advocate responsible "best management
	practices" for land development, recreational
	activities, and commercial operations to reduce
	damage or loss of natural resources
	6.3 Support effective natural resources of
	commercial significance and critical areas plans
	and regulations

Two types of Hazard Mitigation Actions in the plan implement Hazard Mitigation Goals and Objectives. Tier 1 Mitigation Actions are those projects or programs generally eligible for funding under the Hazard Mitigation Grant Program. Tier 2 Mitigation Actions are not, but they could be eligible for other grant and loan programs, either public or private. The matrix below summarizes those Tier 1 and 2 Mitigation Actions with project sponsors. Many of these actions satisfy more than one goal and address more than one hazard.

Tier 1 Mitigation Actions		
Upgrade public buildings to ensure earthquake resistance		
1.1 Retrofit the Grays Harbor Hospital to withstand earthquake events		
1.2 Retrofit Aberdeen School District buildings to current building codes		
1.3 Retrofit the Pearsall Building (Public Health) to current building codes		
1.4 Relocate utility corridors out of areas prone to severe earthquake damage		
Retrofit bridges and reconstruct county roads on primary transportation routes		
2.1 Replace culvert with bridge at MP 8.2 of the South Bank Road		
2.2 Raise the Wishkah Road approximately 2 feet between MP 1 and 5		
2.3 Replace 3-foot diameter with 10-foot diameter culvert on Barrett Road West at MP 0.1, ½ mile west of	Brady	
Safeguard priority community assets from the impacts of hazard events		
3.1 Locate, design, permit, and construct a solid waste staging area		
3.2 Replace the Grays Harbor Fire District 11 Fire Station with a tsunami/earthquake resistant structure		
3.3 Build the KXPB radio station on higher ground and upgrade antenna (North Beach)		
3.4 Construct road maintenance shop in hazard-free "safe zone" to store equipment and supplies for hazar	d	
response		
Protect community power infrastructure from severe storm and other hazard events		
4.1 Relocate power lines underground in areas prone to blow-down during high wind storms		
4.2 Upgrade back-up power at county facilities, including Jail, Juvenile Detention, and Health Department		
Create a program that assists property owners in making their homes hazard-proof		
5.1 Assist homeowners in making their buildings flood, earthquake, and severe storm proof (chimneys,		
foundations, roofs)		
Mitigate the potential for flood damage by identifying and restoring natural floodplains		
6.1 Do LiDAR flyovers to identify natural and converted areas capable of providing natural storage of flood	waters	
Install improvements that warn the public of tsunami events and/or construct shelters for displaced residents		
and visitors		
7.1 Install flashing lights on tsunami-resistant structures near ocean		

Tier 2 Mitigation Actions

Improve mass casualties, fatalities, evacuation, and sheltering plans

- 8.1 Identification of public buildings that could be used as emergency shelters
- 8.2 Ensure shelter sites are served by approved public water and develop minimal food safety requirements
- 8.3 Create a work group to develop a plan that coordinates the use of local emergency water resources during a hazard event

Create a public education program that informs citizens about the risks and preparation needs of earthquakes, flooding, severe storms, and tsunamis

- 9.1 Use Grays Harbor Community Hospital's Pillar Talk newsletter, website, and Speaker Series to communicate about risks and preparing for hazard events
- 9.2 Ensure that homeowners with on-site water and septic systems receive information about maintenance and hazard mitigation activities

Continue to update county plans and codes that reduce the potential of damage to structures from hazard events

- 10.1 Update the countywide Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program to position the county towards enrollment in the Community Rating System

Create a coordinated countywide approach to addressing hazardous materials incidents

11.1 Establish a countywide hazardous materials incident response team

SECTION 1: INTRODUCTION TO THE HAZARD MITIGATION PLAN

WHY IS A HAZARD MITIGATION PLAN IMPORTANT?

Thinking about disasters after they happen is usually too late. Floodwaters can sweep away homes, bridges, and other infrastructure at tremendous public and private cost. Severe weather can down utility lines and close roads, closing businesses and incapacitating critical public facilities. Worse yet, earthquakes can kill community members in buildings that collapse due to their susceptible to excessive shaking. However, communities can avoid or mitigate any of these scenarios through hazard mitigation planning.

A **hazard mitigation plan** is about taking action <u>before</u> disasters strike. When Grays Harbor County takes a comprehensive, well thought-out approach to hazard mitigation, it will

- Reduce or prevent the loss of life, property, essential services, and critical facilities
- Lessen significant, economic hardship after a disaster
- Decrease short- and long-term recovery and reconstruction costs
- Increase cooperation and communication within the community
- Expedite post-disaster grant funding when disasters do happen

The *Grays Harbor County Hazard Mitigation Plan* helps the county strive towards these post-hazard outcomes through effective, systematic planning. While the primary purpose of hazard mitigation planning is to create a document that identifies goals, objectives, and mitigation actions that result in disaster risk reduction for the county, the planning process does provide two other benefits as well.

One particularly important outcome is increased awareness about hazards in the county. Preparing the plan puts hazard mitigation back "on the radar screen" for many elected and appointed officials who participated in the plan's development. The consequences of inaction become clear to them and hazard mitigation projects resurface as priorities. An often quick to forget public also reacquaints itself about the dangers of hazards. Information on the county's Emergency Management website and at public outreach programs teaches citizens to be mindful of how hazards can affect their lives. Such knowledge within the community is essential when the county asks citizens to commit public investment at projects and programs that protect lives, property, and the local economy.

A second beneficial outcome of hazard mitigation planning is that it communicates to state and federal officials and agencies regarding the prioritized, up-to-date hazard mitigation needs of Grays Harbor County. The availability of such a plan enables to the county to identify the technical and financial resources it will need for implementation as well as be in a competitive position whenever funds become accessible.

PLAN SCOPE

The scope of the *Grays Harbor County Hazard Mitigation Plan* focuses solely on the jurisdictional interests of Grays Harbor County. These interests encompass the rural population, property, businesses, and industries located outside of the county's nine municipalities. It also includes the public services and infrastructure that serve the needs of this area, such as roads, public safety, public health, and utilities. The county's jurisdictional interests within this plan does extend over municipal boundaries when it focuses on public services and facilities that serve both rural and urban county residents, as is the case with public health services.

The plan also addresses the needs of county facilities located within cities and other critical facilities in urban areas that serve rural residents, such as hospitals and schools. Grays Harbor County encourages all of the county's nine municipalities and its many special use districts to coordinate and integrate their hazard mitigation plans with the county's one to create a seamless countywide hazard mitigation effort.

PLAN ORGANIZATION

The *Grays Harbor County Hazard Mitigation Plan* is a framework of policies adopted by the Grays Harbor Board of County Commissioners that direct county resources at reducing the potential impacts of disaster events on lives, property, and economy over the next five years, from 2011 through 2016.

The plan focuses on risk reduction and loss-prevention by identifying goals, objectives, and mitigation actions that address eight hazards: floods, earthquakes, severe storms, tsunamis, landslides, volcanoes, wildland fires, and hazardous material incidents.



The *Grays Harbor County Hazard Mitigation Plan* consists of four parts: Mitigation Strategy, Plan Maintenance, Planning Process, and Risk Assessment. These parts of the plan reflect the required planning elements for Hazard Mitigation Plans as prescribed by the Federal Emergency Management Agency (FEMA).

The **Mitigation Strategy** is the heart of the plan. It sets goals, identifies objectives, and details specific mitigation actions for hazard mitigation in Grays Harbor County. It also provides an overview regarding how it implements the National Flood Insurance Program.

Plan Maintenance covers how the county intends to monitor the plan over the next five years, continue to involve citizens, and integrate the Mitigation Strategy into other existing county plans, policies, and ordinances. A documentation of the **Planning Process** is the subject matter of the third part of the plan. It discusses the plan's development and identifies who served on the local planning team along with their field of expertise.

The final part of the plan, the **Risk Assessment**, is the informational foundation to the plan. It begins with a data profile of Grays Harbor County that provides context for understanding the human and natural environment. The remaining eight sections of the Risk Assessment profiles each hazard in a similar format: hazard definition, factors that contribute to the hazard, affects of the hazard, a summary the structures and people vulnerable to a hazard, and a history of hazard events.

In accordance with FEMA requirements, there are *Plan Update Statements* throughout the plan that discusses changes that occurred between the 2005-2010 and the 2010-2015 Hazard Mitigation Plans. These fall throughout the plan where appropriate.

PLAN ADOPTION

The Board of County Commissioners adopted this plan as official county policy after the review and approval of the Emergency Management Division of the Washington State Military Dept and the US Federal Emergency Management Agency, Region X.

The county adopted this plan by resolution on February ____, 2011.

MITIGATION STRATEGY

SECTION 2: HAZARD MITIGATION GOALS AND OBJECTIVES

Grays Harbor County has adopted six Hazard Mitigation Goals for protecting people and structures, reducing the costs of disaster response and recovery, and minimizing disruptions to the local economy and public services. The six goals correspond to the Federal Emergency Management Agency (FEMA) Hazard Mitigation Categories.

These six goals are long-term policy achievements that Grays Harbor County intends to accomplish over the next five years. Goals are broad statements of intent about what the county wants to achieve through hazard mitigation planning. **Goals** are broad statements of intent of what we want to accomplish through Hazard Mitigation Planning

Objectives are specific & measureable milestones that mark our progress in achieving our goals

Accompanying each goal is a series of Hazard Mitigation Objectives – specific and measurable milestones that mark the county's path towards success in achieving the implementation of each goal.

PREVENTION

Prevention goals influence land development, construction practices, and public activities that reduce losses from hazard events.

Prevention Goal

A well-established Grays Harbor County hazard mitigation program will reduce the risks associated with natural and human caused hazards.

This program will rely on an atmosphere of cooperation among the private sector, county government, and state and federal agencies to promote mitigation planning and coordination of achieving objectives.

Grays Harbor County will build the necessary institutional capacity for an effective hazard mitigation program and will secure public and private financial resources for investment in hazard mitigation planning, implementation actions, and post disaster recovery.

Prevention Objectives

- 1.1 Emphasize preventative measures that eliminate or reduce hazard impacts in all County plans, regulations, and programs, and special purpose districts
- Promote partnerships between the county, state and federal agencies, the Confederated
 Tribes of the Chehalis, and the Quinault Indian Nation to pursue joint hazard mitigation efforts

- 1.3 Develop a coordinated mitigation approach with all the incorporated cities in Grays Harbor County
- 1.4 Assure plans are in place to reduce the public health impacts of a disaster event.
- 1.5 Prevent land development in extreme hazard prone areas
- 1.6 Minimize disruption of utility and transportation systems
- 1.7 Identify resources to provide ongoing program support and funding for hazard mitigation programs and projects

PROPERTY PROTECTION

Property protection involves the modification of existing buildings and structures to protect them from a hazard or their removal from a hazard area.

Property Protection Goal

Grays Harbor County will seek to reduce the impact of hazards on the built environment whenever possible. It will place particular emphasis on actively safeguarding critical facilities in hazard prone areas to protect public health and safety.

Property Protection Objectives

- 2.1 Promote the use of appropriate hazard resistant design, construction, and maintenance for all structures, both public and private
- 2.2 Support programs that assist homeowners and businesses establish hazard mitigation measures on their property
- 2.3 Develop hazard resistant protective measures for critical facilities and lifelines
- 2.4 Encourage the retrofit of critical facilities in hazard areas to protect public health and safety
- 2.5 Protect valuable historic and cultural resources

PUBLIC EDUCATION AND AWARENESS

Public education and awareness seeks to inform and educate citizens, elected officials, and property owners about hazards and the potential ways to mitigate them.

Public Education and Awareness Goal

Grays Harbor County citizens, businesses, and visitors will be informed, prepared for, and recognize what actions to take during and after a hazard event.

Public Education and Awareness Objectives

- 3.1 Make available programs and information to assist residents, schools, businesses, and visitors prepare for and recognize what actions to take during and after a hazard event
- 3.2 Increase awareness of mitigation actions that reduce the impact of hazards

- 3.3 Develop cooperative education and awareness programs with schools and non-profit and private organizations that provide disaster programs
- 3.4 Disseminate information to the public about specific emergency action plans and procedures

STRUCTURAL PROJECTS

Structural projects involve the construction of public infrastructure improvements to reduce the impacts of a hazard.

Structural Projects Goal

Support development of suitable structural projects that significantly reduce the impact of a hazard when no other option is feasible.

Structural Projects Objectives

- 4.1 Prioritize and secure funding for all structural projects identified in existing plans
- 4.2 Identify and prioritize the need for new structural projects to increase protection of life, property, and the natural environment

EMERGENCY SERVICES PROJECTS

Emergency Services Goal

Grays Harbor County will have sufficient expertise and resources for emergency preparedness, response, and recovery to reduce the loss of life and property damage due to hazard events. It will have a reliable communication system that will coordinate action between emergency responders, the public, and media outlets before, during, and after a hazard event. Furthermore, disaster events will not significantly disrupt county emergency operations and services.

Emergency Services Objectives

- 5.1 Provide for a well-trained group of professional and volunteer emergency personnel with the capability to effectively respond to hazard events
- 5.2 Assure effective coordination with all local, state, and federal agencies during a hazard event
- 5.3 Maintain a secure, dedicated emergency communication system with built in redundancy
- 5.4 Minimize disruption to public facilities and services during a hazard event
- 5.5 Make shelter available to people, businesses, and animals displaced by hazard events

NATURAL RESOURCE PROTECTION

Natural resource protection minimizes losses from hazard events through preserving or restoring the functions of natural systems.

Natural Resource Protection Goal

Grays Harbor County will promote natural resource protection that protects life and public safety.

Natural Resources Protection Objectives

- 6.1 Conserve and rehabilitate natural systems to serve hazard mitigation functions
- 6.2 Advocate responsible "best management practices" for land development, recreational activities, and commercial operations to reduce damage or loss of natural resources
- 6.3 Support effective natural resources of commercial significance and critical areas plans and regulations

Plan Update Statement

The goals remain the same as in 2002 – 2010 **All Hazard Mitigation Plan**. There were changes in the objectives that reflected new directions the county is now pursuing in its Mitigation Actions covered in the next section.

SECTION 3: IDENTIFICATION OF MITIGATION ACTIONS

Project actions are specific, concrete, stand-alone projects, activities, or programs that implement Hazard Goals and Objectives. Altogether, these form the overall strategy Grays Harbor County intends to pursue over the next five years to mitigate the impacts of hazards on life, property, and the local economy.

In Tables 1 and 2, individual Mitigation Actions fall under prioritized categories that appear in bold. Specific Mitigation Actions under each category have an assigned number that corresponds to its implementation plan in Section 4.

Mitigation Actions in the plan fall under one of two categories: Tier 1 or Tier 2. Tier 1 Mitigation Actions consist of those projects likely eligible for funding under FEMA's Hazard Mitigation Grant Program. Tier 2 Actions are not eligible for Hazard Mitigation Grant Program funding, but may be eligible for funding from other local, state, or federal sources.

Those Mitigation Actions that have a designated sponsor also have an accompanying Hazard Mitigation Implementation Strategy. Each Implementation Strategy describes the action in more detail, including which agency or organization will lead its completion, and provides information, if available, about timelines and estimated costs. Other comments follow, if appropriate.

Those Mitigation Actions currently without an interested sponsor do not have an Implementation Strategy. Although these actions are important, they lack the priority or ability for local agencies or entities to implement at this time. Their inclusion in the plan, however, will remind the Hazard Mitigation Planning Team Subcommittee and the Local Emergency Planning Committee of their importance during the Plan Maintenance process. Some of these projects may pick up sponsors during the plan's five-year lifespan.

During the workshop process, there were Tier 1 and Tier 2 Mitigation Actions proposed that did not pick up an immediate project sponsor. These projects may gain more interest over the course of the next five years given resources or hazard events. Therefore, these projects are included for consideration in future annual plan reviews.

The organization of this section first focuses on identifying project categories by tier, along with which goals, objectives, and hazards they address. It then follows with implementation strategy descriptions for each Tier 1 and 2 Mitigation Action that has a sponsor.

Plan Update Statement

The HMP completely revised the list of Mitigation Actions that implement the Mitigation Goals and Objectives.

TIER 1 AND 2 MITIGATION ACTIONS

Tier 1 N	Antigation Actions by Priority	Goals/ Objectives/ Hazard Events
1. Upgr	ade public buildings to ensure earthquakes resistance	Goal: Property Protection
1.1	Retrofit the Grays Harbor Hospital to withstand earthquake events 1.1.1 Retrofit Building 58 to current building codes	<u>Objectives</u> : 2.1, 2.3, and 2.4
	1.1.2 Construct a retaining wall to prevent slipping along hillside1.1.3 Install a 30,000-gallon water storage facility and water system improvements	Hazard Events: Earthquakes
	1.1.4 Install seismic shut-off valves for main natural gas lines and upgrade hospital boilers	
1.2	Retrofit Aberdeen School District buildings to current building codes	
1.3	Retrofit the Pearsall Building (Public Health) to current building codes	
1.4	Relocate utility corridors out of areas prone to severe earthquake damage	
Project	s without a sponsor:	
1.5	Relocate critical public facilities and infrastructure to areas less prone to earthquake damage	
2. Retro	ofit bridges and reconstruct county roads on primary transportation routes	Goal: Property Protection
2.1	Replace culvert with bridge at MP 8.2 of the South Bank Road Baise the Wishkah Road approximately 2 feet between MP 1 and 5	<u>Objectives</u> : 2.1, 2.3, 2.4
2.3	Replace 3-foot diameter with 10-foot diameter culvert on Barrett Road West at	Henry Frenches Flag dia a Terranati
	MP 0.1, 1/2 mile west of Brady	Hazard Events: Flooding, Tsunamis
Projects	s without a sponsor:	
2.4	Replace bridge at Moclips as critical evacuation route or identify alternative evacuation route (North Beach)	
1		1

Table 1. Tier 1 Mitigation Actions Reflecting Goals, Objectives, and Hazard Events

Tier 1 N	Aitigation Actions by Priority	Goals/ Objectives/ Hazard Events
3. Safeg 3.1 3.2 3.3 3.4	guard priority community assets from the impacts of hazard events Locate, design, permit, and construct a solid waste staging area Replace the Grays Harbor Fire District 11 Fire Station with a tsunami/earthquake resistant structure Build the KXPB radio station on higher ground and upgrade antenna (North Beach) Construct road maintenance shop in hazard-free "safe zone" to store equipment and supplies for hazard response	<u>Goals</u> : Property Protection, Structural, and Emergency Services Projects <u>Objectives</u> : 2.1, 2.3, 2.4, 4.1,5.4 <u>Hazard Events</u> : Tsunamis, Earthquakes, Hazardous Materials Incidents
Projects	s without a sponsor:	
3.5 3.6	Assist community water systems in elevating and sealing wells to prevent contamination by floodwaters Raise beach approaches to area dune heights to reduce the threat of potential tsunami flooding	
3.7	Protect aquifers for community water supplies by constructing containment fields along rail lines and other transportation corridors	
4. Prote	ect community power infrastructure from severe storm and other hazard events	Goals: Property Protection and Structural Projects
4.1	Relocate power lines underground in areas prone to blow-down during high wind storms	<u>Objectives</u> : 2.1, 2.3, 2.4, 4.1
4.2	Upgrade back-up power at county facilities, including Jail, Juvenile Detention, and Health Department	<u>Hazard Events</u> : Severe Storm, Tsunami, Earthquake, Flooding
5. Creat	te a program that assists property owners in making their homes hazard-proof	Goal: Property Protection Projects
5.1	Assist homeowners in making their buildings flood, earthquake, and severe storm proof (chimneys, foundations, roofs)	<u>Objectives</u> : 2.1, 2.2, 2.4
Projects	s without a sponsor:	Hazard Events: Earthquake, Flooding, Severe Storm
5.2	Assist private well owners in elevating and sealing their wells to prevent contamination by floodwaters	

Tier 1 Mitigation	n Actions by Priority	Goals/ Objectives/ Hazard Events
6. Mitigate the	potential for flood damage by identifying and restoring natural floodplains	Goals: Property and Natural Resource Protection Projects
6.1 LiDAR f storage	lyovers to identify natural and converted areas capable of providing natural of floodwaters	<u>Objectives</u> : 6.1, 6.2, 6.3, 2.2
		Hazard Events: Flooding, Tsunamis
Projects without	t a sponsor:	
6.2 Restore habitat	e wetlands that provide natural flood protection and reconnect off-channel	
7. Install improv displaced resi	vements that warn the public of tsunami events or construct shelters for idents and visitors	Goals: Structural Projects
7.1 Install f	flashing lights on tsunami-resistant structures near ocean	Objectives: 4.1
Projects without	t a sponsor:	Hazard Events: Tsunamis, Flooding, Earthquakes, Severe Storms
7.2 Install f condition	flashing lights at beach approaches to identify escape points during dense fog ons	
7.3 Constru	uct shelters in areas of the county currently not served	

Table 2. Tier 2 Actions and Applicable Goals, Objectives, and Hazard Events

Tier 2 Actions	Goals/ Objectives
1. Improve mass casualties, fatalities, evacuation, and sheltering plans	Goals: Prevention and Emergency Services Projects
1.1 Identification of public buildings that could be used as emergency shelters1.2 Ensure shelter sites are served by approved public water and develop minimal food	<u>Objectives</u> : 1.1, 1.2, 1.3, 1.4, 1.6, 5.1, 5.2, 5.3, 5.4, 5.5
safety requirements1.3 Create a work group to develop a plan that coordinates the use of local emergency water resources during a hazard event	Hazard Events: Flooding, Earthquake, Severe Storm, Tsunamis, Landslide, Hazardous Materials Incidents, Volcano, and Wildland Fire

Tier 2 A	ctions	Goals/ Objectives
Projects	s without a sponsor:	
1.4 1.5 1.6 1.7	Identify "high points" as safe places for animals during flood events Make Satsop Development Park a shelter for businesses displaced by hazard events Prepare and distribute a uniform inventory of utility resources available through cities and special use districts Develop a broad network of secondary communication links (i.e., ham radio)	
2. Crea nee	te a public education program that informs citizens about the risks and preparation ds of earthquakes, flooding, severe storms, and tsunamis	Goals: Public Education & Awareness and Emergency Services Projects
2.1	Use Grays Harbor Community Hospital's Pillar Talk newsletter, website, and Speaker Series to communicate about risks and preparing for hazard events	<u>Objectives</u> : 3.1, 3.2, 3.3, 3.4
2.2	Ensure that homeowners with on-site water and septic systems receive information about maintenance and hazard mitigation activities	<u>Hazard Events</u> : Flooding, Earthquake, Severe Storm, Tsunamis, Landslide, Hazardous Materials Incidents,
Projects	s without a sponsor:	
2.3 2.4	Earthquake education and preparation drills in schools Assist homeowners in forested areas or near dune grasses in developing defensive perimeter plans	
3. Cont stru	inue to update county plans and codes that reduce the potential of damage to ctures from hazard events	<u>Goal</u> : Prevention Projects
3.1 3.2	Update the countywide Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures	<u>Objectives</u> : 1.1, 1.5, 1.6 <u>Hazard Events</u> : Flooding, Earthquake, Severe Storm, Tsunamis, Landslide, Hazardous Materials Incidents, Volcano, and Wildland Fire
3.3	Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program to position the county towards enrollment in the Community Rating System	

Tier 2 A	ctions	Goals/ Objectives
Projects	s without a sponsor:	
3.4	Encourage FEMA to update Flood Insurance Rate Maps (FIRM), especially for the	
	Satsop and Wynoochee Valleys	
3.5	Design roads to withstand earthquake damage	
3.6	Create and implement a countywide preventative maintenance program that would	
	reduce the impacts of flooding (i.e., keeping storm facilities in good working order)	
3.7	Update codes to reduce the threat of storage facilities with potential contaminants	
	from breaking loose or collapsing during tsunami or flooding events (i.e., fuel and	
	propane tanks)	
3.8	Require beach setbacks to reduce threats from tsunamis	
3.9	Require "second story" homes along beaches to elevate them above tsunamis	
4. Crea	te a coordinated countywide approach to addressing hazardous materials incidents	Goals: Public Education & Awareness and Emergency
11	Establish a countywide bazardous materials incident response team	Services Projects
4.1	Establish a countywide hazardous materials incluent response team	
		Objectives: 3.1, 3.4, 5.1, 5.2, 5.3
		Hazard Events: Hazardous Materials Incidents

TIER 1 IMPLEMENTATION STRATEGIES

1. Upgrade public buildings to ensure earthquakes resistance

1.1 Retrofit the Grays Harbor Community Hospital to withstand earthquake events

Description: This project consists of five major elements:

- Grays Harbor Community Hospital provides critical medical care and emergency services to the public and must remain in service after an earthquake to treat injured citizens. The cost associated with the disruption and losses in productivity can often be greater than the direct construction cost for seismic improvements. Retrofit of 58 Building to current codes to help protect life, property, infrastructure, & economic security in the event of a major earthquake for the safety of all patients, visitors & staff. Critical areas of the 58 Building are the 2nd & 3rd floor patient rooms, cardiopulmonary, nutrition, the administrative wing, & the Doctors Lounge as well as critical building equipment (i.e., boilers, fan room, mechanical room).
- Install seismic shut-off valves for the main natural gas line to the hospital boilers. This is a solid line that runs from the front of the hospital to the boilers and has not been retrofitted to withstand a major earthquake. A major earthquake could rupture the line and cause an explosion or leak since the current gas line has no "give" or flexibility.
- Loss of water is the greatest utility risk to the operations of Grays Harbor Community Hospital (GHCH). Water is a critical utility for GHCH in that drinking, bathing, food service, & critical utility systems (heating, cooling, and medical vacuum) rely on a continuous source. Without it the hospital would need to be evacuated. Develop a 30,000-gallon water source well capable of producing water for emergency use. Design a pumping & pipe construction system to include backflow protection, construct pumping & piping system & connect to hospital water network. Construct a retaining wall for the slipping of the hill that is directly behind the GHCH building.
- The Grays Harbor Community Hospital uses a Hurst boiler and has two back-up boilers that are failing; a 1958 boiler and a 1970 boiler. The hospital would replace the two old boilers with a new Hurst boiler.

Lead Agency: Grays Harbor Community Hospital, Monica Simpson

Project Timeline: Unspecified

Estimated Cost: Unknown

1.2 Retrofit Aberdeen School District buildings to current building codes

<u>Description</u>: The Aberdeen School District currently is undergoing an architectural assessment of its school buildings to determine their earthquake resistance. The expected release of this study is March 2011. This report will provide details regarding which buildings will require retrofit and estimated budget.

Lead Agency: Aberdeen School District, Tom Laufmann

Project Timeline: Unknown

Estimated Cost: Unknown

1.3 Retrofit the Pearsall Building (Public Health)

<u>Description</u>: The Pearsall Building primarily supports the operations of the Grays Harbor Public Health Department. Located on soils susceptible to liquefaction, an earthquake could result in significant structural failure that would endanger numerous lives and affect public health, especially for low-income people. The Department of Public Services, which manages countyowned buildings, wants to retrofit the building to mitigate earthquake damage.

Lead Agency: Grays Harbor County Department of Public Services

Project Timeline: Unknown

Estimated Cost: Unknown

2. Retrofit bridges and reconstruct county roads on primary transportation routes

2.1 Replace culvert with bridge at MP 8.2 of the South Bank Road

<u>Description</u>: Replace a culvert with a bridge to allow more water to flow under the road. Construct a bridge and raise the road to allow flood waters to pass under the roadway. Currently major floods wash out the roadway. Approximately a 250-foot long bridge would be constructed with finished grade approximately 4-feet higher than the existing road.

Lead Agency: Grays Harbor County Public Works Division, Russ Esses

Project Timeline: 2015

Estimated Cost: \$3,000,000

2.2 Raise the Wishkah Road approximately 2 feet between MP 1 and 5

<u>Description</u>: Raise road approximately 2-feet in flood areas, Wishkah Road M.P. 1 to M.P. 5. Raise sections of Wishkah Road that currently flood approximately 2-feet so that the road does not have to be closed to through traffic during major flood events. Five areas totaling approximately 1 mile in length would need to be reconstructed.

Lead Agency: Grays Harbor County Public Works Division, Russ Esses

Project Timeline: 2020

Estimated Cost: \$5,000,000

2.3 Replace 3-foot diameter with 10-foot diameter culvert on Barrett Road West at MP 0.1

<u>Description</u>: Replace 3-foot diameter culvert with a 10-foot diameter culvert, M.P. 0.1 Barrett Road West (1/2 mile west of Brady). Existing 3-foot diameter culvert cannot carry all the water flow from flood events. Water passes over the road and floods homes and yards.

Lead Agency: Grays Harbor County Public Works Division, Russ Esses

Project Timeline: 2012

Estimated Cost: \$100,000

3. Safeguard priority community assets from the impacts of hazard events

3.1 Locate, design, permit, and construct a solid waste staging area

<u>Description</u>: Currently, all of Grays Harbor County and its municipalities export garbage to the Roosevelt Landfill in Klickitat County via a rail pickup point in Centralia. If a hazard event would sever rail and highway access to Centralia, the County waste stream would quickly back-up. This project entails finding and setting up a suitable site for temporarily holding household solid waste under emergency conditions until the county/contractor would be able to resume out-of-county shipments.

Lead Agency: Grays Harbor County Environmental Health, Garrett Dalan

Project Timeline: Unspecified

Estimated Cost: The cost of this project may vary widely due to land values, site location, permitting, and adjacent land uses.

3.2 Replace the Grays Harbor Fire District 11 Fire Station with a tsunami/earthquake resistant structure

<u>Description</u>: The Grays Harbor Fire District 11 Fire Station is an older structure that does not meet building codes for earthquake resistance, nor could likely withstand a minor tsunami event. This building needs replacement with a structure capable of withstanding hazard events as well as one that could potentially provide shelter to the local population. The district will need to undergo a conceptual design study to evaluate how to move forward with this project. If SR 105 gets cut off by flooding, Fire District 11 is the only emergency response agency in the South Beach area.

Lead Agency: Grays Harbor Fire District 11, Chuck Chafin

Project Timeline: Unknown

Estimated Cost: Unknown

3.3 Build the KXPB radio station on higher ground and upgrade antenna

<u>Description</u>: The KXPB radio station is a publicly owned radio station providing news and entertainment to North Beach communities. This station is a critical link in disseminating public information in the event of a hazard event. However, its current location would make it susceptible to destruction in the event of a tsunami. This project entails acquiring a new site, building a building, and reinstalling existing equipment.

Lead Agency: Pacific Beach Food Bank (licensee), Stephanie Allestad

Project Timeline: Unspecified

Estimated Cost: Unknown

4. Protect community power infrastructure from severe storm and other hazard events

4.1 Relocate power lines underground in areas prone to blow-down during high wind storms

<u>Description</u>: There are areas within the county that have repeatedly been susceptible to high winds that blow large timber down on aboveground power lines. Power disruptions from these events in past events have left large sections of the county without power for as much as a week at a time. This project aims at moving the most historically hard-hit sections underground.

Lead Agency: Grays Harbor Public Utility District, Lyle Powell

Project Timeline: Unspecified

Estimated Cost: Unspecified

4.2 Upgrade back-up power at county facilities and utilities

<u>Description</u>: This project would upgrade or add backup power at county facilities and utilities. Facilities with old, outdated, unreliable generators are the Jail, Juvenile Detention, and Health Departments. Utility facilities that currently do not have emergency backup power include those in the North Beach communities, Ocean City, and Copalis. These new generators would allow uninterrupted delivery of public safety services and utilities at vital county facilities during frequent winter power outages.

Lead Agency: Grays Harbor County Department of Public Services, Kevin Varness

Project Timeline: 2015

Estimated Cost: \$230,000

5. Create a program that assists property owners in making their homes hazard-proof

5.1 Assist homeowners in making their buildings flood, earthquake, and severe storm proof

<u>Description</u>: Older housing throughout the county has suffered severe damage from recent earthquakes, floods, and severe storms, especially high winds. This project aims at elevating homes in the 100-year floodplain above flood levels and upgrading them to make them more earthquake and storm resistant.

Lead Agency: NeighborWorks of Grays Harbor, David Murnen

Project Timeline: Ongoing

Estimated Cost: Unknown

6. Mitigate the potential for flood damage by identifying and restoring natural floodplains

6.1 LiDAR flyovers to identify potential restoration areas for those areas capable of providing natural storage for floodwaters

<u>Description</u>: The Chehalis Watershed, second largest in the state, has experienced land conversions and other land use activities that have cut-off natural floodplains from rivers. This has significantly altered the hydrology of some subbasins and increased the potential of flooding. Having data generated through LiDAR will assist the county in identifying these areas, an essential step in conceptual project planning. Lead Agency: Grays Harbor County Planning Division

Project Timeline: 2015

Estimated Cost: Unknown

7. Install improvements that warn the public of tsunami events or construct shelters for displaced residents and visitors

7.1 Install flashing lights on tsunami-resistant structures near ocean beaches that serve as escape points for people

<u>Description</u>: Incorporated and unincorporated communities along the North and South Beach areas receive thousands of tourists annually. An earthquake along the Cascadia Fault could generate a tsunami in as little as 20 minutes. Buildings do exist in both areas that potentially could serve as quick refuges that would save a large number of lives.

Flashing lights on appropriate buildings would alert visitors and citizens where these safe points exist. This project would identify which buildings would be appropriate for this use, install the lights, and establish an awareness program.

Lead Agency: Grays Harbor County Emergency Management, Chuck Wallace

Project Timeline: 2015

Estimated Cost:

TIER 2 IMPLEMENTATION STRATEGIES FOR MITIGATION ACTIONS

1. Improve mass casualties, fatalities, evacuation, and sheltering plans

1.1 Identification of public buildings that could be used as emergency shelters

<u>Description</u>: This project involves identifying those public buildings throughout that the county that could serve as emergency shelter during hazard events. Potential facilities serving as fully functioning shelters should have generators, full kitchen facilities, large restroom facilities, and bedding supplies. In lieu of kitchen facilities, shelter should be in close proximity to a food preparation facility, such as a restaurant, school, food store etc. In addition, the project should identify facilities capable of serving as cooling and warming centers.

Lead Agency: Grays Harbor County Emergency Management, Charles Wallace

Project Timeline: 2015

1.2 Ensure shelter sites are served by approved public water and develop minimal food safety requirements

<u>Description</u>: Using a list of pre-identified shelter locations ensure each is served by an approved public water system in compliance with applicable monitoring requirements. Likewise, make sure shelter facilities are equipped with the resources to deliver food safely, including making sure such facilities are stocked with gloves and thermometers. Ensure each shelter location is provided with information on safe food handling techniques and other relevant considerations.

Lead Agency: Grays Harbor County Environmental Health Division, Jeff Nelson

Project Timeline: Unknown

Estimated Cost: Unknown

1.3 Develop a work group to develop a plan that coordinates the use of local emergency water resources during a hazard event

<u>Description</u>: Create a local work group to develop a plan that coordinates the use of local emergency water resources during an emergency; i.e., pre-identify local availability of vehicles capable of hauling potable water, develop policies and procedures, and provide resources towards this effort. Establish protocols for activating the use of these resources. Take into consideration sheltering locations and other emergency staging areas

Lead Agency: Grays Harbor County Environmental Health Division, Jeff Nelson

Project Timeline: Unknown

Estimated Cost: Unknown

2. Create a public education program that informs citizens about the risks and preparation needs of earthquakes, flooding, severe storms, and tsunamis

2.1 Use Grays Harbor Community Hospital's Pillar Talk newsletter, website, and the Speakers Series to communicate about risks and preparing for hazard events

<u>Description</u>: The Grays Harbor County Hospital newsletter Pillar Talk is available online and serves both the community and the staff. The hospital also has the daily communication tool (Huddle) to educate staff and community on hazard mitigation preparedness.

Emergency management coordinators will continue to work with the Grays Harbor Institute's Speaker Series to bring more community awareness and education to Grays Harbor by inviting

public speakers. Coordinators will also assist in distributing brochures to vulnerable populations that are available through the Washington State Printing Website.

Lead Agency: Grays Harbor Community Hospital, Monica Simpson Grays Harbor County Emergency Management, Chuck Wallace

Project Timeline: Unknown

Estimated Cost: Unknown

3. Continue to update county plans and codes that reduce the potential of damage to structures from hazard events

3.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters

<u>Description</u>: The Grays Harbor County Comprehensive Plan can play a critical role in directing future private and public development and infrastructure from areas prone to hazards. This project will integrate hazard mitigation planning during the plan update.

Lead Agency: Grays Harbor County Planning Division

Project Timeline: Unknown

Estimated Cost: Unknown

3.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures

<u>Description</u>: The Grays Harbor County Shoreline Master Program regulates projects and activities within 200 feet of shorelines. Jurisdictions also have the opportunity to extending shoreline management to include the 100-year floodplain. The State of Washington requires the county to update the plan and its associated regulations by 2014. This process will incorporate hazard mitigation, especially flooding and tsunami, in its update process. The update will also examine how to use Shoreline Development regulations to assist the county in enrolling in the Community Rating System.

Lead Agency: Grays Harbor County Planning Division

Project Timeline: 2014

Estimated Cost: Unknown

3.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

<u>Description</u>: The Grays Harbor County Critical Areas Ordinance is the primary county mechanism for regulating development in frequently flooded areas of the county. Staying on top of periodic NFIP regulatory requirement changes is critical to keeping the county in good standing. In addition, the county eventually wants to consider the option of enrolling in the Community Rating System, which would provide significant advantages in insurance cost savings of 5% to 45% to NFIP enrollees. The Critical Areas Ordinance will play an important role in meeting many of the 18 floodplain management activities needed for enrollment.

Lead Agency: Grays Harbor County Planning Division

Project Timeline: Unknown

Estimated Cost: Unknown

4. Create a coordinated countywide approach to addressing hazardous materials incidents

4.1 Establish a countywide hazardous materials incident response team

<u>Description</u>: Grays Harbor County and emergency responders throughout the county are developing a countywide approach to responding to hazardous materials incidents. This program will contain the following elements:

- Identify and coordinate jurisdictional responsibilities for hazardous materials incidents
- Develop and implement a public notification system after a hazardous materials incident occurs
- Identify and catalog the resources available for responding to hazardous materials incidents in the county
- Develop a verification program regarding hazardous materials inventories at fixed facilities

Lead Agency: Grays Harbor Emergency Management, Charles Wallace

Project Timeline: Ongoing

Estimated Cost: Unknown

Plan Update Statement

This section marks the greatest difference from the 2005-2010 and the 2010-2015 plans. The Mitigation Actions are now more specific in nature, which should result in a higher completion rate than accomplished during the last planning cycle.

Reasons for Incomplete Mitigation Actions: The county's local economy has struggled and has not produced the local tax revenues essential for completing capital projects. The Emergency Management Division also underwent a leadership change in 2009 that did improve progress on moving forward with noncapital mitigation actions.

Actions Completed: Grays Harbor County completed or initiated several mitigation actions still underway that were in the 2005-2010 plan.

Tier 1 Actions

T1-2: *Distribute hazard mitigation information and publications*. The county expanded its website and published the *All Hazards Guide* for citizens.

T1-3b: *Coast-wide siren-warning system.* The county continues to work with local jurisdictions on the coast to establish and maintain a system of sirens. It produced the *Tsunami Warning Plan* in June 2006.

T1-6: *Home elevation and buy-out program for repetitive loss properties.* The county initiated a grant application in 2007 to evacuate the first floor of a home and add a second story.

Tier 2 Actions

T2-4: *Create a Disaster Information Section on the county EMD website.* The county has included this information on its website.

T2-5b: *Develop agreements to coordinate disaster evacuation efforts and traffic control protocols*. The county EMD continues to work with local jurisdictions and the LEPC to coordinate response to hazard events, especially tsunami evacuation.

T2-9a: *Establish protocols to assure consistency of public information provided during a disaster*. The county EMD continues to work with local jurisdictions and the LEPC on developing protocols for coordinating public information.
SECTION 5: IMPLEMENTATION OF NATIONAL FLOOD INSURANCE PROGRAM

PROGRAM COMPLIANCE

The National Flood Insurance Program (NFIP) is a federal program to identify flood prone areas and make flood insurance available to the owners and leasers of property. This insurance provides an insurance alternative to disaster assistance for meeting escalating costs of repairing damaged buildings and their contents from floods. Participation in the NFIP by Grays Harbor County is by agreement with the federal government predicated on the adoption and enforcement of a floodplain ordinance that ensures new buildings will be free from flood damage and prevents new developments from increasing flood damages on existing properties.

There are currently 3,721 flood insurance policies in effect in Grays Harbor County. The State Hazard Mitigation Plan reports there have been 569 flood insurance claims as of January 31, 2010. There are currently 48 repetitive loss properties, including one that falls under the severe repetitive loss category.

The county's "floodplain ordinance" recently moved from Title 17, Zoning Code, to Chapter 18.06, Critical Areas Protection Ordinance (§18.06.100).

Grays Harbor County currently meets the minimum requirements of the NFIP. The county's Community Identification Number is 530057. The last Community Assistance Visit by FEMA in July 2005 indicated that the county complied with participation requirements.

The county currently does not participate in the Community Rating System, but it has identified its enrollment in the program as a long-term priority and has already moved into that direction by adopting several facets of that program.

FLOOD MANAGEMENT PLANS

Flooding is the perennial hazard that Grays Harbor County faces. The frequency of flooding in turn has prompted the county to spearhead the development of a number of plans that examined the problem; some on a wide scale while others more focused to specific areas. These plans make recommendations regarding projects and programs, but it has been difficult for the county to implement most of them due to funding limitations.

Figure 1. NFIP Compliance Letter



STATE OF WASHINGTON DEPARTMENT OF ECOLOGY PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000 711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

May 26, 2009

Ms. Lee Napier Deputy Director of Community Development Department of Public Services Grays Harbor County 100 West Broadway, Suite 31 Montesano, WA 98563

RE: National Flood Insurance Program (NFIP) Status

Dear Ms. Napier:

This letter certifies that Grays Harbor County is a participating member in good standing in the National Flood Insurance Program (NFIP) with an approved flood damage prevention ordinance.

The Grays Harbor NFIP Community Identification Number is 530057. There are no unresolved issues from the last community assistance visit, which was conducted on July 26, 2005.

If you need further documentation, please call me at (360) 407-7253 and I will be glad to provide you with any other information you may need.

Sincerely,

Kevin Farrell

Kevin B. Farrell Floodplain Management Specialist - SWRO Shorelands and Environmental Assistance Program

Cc. Dan Sokol, Ecology

Chehalis River Basin Flood Authority Comprehensive Flood Hazard Management Plan (2011)

- Lays out a strategic plan for moving forward on a variety of options that reduce flooding within the Chehalis Basin (see Section 6 for more detail)
- As of January 2011, this plan has not yet been adopted by Grays Harbor County

The Grays Harbor County Comprehensive Flood Hazard Management Plan, 2001

- Primarily concentrated on the Humptulips, Wynoochee, and Satsop Rivers
- Examined and made recommendations for structural and non-structural measures
- Repetitive loss properties on Geissler Road, Satsop Riviera, Monte-Elma Road near Brady, Humptulips Dike Road, Walker Bottom, and Wynoochee Tracts. Wynoochee Tracts were eventually bought out and are no longer repetitive loss properties.

North Beach Flood Hazard Management Plan, 1999

- Dealt with local drainage and shallow flooding associated with Highway 109 near:
 - Silver Maple Resort Roosevelt Road
 - Haven-by-the-Sea
 - Depressed area adjacent to Johnson Mercantile
 - Rod's Resort
- Examined alternatives for Connor Creek in the vicinity of Ocean City

South Coastal Flood Hazard Management Plan, 1997

- Analyzed contributing factors to major and localized flooding in the South Beach area
- Listed recommended actions that include limiting development in floodplains, flood storage area, and preventing development of wetlands
- Suggested other capital projects to deal with smaller, localized flooding and structural projects along Winter Creek Channel

Grayland Flood Hazard Reduction Plan, 1995

- Examined localized flooding issues along SR 105, in cranberry bogs, along some county roads, and drainage ditches
- Recommended elevation of affected homes and business, development of regulations that limited development in floodplains, and creation of a drainage district

Vance Creek Drainage Evaluation, 1994

• Reviewed issues related to flooding and recommended flood reduction hazards that protected and improved historic flood channels that accommodated flood flows. The plan also called for installing larger culverts on some roads.

Grays Harbor County has made limited progress on the majority of the recommendations in these plans primarily due to the availability of local funding. The county is heavily dependent on grant funding for such projects; even securing local match can be a challenge.

NATURAL RESOURCE PLANS AND ORDINANCES

Grays Harbor County has adopted several natural resource plans and ordinances that indirectly bring major benefits to flood reduction or mitigation.

Chehalis River Basin Watershed Management Plan and Detailed Implementation Plan (2004)

- Lays out a strategic vision and Detailed Implementation Plan for conserving watershed resources within Water Resource Inventory Areas 22 and 23 (see Section 6 for more detail)
- Many of these strategies will lead to flood reduction by generating a more complete understanding of water resources within the planning area

Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan (2010)

• Salmon recovery efforts aimed at restoring natural floodplains, channel hydrology, and riparian corridors (see Section 6 for more detail)

Critical Areas Ordinance (2010)

The Critical Areas Ordinance passed in 2010 will have a major effect in reducing or mitigating flood hazards in Grays Harbor County. In addition to the frequently flooded areas section of the ordinance that implements specific requirements of the National Flood Insurance Program, there are buffer requirements established for wetlands, streams, and rivers. While environmental attributes drive the buffer widths, not benefit to floodplains, the limitations on structures in these areas do indirectly benefit the National Flood Insurance Program.

Grays Harbor County Code

Critical Areas: Chapter 18.06

Frequently Flooded Areas: §18.06.100-130

Wetland Buffers: §18.06.135

Stream Buffers: §18.06.140

A second element to the Critical Areas Ordinance that will have benefit floodplain management is the integration of the **2005 Stormwater Management Manual for Western Washington.** This section of the code aims at retention or dentition requirements that limit the quantity of stormwater runoff that can contribute to flood events during heavy rainfall.

Plan Update Statement

The county's adoption of a number of plans and the Critical Areas Ordinance represents the largest actions related to hazard mitigation planning since passage of the 2005 -2010 plan. While noticeable outcomes from these plans and ordinance efforts may be years away, they do represent positive change in hazard mitigation.

PLAN MAINTENANCE

SECTION 6: PLAN MAINTENANCE

Regular plan maintenance ensures that the *Grays Harbor Hazard Mitigation Plan* remains a relevant document for protecting life and property within Grays Harbor County. This section presents an overview of the process as to how Grays Harbor County will monitor, evaluate, and update the plan.

ADOPTION

The Grays Harbor County Board of County Commissioners is the responsible body for adopting the *Hazard Mitigation Plan*. This document will serve as the county's five-year public policy statement in guiding hazard mitigation activities within the jurisdictional responsibilities of Grays Harbor County.

Before its formal adoption by resolution by the Board of Commissioners, the initial plan must undergo review by the Washington State Emergency Management Division (EMD) and the Federal Emergency Management Agency (FEMA) to determine if it meets established criteria for hazard mitigation planning. Once EMD and FEMA accept the plan, Grays Harbor County will be eligible for participation in the Hazard Mitigation Grant Program (HMGP).

MAINTAINING AND UPDATING THE PLAN

Monitoring the Plan

The Board of County Commissioners (BOCC) relies on the assistance of the Grays Harbor County Local Emergency Planning Committee (LEPC) and the Hazard Mitigation Planning Team (HMPT) in monitoring and updating the *Hazard Mitigation Plan*. The LEPC and HMPT does this through an annual review process and if necessary, forwarding recommendations relevant to the plan for BOCC consideration and action. Coordinating this effort for the LEPC and HMPT is the Deputy Director for Emergency Management Division.

The HMPT will meet annually in May to monitor the *Hazard Mitigation Plan*. Monitoring the plan entails reviewing and evaluating:

- The validity or current relevance of the planning data within Sections 9 through 17
- How changes in the planning data affect the Goals and Objectives in Section 2 and Mitigation Actions in Section 3
- The extent of progress made in achieving each Mitigation Action in accordance with its accompanying Implementation Strategy
- If an organization or agency chooses to implement a project currently without a sponsor

Minor Plan Updates

Monitoring the plan may point out the need for minor adjustments, such as adding Mitigation Actions, project sponsors, or disaster declarations. If such changes prove necessary, the HMPT forwards its recommendations in a report to the LEPC. The LEPC examines the HMPT report and assesses it in context with the overall Comprehensive Emergency Management Plan (CEMP) and the *Hazard Mitigation Plan*. The LEPC then forwards the HMPT report to the BOCC along with its recommendations.

The BOCC reviews the HMPT report and LEPC recommendations and then holds a public hearing on the report. Once receiving public comment and making appropriate amendments as needed, the BOCC adopts the revised *Hazard Mitigation Plan*.



Figure 2. Monitoring and Updating the Hazard Mitigation Plan

FIVE-YEAR UPDATE PROCESS

Every five years, FEMA and DEM require the county to update its *Hazard Mitigation Plan* to remain eligible for grant funding under the Hazard Mitigation Grant Program. Because preparing a plan update is more intensive than an annual monitoring process, Grays Harbor Emergency Management needs to allot sufficient time to ensure a thorough planning process that accommodates citizen involvement and review by DEM and FEMA.

The Grays Harbor County Deputy Director of Emergency Services will be responsible for both initiating and tracking the update process. Table 3 below outlines the general steps and estimated dates for this process.

Table 3: Steps and Timetable for Five-Year Update Process

Steps	Estimated Dates
Initiation of planning process	November-December 2015
HMPT review of risk assessment	December 2015-February 2016
HMPT review of goals and objectives	February 2016
Citizen participation program	March 2016
HMPT evaluation and prioritization of mitigation actions	March-April 2016
Availability of Draft Plan for HMPT and public review	May 2016
Final public review	June 2016
Review by DEM	July-August 2016
Review by FEMA	August-September 2016
Adoption by County Commissioners	October 2016

Planning for the *Hazard Mitigation Plan* update actually should begin as early as January 2015 to assess whether the county has the staff resources to complete the planning process. If not, the county may need to apply for Hazard Mitigation Planning Grant Assistance to acquire the resources necessary for ensuring plan completion by October 2016.

CONTINUING CITIZEN PARTICIPATION AND INVOLVEMENT

On-going citizen participation is essential for keeping citizens involved in and supportive of hazard mitigation after completion of the plan. Along with its plan monitoring and maintenance duties, it is also the responsibility of the HMPT to work with the Emergency Management Division to keep hazard mitigation in the public's mind by:

- Securing more resources to continue public education about hazard mitigation
- Participating in National Emergency Preparedness every April
- Participating in Tsunami Awareness every September
- Participating in Flood Awareness
- Having a hazard mitigation display annually at the Grays Harbor County Fair and other community events
- Distributing brochures on hazard mitigation for families through the school districts, the Dept of Public Health and Social Services, GH PUD, Community Hospital, food banks, and other public places
- Maintaining hazard mitigation displays
- Having an interactive hazard mitigation web site with public comment capabilities

ENCOURAGING OTHER LOCAL GOVERNMENT JURISDICTIONS TO DO HAZARD MITIGATION PLANNING

Grays Harbor County encourages other local government jurisdictions to adopt their own Hazard Mitigation Plan by using the *Grays Harbor County Hazard Mitigation Plan* as a foundation document.¹ This approach minimizes the amount of work a jurisdiction needs to accomplish by focusing only on those issues and needs that the jurisdiction differs from Grays Harbor County's plan. Once a local jurisdiction satisfies all of the Local Mitigation Plan requirements identified in 44 CFR §201.6, its plan will become part of the county's plan.

WMED and Grays Harbor County has agreed to a series of procedural steps that allows local government jurisdictions to follow this process. These steps follow below.

- 1. A local government jurisdiction interested in joining with the Grays Harbor Plan must contact the Gray Harbor County Emergency Management Division (EMD) with a request to become part of the plan.
- 2. The Grays Harbor County EMD will provide the local government jurisdiction with a copy of the approved plan, planning requirements, and any other pertinent data.
- 3. The local government jurisdiction reviews the county's plan and develops a draft planning document under the direction of the Grays Harbor County EMD that is specific to the local government jurisdiction. The preparation of this document must meet the requirements of the most current FEMA *Local Multi-Hazard Mitigation Planning Guidance* publication. Section 31 contains a suggested template for formatting this document.
- 4. Upon completion of the draft planning document, the local government jurisdiction then submits its draft to the Grays Harbor County EMD, which then forwards it to the State Hazard Mitigation Program Manager at WEMD for compliance review with current FEMA Local Multi-Hazard Mitigation Planning Guidance.
- The state Hazard Mitigation Program Manager reviews the local government jurisdiction's draft planning document for compliance with current FEMA Local Multi-Hazard Mitigation Planning Guidance in conjunction with the *Grays Harbor County Hazard Mitigation Plan*. If the local government jurisdiction's draft plan fails to meet the required standard, the Hazard Mitigation Program Manager will work with the jurisdiction until resolution of all outstanding issues.
- 5. The state Hazard Mitigation Program Manager will forward the local government jurisdiction's planning document to FEMA Region X for review and approval.

¹ "Local government jurisdictions" include municipalities and special use districts, such as fire districts, public school districts, drainage districts, port districts, transit authorities, and water districts.

- 6. Upon approval by FEMA Region X, the local government jurisdiction's planning document will become part of the *Grays Harbor County Hazard Mitigation Plan* and must comply with the update schedule contained in this Section.
- 7. Grays Harbor EMD will incorporate new local government jurisdiction's planning document into the *Grays Harbor County Hazard Mitigation Plan* as an Addendum.

INCORPORATING MITIGATION STRATEGY INTO EXISTING PLANNING MECHANISMS

Grays Harbor County currently has a broad framework of plans, policies, and development regulations that mitigate or reduce the threat of hazards to life, property, and the economy. Evaluating the completeness of this framework can be a difficult task. Rural counties typically lack the funding and access to the expertise and resources often available to larger, urbanized ones.

Tier 1 Mitigation Actions with sponsors for the most part fold into the inventory of plans, policies, and ordinances that implement on-the-ground hazard mitigation projects. Many of the Tier 2 Mitigation Actions with sponsors, however, most often represent expansions of plans, policies, and development regulations that support hazard mitigation planning. As the county updates plan, policies, and ordinances, information from the Risk Assessment and the Mitigation Strategy will be added or cited as appropriate. Likewise, as new data or mitigation actions that becomes available, it will be incorporated into the Hazards Mitigation Plan during annual updates.

1. Building Codes

Grays Harbor County has adopted the following building codes that mitigate hazard threats through construction practices:

- International Building Code (IBC), 2009 Edition, including Appendix J governing grading;
- International Residential Code (IRC), 2009 Edition, including Appendix J governing existing buildings (with the exception of AJFO 1.5)

Building Codes are in Title 15 of the Grays Harbor County Code and was updated in 2010.

Tier 1 Mitigation Actions addressed through building codes:

- 1.1 Retrofit the Grays Harbor Community Hospital to withstand earthquake events
- 1.2 Retrofit Aberdeen School District buildings to current building codes
- 1.3 Retrofit the Pearsall Building (Public Health)
- 3.2 Replace the Grays Harbor Fire District 11 Fire Station with a tsunami/earthquake resistant structure

2. Comprehensive Plan

The Comprehensive Plan contains long-range goals, objectives, and policies for directing public and private development in Grays Harbor County. It establishes the policy foundations to various county ordinances that regulate development.

The Comprehensive Plan consists of several stand-alone elements pertaining to land use, transportation, critical areas, rural lands, industrial development, and parks and recreation. The plan directs the county to adopt development regulations that preclude land uses or development incompatible with critical areas.

Main documents that make up the plan are Resource Lands and Critical Areas Designation; Agricultural Lands Element; Industrial Lands Element; Parks and Recreation Element. The adoption of the first elements of the plan occurred back in 1968 with amendments and additions since then.

The Tier 1 Mitigation Action that may need integration into the Comprehensive Plan is:

3.1 Locate, design, permit, and construct a solid waste staging area

Tier 2 Mitigation Actions that will be part of the Comprehensive Plan are:

- 3.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 3.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

3. Zoning Code

The Grays Harbor County Zoning Code is the primary regulatory framework for managing new and expanded development in the county. Other development codes, such as the Critical Areas Ordinance, integrate their application through each development district.

Zoning is an important tool in hazard mitigation as it regulates types of development at appropriate densities. Used in conjunction with the Critical Area Ordinance and the Shoreline Master Program, it can limit new development in areas prone to natural hazards. Variances are possible under the zoning code new development if it meets specific hardship criteria.

Zoning is in Title 17 of the Grays Harbor County Code. The county originally adopted the current version of zoning in 1969. There have been periodic amendments since then.

The Tier 1 Mitigation Action that needs integration into the zoning code is:

3.1 Locate, design, permit, and construct a solid waste staging area

4. Critical Areas Ordinance

The purpose of the Grays Harbor Critical Areas Ordinance is to preserve the natural environment and protect the public's health and safety, including reducing the threat of hazards related to frequently flooded and geologically hazardous areas. The county is required to protect critical areas through the Growth Management Act, Chapter 36.70A RCW. The county uses the critical areas ordinance as an overlay to the development requirements within each district classifications of the zoning code.

The county codified its Critical Areas Ordinance under Section 18.06 County Code. Specific provisions relating to flood hazard reduction are in §18.06.120-130. Those provisions relating to geologically hazardous areas are in §18.06.095. The county adopted the ordinance in 2010.

The Tier 1 Mitigation Actions that may interface or add best available science to the Critical Areas Ordinance are:

- 3.1 Locate, design, permit, and construct a solid waste staging area
- 6.1 Use LiDAR to identify potential restoration areas for those areas capable of providing natural storage for floodwaters
- Tier 2 Mitigation Actions that increase the capacity of the Critical Areas Ordinance for hazard mitigation are:
- 10.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

5. Subdivision Ordinance

The Subdivision Ordinance implements Chapter 57.18 of the Revised Code of Washington (RCW) and falls under Title 16 of the Grays Harbor County Code. Sections of this code mitigate threats from hazard events by identifying unsuitable lands for subdivision, setting review criteria, and regulating drainage and storm water runoff. The Critical Areas Ordinance has boosted the ability of the Subdivision code at mitigating the impacts of hazards through the application of development standards. However, it does not apply to existing development.

Title 16 contains the Subdivision Ordinance. §16.16.230; §16.20.100 and §16.20.210 specifically address flood hazard issues.

While the Subdivision Ordinance is an important tool for hazard mitigation, there are no Mitigation Actions specific to this regulatory tool.

6. Stormwater Manual

Grays Harbor County adopted the **2005 Stormwater Management Manual for Western Washington** to control stormwater runoff from developed properties and activities. The stormwater management manuals establishes site design principles; construction techniques to prevent erosion and the discharge of sediments and other pollutants; source controls to keep pollutants out of stormwater; flow control facilities to reduce discharge flow rates; and treatment facilities to reduce pollutants. The manual's focus on reducing discharge flow rates mitigates the potential for flooding.

The county has integrated the manual in 2010 in a variety of chapters in its code, including the Critical Areas Ordinance and the Subdivision Ordinance; the zoning code refers to stormwater considerations but does not mention the manual specifically.

The Tier 2 Mitigation Action that interfaces with the Stormwater Manual is:

10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

6. Capital Improvements Plan

The Capital Improvements Plan lists prioritized structural and critical facility protection projects over a five-year period. The county uses this document to guide its annual budget development process and in applying for grants and loans from state and federal agencies. The county adopts its Capital Improvements Plan by resolution, which it amends on an as needed basis. Other jurisdictions, such as the Grays Harbor Community Hospital, the Grays Harbor Public Utility District, Fire Districts, and the Pacific Beach Food Bank, will need to take similar action.

There are a number of Tier 1 Mitigation Actions that need to be added to capital improvement plans for the county and other entities during the next update cycle:

- 1.1 Retrofit the Grays Harbor Community Hospital to withstand earthquake events
- 1.2 Retrofit Aberdeen School District buildings to current building codes
- 1.3 Retrofit the Pearsall Building (Public Health)
- 3.2 Replace the Grays Harbor Fire District 11 Fire Station with a tsunami/earthquake resistant structure

- 3.3 Build the KXPB radio station on higher ground and upgrade antenna
- 3.4 Construct road maintenance shop in hazard-free "safe zone" to store equipment and supplies for hazard response
- 4.1 Relocate power lines underground in areas prone to blow-down during high windstorms
- 4.2 Upgrade back-up power at county facilities and utilities
- 7.1 Install flashing lights on tsunami-resistant structures near ocean beaches that serve as escape points for people

One Tier 2 project that may need inclusion into the county Capital Improvement Plan pending examination is:

8.2 Ensure shelter sites are served by approved public water and develop minimal food safety requirements

7. Grays Harbor County Comprehensive Flood Management Plans

Grays Harbor County has adopted a series of Flood Management Plans governing various areas of the county. These plans document local issues relating to flood hazard events, evaluate flood management measures, and identify preferred alternatives. Areas of the county specifically addressed include Grayland, Vance Creek Drainage, South Coastal, and North Beach. Adopted in December 2001, these plans meet FEMA requirements. They will also contribute to the knowledge base needed to begin moving the county towards Community Rating System eligibility.

The Tier 2 Mitigation Actions that allies itself with these plans are:

- 10.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

8. Chehalis River Basin Flood Authority Comprehensive Flood Hazard Management Plan

Grays Harbor County is a member of the Chehalis River Basin Flood Authority, which has prepared a Comprehensive Flood Hazard Management Plan (CFHMP) for the Chehalis River. The purpose of the plan is to define flood problems in the Chehalis Basin and propose solutions. The plan has adopted nine goals, including calling for the establishment of a flood control district. As of December 2010, while the Flood Authority adopted the plan, Grays Harbor County has not. Expected adoption by resolution likely will happen in early 2011. The Tier 2 Mitigation Actions that allies itself with these plans are:

- 10.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

9. Chehalis River Basin Watershed Management Plan

The Chehalis Basin Watershed Management Plan provides the collective vision of citizens, utilities, federal, state, tribal, and local governments within the Chehalis Basin Partnership. The Plan is a framework for water resource management, examining water quantity, water quality, instream flow, habitat, and water rights issues in the basin. The plan is a policy document that directs future action on water management in the basin. The plan was adopted by resolution in 2004.

Ultimately, this plan will play a strategic role in flood hazard reduction throughout the county by restoring natural hydrological functions.

The Tier 2 Mitigation Actions that allies itself with these plans are:

- 10.1 Update the Grays Harbor County Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program and to position the county towards enrollment in the Community Rating System

10. Comprehensive Emergency Management Plan (CEMP)

The CEMP establishes a systematic and coordinated countywide response plan for emergencies and disasters to minimize impacts to people, property, environment, and economy. The county adopted the CEMP in 2005 with amendments in 2010.

A Tier 1 Mitigation Action to integrate within the CEMP is:

3.4 Construct road maintenance shop in hazard-free "safe zone" to store equipment and supplies for hazard response

The Tier 2 Mitigation Actions to coordinate within the CEMP are:

- 8.1 Identification of public buildings that could be used as emergency shelters
- 8.2 Ensure shelter sites are served by approved public water and develop minimal food safety requirements
- 8.3 Create a work group to develop a plan that coordinates the use of local emergency water resources during a hazard event

11. 10-Year Plan to End Homelessness and the Low- and Moderate-Income Housing Plan for Grays Harbor County

These two policy documents address housing issues for special needs populations in the county. While both plans do not deal specifically with hazard mitigation, the outcome of projects identified in these plans indirectly protect life and property by creating sheltering opportunities and rehabilitating older properties, which make them more flood, earthquake, and severe-storm proof. The county adopted these plans in 2010.

Tier 1 Mitigation Actions to fold within these two plans include:

5.1 Assist homeowners in making their buildings flood, earthquake, and severe storm proof (chimneys, foundations, roofs)

Tier 2 Mitigation Actions to incorporate into these plans are:

- 8.1 Identification of public buildings that could be used as emergency shelters
- 8.2 Ensure shelter sites are served by approved public water and develop minimal food safety requirements
- 9.1 Use Grays Harbor Community Hospital's Pillar Talk newsletter, website, and Speaker Series to communicate about risks and preparing for hazard events
- 9.2 Ensure that homeowners with on-site water and septic systems receive information about maintenance and hazard mitigation activities

12. Shoreline Management Master Program/Grays Harbor Estuary Plan

The purpose of the county's Shoreline Management Master Program and the Grays Harbor Estuary Plans is to encourage water-dependent uses, protect shoreline natural resources, and promote public access. These policies apply to all marine waters below the ordinary high water mark (OHWM), rivers with a mean annual flow greater than 20 cfs, lakes and reservoirs greater than 20 acres in area, uplands 200 feet from the OHWM, and associated wetlands. These policies contribute to hazard mitigation by controlling land uses and activities within its jurisdictional boundaries, especially within the 100-year floodplain. The county first adopted the Grays Harbor County Shoreline Management Master Program in 1974 (Resolution #7419) and Grays Harbor Estuary Management Plan in January 1986. The county is responsible for updating its Master Program under state law on or before 2014. The Tier 2 Mitigations Actions that apply to the Master Program are:

- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program to position the county towards enrollment in the Community Rating System

13. National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a federal program to identify flood prone areas and make flood insurance available to the owners and leasers of property. This insurance provides an alternative to disaster assistance for meeting escalating costs of repairing damaged buildings and their contents from floods. Participation in the NFIP by Grays Harbor County is by agreement with the federal government predicated on the adoption and enforcement of a floodplain ordinance that ensures new buildings will be free from flood damage and prevents new developments from increasing flood damages on existing properties. The county's "floodplain ordinance" recently moved from Title 17, Zoning Code, to Chapter 18.06, Critical Areas Protection Ordinance (§18.06.100).

Grays Harbor County currently meets the minimum requirements of the NFIP. The county's Community Identification Number is 530057. The last Community Assistance Visit by FEMA in July 2005 indicated that the county complied with participation requirements.

The county currently does not participate in the Community Rating System, but it has identified its enrollment in the program as a long-term priority and has already moved into that direction by adopting several facets of that program.

The Tier 2 Mitigations Actions that would move the county towards the Community Rating System are:

- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program to position the county towards enrollment in the Community Rating System

14. Six-Year Road and Annual Construction Programs

RCW 36.81.121 and .130 require the preparation and annual updating of a six-year comprehensive transportation and annual construction programs. These program are adopted by the Board of County Commissioners at any time before the annual budget and are to include

all anticipated road and bridge construction projects, paths and trails projects and any other specified capital outlays for the following six-year period.

Tier 1 Mitigation Actions that are already integrated within the Six-Year Road and Annual Construction Programs are:

- 2.1 Replace culvert with bridge at MP 8.2 of the South Bank Road
- 2.2 Raise the Wishkah Road approximately 2 feet between MP 1 and 5
- 2.3 Replace 3-foot diameter with 10-foot diameter culvert on Barrett Road West at MP 0.1,1/2 mile west of Brady
- 3.4 Construct road maintenance shop in hazard-free "safe zone" to store equipment and supplies for hazard response

15. Chehalis Basin Salmon Habitat Restoration and Preservation Work Plan

The Work Plan identifies goals, strategies, and implementation steps to recovering salmon habitat recovery and preservation within the county. Salmon habitat actions provide floodplain management benefits – restoring natural floodplains and channel hydrology, bank stabilization, barrier removal, and protection of functional habitat/ floodplains. Upland actions directed at road decommissioning and barrier removal also have an impact on reducing landslide. Over the past 10 years, this plan has shepherded a number of projects that have been effective in serving the needs of salmon habitat recovery and floodplain issues. Funding will likely continue in the future.

The Tier 1 Mitigation Action that integrates with the plan is:

6.1 Do LiDAR flyovers to identify natural and converted areas capable of providing natural storage of floodwaters

Tier 2 Mitigation Actions that implement both this plan and the watershed plan are:

- 10.1 Update the countywide Comprehensive Plan to encourage development in areas less vulnerable to all natural disasters
- 10.2 Update the Shoreline Master Program to manage development adjacent to shorelines to reduce the risk of hazard events to structures
- 10.3 Update the Critical Areas Ordinance to retain enrollment in the National Flood Insurance Program to position the county towards enrollment in the Community Rating System

Plan Update Statement

The county has not made any readjustments to how it intends to monitor and maintain the current plan or how it anticipates managing citizen participation and involvement.

Grays Harbor County, however, has been busy since the 2005 – 2010 plan in adopting a number of plans and ordinances that will reduce or mitigate the impact of hazards on life, property, and the economy. The Critical Areas Ordinance is the most significant piece of legislation passed to date; the hazards it will influence most are flooding, earthquake, and landslides. The county expects to continue expanding its planning and regulatory tools to reduce or mitigate hazards in the county. Integration of Mitigation Actions throughout county planning, regulations, and capital budgets will continue until the next scheduled plan update.

PLANNING PROCESS

SECTION 7: DEVELOPING THE PLAN

The planning process leading to the development of the updated *Grays Harbor County Hazard Mitigation Plan* began in July 2009 with an award from the Hazard Mitigation Grant Program. The county matched this award with in-kind contributions in staff time and then contracted with the consulting firm of Creative Community Solutions, Inc. to design and implement the hazard mitigation planning process with a local planning team.

BUILDING ON THE 2005-2010 PLAN

The initial **2005-2010** All Hazards Mitigation Plan served as a jumping off point for the update process, albeit with several major improvements intended for this plan. The first one was to evaluate what changed in the county since the first adoption of the plan in relation to hazards, particularly in their impact on the community. The foundation of this effort was to update the Risk Assessment. The updated Risk Assessment reflects the steadily growing database of new information available from a wide variety of local, state, federal, and nonprofit sources. Recent experiences and analysis from Washington State, the rest of county, and the world have contributed to the newest edition. The tsunami in Southeast Asia and earthquakes as recent as this year's event in Chile helped to focus the material in the revised Risk Assessment.

In the 2009 Risk Assessment, the WSEMD identified five natural hazards with the greatest potential to affect people adversely, environment, economy, and property in Grays Harbor County. These five natural hazards are:

- Floods,
- Earthquakes,
- Severe storms (high winds, tornado and coastal flooding),
- Landslides, and
- Tsunami

The state selected these natural hazards through a rigorous review process that considered scientific data, history of occurrences, damage reports, and potential impacts to people. Grays Harbor County added wildland fire, volcanoes, and hazardous materials incidents due to their potential of disrupting the county despite limited past events.

The second major improvement slated for the updated plan was to push for identifying specific projects. While the initial plan was strong on objectives, the local planning team at that time had trouble in bringing a level of specificity to its mitigation actions. The new planning process sought to improve upon this by appointing individuals with greater expertise in analyzing critical infrastructure, property, and community economic needs. Growing familiarity of what other communities were accomplishing through the hazard mitigation plans also helped the local planning team better understand the process.

ROLES OF PLANNING PARTICIPANTS

Preparing a draft of the *Grays Harbor Hazard Mitigation Plan* was the combined responsibility of county staff, a consulting firm, and the Hazard Mitigation Planning Team

County Staff Roles

County staff participated in a variety of roles during the plan development process. Interim Planning Director Lee Napier served as the overall project lead. She supervised the overall planning process, the county's contract management with the state Emergency Management Division, and the project consultants. Deputy Director of Emergency Management Charles Wallace focused on ensuring consistency of the Hazard Mitigation Plan development process with other Emergency Management functions and plans.

Other county staff represented their department or participated on the Hazard Mitigation Planning Team. Their contributions to the planning process included identifying problem areas and projects associated with hazard events as well as reviewing the final draft of the plan to ensure accuracy. Table 3 includes the names and departments of all county staff participating in the plan development process.

In addition, Grays Harbor Geographic Information Systems Program prepared maps and provided the parcel data used for analysis in the plan.

Consulting Firm

Assisting county staff in preparing the plan was the consulting firm of Creative Community Solutions, Inc. The firm's role was to develop the planning approach, conduct research for the hazard profile, facilitate meetings for the Hazard Mitigation Planning Team, design and implement the public participation component, prepare all written drafts, and coordinate the plan review process.

Hazard Mitigation Planning Team

The heart of the county's approach to updating plan was the appointment of its Hazard Mitigation Planning Team (HMPT) by the Board of County Commissioners. The HMPT officially consisted of 17 members representing citizens at large, county staff, non-profit agencies, and private industry from throughout the county. In addition, the HMPT members, representatives from other municipalities and special districts attended meetings of interest to them. For instance, workshops focusing on earthquakes and tsunamis generated strong interest from representatives in the coastal areas. The names, representation, and interest of appointed and visiting members follow in Table 1. The purpose of the HMPT was to serve as an advisory body to the Board of County Commissioners in guiding the content development of the plan. The HMPT accomplished this task in workshops by focusing on:

- Learning about the importance of hazard mitigation and what it entails
- Understanding the legal framework for hazard mitigation
- Identifying and assessing risks from natural and man-made hazards
- Setting mitigation goals, objectives, and general mitigation actions
- Creating specific mitigation actions and implementation strategies
- Establishing a plan monitoring program

Members	Representing	Expertise
Kevin Varness* ⁺	Grays Harbor Co. Utilities & Development Division	Public infrastructure
Lee Napier* ⁺	Grays Harbor Co. Community Development	Land use planning, natural resource management
Charles Wallace* ⁺	Grays Harbor Co. Emergency Management Division	Emergency management
Liz Anderson*	Grays Harbor Public Utility District	Public utilities
Nick Bird	City of McCleary Director of Public Works	Public infrastructure, utilities
Dave Carlberg	City of Aberdeen Fire Chief	Public safety
Chuck Chafin	Grays Harbor Fire Dist. #11, Grayland, WA 98547	Public safety, Water district
Ronald Cinert M. Townsend	Aberdeen School District	School districts
Curt Crites ⁺	Grays Harbor Co. Planning & Building Division	Land use planning, floodplain management
Garrett Dalan⁺	Grays Harbor County Environmental Health	Environmental health
Gary Dent	Mayor of McCleary	Elected official
Russ Esses**	Grays Harbor Public Works	Transportation (roads and bridges)
Mike Ferry* ⁺	Grays Harbor Co. Planning & Building Division	Building and construction
Karolyn Holden**	Grays Harbor Public Health	Public health & social services
Mike Johnson*	Port of Grays Harbor	Port District
Nora LaBlanc ⁺	Grays Harbor Co. Public Health & Social Srvcs	Public health and social srvcs
Tom Laufmann*	Aberdeen School District	School districts
Slim Mattox*	Puget Sound & Pacific Railway	Transportation (railroads)

Table 4. Hazard Mitigation Planning Team Participants

Members	Representing	Expertise
Dave Murnen*	NeighborWorks of Grays Harbor	Low- and moderate- income housing, nonprofits, construction
Jeff Nelson* ⁺	Grays Harbor Co. Environmental Health	Environmental health
Steve Pettit	City of Elma Dir Community Development / Building Official / Fire Marshal	Building and construction
Lyle Powell	Grays Harbor Public Utility District	Public utilities
Stan Ratcliff *	Grays Harbor Public Development Authority / Satsop	Public development park, business
Brian Shea*+	Grays Harbor Co. Planning & Building Division	Land use planning
Sharon J. Simmons	Grays Harbor Fire Dist. #11	Public safety
Monica Simpson*	Grays Harbor Community Hospital	Hospital
Betty Singer	Grays Harbor Fire Dist. #11, Grayland, WA	Public safety
Chief Torgerson	City of Aberdeen Chief of Police	Public safety
Michael Tupper	Stafford Creek Correction Center	Public safety, emergency management
Tim Walker*	Sierra Pacific Industries	Industry
Dennis Benn	Westport Fire District	Public safety

*Denotes appointment by Board of County Commissioners

⁺Denotes county staff representative

HMPT WORKSHOPS

The following table shows a schedule of the workshops for the planning team and their accomplishments during the hazard mitigation planning process.

Table 5 Hazard Mitigation Planning Schedule

Hazard Mitigation Planning Schedule
July 7, 2010: Planning Team workshop
Orientation, Earthquake planning
July 21, 2010: Planning Team Workshop
Flood, Severe Storm, Landslide and Tornado planning
August 4, 2010: Planning Team Workshop
Tsunami planning
August 24, 2010: Planning Team Workshop
Volcano, wildland fire, hazardous materials
September 1, 7, 9, 2010 Citizen Open House Events in Grayland, Elma, and Pacific Beach
All hazards
September 22, 2010: Planning Team Workshop
Prioritizing Objectives and Mitigation Actions

The first workshop for the HMPT focused on making decisions on organizational issues, learning about hazard mitigation planning, and understanding the purpose of the Hazard Identification and Vulnerability Assessment (HIVA). The workshop followed with its first in depth focus on a hazard: earthquakes. During this section of the workshop, the HMPT examined the causes of the hazard, its potential impact to life, property, and the economy, and its past occurrences. This information then served as a springboard to brainstorm and discuss general mitigation actions for eliminating or reducing their impacts.

This format repeated for each subsequent workshop focusing on floods, severe storms, landslides, tsunami, wildland fire, and hazardous materials. To keep citizens and elected and appointed officials up to date on the progress generated at each workshop, the county set up a special hazard mitigation planning webpage within its Emergency Management Division website. This site not only included general information about hazard mitigation planning, but also sections from the HIVA, the presentation materials used at each workshop, and minutes.

PUBLIC PARTICIPATION PROCESS

The plan development process invited county residents to learn about hazard mitigation planning and to share their comments through a mix of active and passive participation opportunities. These included the use of press releases, the County Website, Open House events, and public meetings.

Planning Website and Press Releases

The first public outreach effort undertaken by the county was to set up a special website about hazard mitigation planning. This website provided county residents updated information about the planning process, participation events, documents and meeting notes, links to other hazard mitigation sites, and contact information. Press releases issued by the Division of Emergency Management went out to local newspapers and radio stations to inform the public about the planning process and open house events. Copies of these press releases follow in Section 30, Public Participation Appendix.



Open House Events

Once the HMPT generated an extensive list of mitigation objectives and actions, their next step was to host a series of open house events to reach out to the wider audience of Grays Harbor County residents. There were three open house events held in Grayland, Elma, and Pacific Beach, each running from 4 pm to 7 pm.

The purpose of these open house events was to share information with citizens about hazard mitigation planning, each profiled hazard, and suggested approaches to reducing or eliminating their impacts to life, property, and economy. The open house format employed a series of display boards that shared information and solicited public opinion. The project consultants were available to provide additional explanations or answer questions.

As part of the public opinion gathering process at the open house events, each attendee received six dots to identify those mitigation objectives and actions they thought had the highest priority to them and their community. Open house attendees also had the opportunity to add objectives and mitigation actions, too.

Welcome to Our Open House!

Come in to find two sets of displays about disaster planning in Grays Harbor County.

The first set of displays provides information about the types of disasters facing our county and where their impact will be most felt.

The second set of displays asks you to identify your top 5 actions to reduce the threat of disasters in our county. It also asks you to add any new ideas.

There is also a survey for you fill out.

We have Open House hosts available to answer your questions or guide you through our displays. Feel free to say hello to them!

Despite reliance on press release and radio advertisement, public attendance at these events was light in comparison to similar open house events held during the development of the 2005 plan. Public awareness of the 2004 tsunami in Southeast Asia likely contributed to higher attendance back then. In addition, holding the open house events outside of the flooding/severe storm season rendered hazard mitigation planning "out of sight – out of mind."





Final Public Comment Meeting

A final plan public comment opportunity occurred on May 11, 2011 from 6:00 to 7:30 pm at the Grays Harbor County Commissioners meeting room. Public notification of the meeting included notice on the county website and a press release that county newspapers and radio stations carried.

For those unable to attend the meeting in person, the county's On-Line Audio/Visual Library carried the presentation portion of the meeting live, including the opportunity to comment in real time. The meeting remains in the Library and still allows citizens submit comments.



The design of the meeting consisted of two parts. The first part of the program featured a presentation about hazard mitigation planning and the highlights of the plan, including its structure, risk assessment, and mitigation goals, objectives, and actives. The presentation was open to audience questions and answers.

The next part of the meeting was an open house format involving a series of workstations. Each workstation highlighted a hazard and the mitigation actions that addressed it. The project consultants and the county's project coordinator and Emergency Services Assistant Director were available at the workstations to answer citizen questions and encourage written comments on 5-by-8 cards. The HMPT later would assess the comments collected at the workstations and change the plan as appropriate.

Despite media coverage and the public's availability to attend the meeting remotely on-line, no citizens attended the meeting.

HMPT PRIORITIZATION OF OBJECTIVES AND MITIGATION ACTIONS

The final workshop for the HMPT focused on ranking a final list of Mitigation Actions. This workshop centered on applying a modified version of the STAPLEE rating system to the objectives and mitigation actions. In this activity, each HMPT member received evaluation criteria shown in Table 3 for use in ranking a consolidated list of mitigation objectives and actions. Working individually, the HMPT applied the criteria to each objective and mitigation action. A "+" under a category received one point while a "-" received no score; this provided a point system that allowed calculation of a total score for an objective or mitigation action. The consultants then added together the total points given by the entire the HMPT for an objective or mitigation action. Those objectives or mitigation actions that ranked with the highest number of points awarded went highest on the priority list. Conversely, those with the lowest number of points were lowest in priority.

This process next entailed dividing the projects into two tiers. Tier 1 projects include those projects eligible under the Hazard Mitigation Grant Program while Tier 2 projects were not. A prioritized list of Tier 1 and Tier 2 projects follow in Table 4.

The planning process then requested one final step from the planning participants – to select those projects they would be willing sponsor if resources would allow. Sponsors then submitted an implementation strategy to include in the plan.

Evaluation Criteria	Analysis					
Benefit to	Will the action provide a wide or narrow benefit to the highest number of people or					
community	properties in the county?					
	 A wide benefit to a large number of properties or people would be a "+" 					
	 A narrow benefit to a small number of properties or people would be "-" 					
Addressing Multi-	Will the action address more than a single hazard?					
Hazards	 Addressing two or more hazards would be a "+" 					
	 Addressing only one hazard would be a "-" 					
Public support	What is the likelihood that the citizens would support the action?					
	 Medium to strong community support would be a "+" 					
	 None to low community support would be a "-" 					
Effectiveness	How effective is the action in avoiding or reducing future losses to life or property?					
	 A highly effective action would be a "+" 					
	• A lesser effective action would be a "-"					
Environmental	Do you think this action will comply with local, state, and environmental protection laws?					
impact	• If yes, "+"					
	• If there would be some degree of difficulty, "-"					
Cost-to-benefit	Does the potential cost for the action seem reasonable in comparison to the long-term					
	benefit it brings to property and lives?					
	• If yes, "+"					
	• If questionable or no, "-"					
Benefit to local	Does the action contribute to countywide economic development?					
economy	• If yes, "+"					
	 If questionable or no, "-" 					
Legal authority	Does the county have the legal authority to implement the proposed action?					
	• If yes, "+"					
	• If questionable or no, "-"					
Availability of	Are there grants or loans available from state or federal sources for funding the action?					
outside funding	 Available grants or loans would be a "+" 					
	 Not available grants or loans would be a "-" 					
Availability of local	Is it reasonable to assume that local government could fund some or all of the action?					
funding	• If yes, "+"					
	• If questionable or no, "-"					

Table 6.	Evaluation	Criteria f	or	Ranking	Mitigation	Objectives	and	Actions
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Tables 1 and 2 in Section 3 show the results from this process.

PLAN REVIEW AND APPROVAL

A release of the first draft of the plan to county staff, the HMPT, and the public occurred in January 2011. Integration of the comments and requested changes received during the comment period next went into a final draft. The Board of County Commissioners held a briefing on the document at a public meeting on February 7, 2011, whereby they moved to send it to the Washington State Emergency Management Division (EMD) for initial review.

After receiving and incorporating comments from WEMD, there was a second final draft released in April 2011. In preparation for the final round of public comment, the county placed an updated posting of the draft plan on the Hazard Mitigation Planning website and issued another press announcement about the meeting. The final public meeting on the plan, held on May 11, 2011, consisted of a summary overview presentation, a question and answer period, and a comment posting opportunity. Grays Harbor County submitted the draft plan to WEMD and the Federal Emergency Management Agency (FEMA) for their final review and approval in May 2011.

Once approved to form by WEMD and FEMA, the Board of County Commissioners adopted the *Grays Harbor County Hazard Mitigation Plan* by Resolution _____, 2011.

Plan Update Statement

The current Hazard Mitigation Planning Team had greater representation from government than in the previous plan version. The 2005-2010 plan, consisting nearly entirely of citizens, experienced difficulty in identifying specific projects and building county commitment to moving forward with projects. It is anticipated that the 2010-2015 plan will bring about outcomes that have a greater opportunity for accomplishment.

RISK ASSESSMENT

SECTION 8 OVERALL SUMMARY

ORGANIZATION OF RISK ASSESSMENT

The organization of the Risk Assessment begins with an examination of important physical and demographic factors regarding the county. The assessment then profiles those hazards that have the greatest probability of occurrence or potential to do damage. These include:

- Floods
- Earthquakes
- Severe storms
- Tsunami

- Hazardous Material Incidents
- Landslide
- Volcano
- Wildland fire

For each of these hazards, the Risk Assessment provides a description of the hazard, its contributing factors, effects caused by an event, a summary vulnerability assessment, discussion of hazard events that includes probability (when possible) and a historical overview of past events.

The Asset Vulnerability Appendix, Sections 18 through 25 expands on the summary vulnerability assessment within each hazard profile by providing a complete breakdown by Commissioner District of the number of people, the number and value of structures by type, and a list of critical facilities affected by each hazard.

Grays Harbor County's Geographic Information Systems (GIS) was the foundation to the methodology used for developing the vulnerability assessment. Using parcel data from the Grays Harbor County Assessor as the base layer, the GIS program added appropriate layers when available to determine the extent of a hazard's impact to structures. This process allowed the assessment to determine the type, number, and dollar value of structures within a hazard area.

For instance, using Flood Insurance Rate Maps as an overlay to the parcel maps allowed the identification of the number, type, and cost of structures within the 100- and 500-year floodplains. Such data layers were available for floods, earthquakes, tsunami, and landslides.

In those situations where site-specific data is unavailable, such as severe storms, hazardous material incidents, volcano, wildfire events, the assessment relied on estimates based on historical accounts of events to determine their extent.

In all cases, the number of people affected by a hazard is an estimate derived by the number of residential structures multiplied by the number of people per household.

SUMMARY RISK ASSESSMENT CONCLUSIONS

Considered altogether, each of the hazards discussed in the plan vary in frequency, area affected, and severity. The major conclusions drawn from the Risk Assessment are:

- The county profile indicates that population and economic development patterns have not changed significantly over the past five years, particularly in comparison with many other areas of Washington State west of the Cascades.
- From a frequency standpoint, severe storms and flooding have the highest number of events. Severe storms and flooding bring the highest number of federally declared disasters, often two or more annually. They can cause considerable damage to property and economic losses.
- Flooding is the most widespread of the hazards due to the geography, rainfall, and number of rivers and streams in the county.
- Occurrences of these events often happen in conjunction with one another. Severe storms often trigger flooding and landslides. Landslides and tsunamis may accompany earthquakes.
- Tsunami and earthquakes have the potential to be the most deadly of the hazards facing the county. Despite their infrequency, a severe tsunami or earthquake event could result in significant mortality, property damage, and crippling economic disruption. Of all of the events, tsunamis and earthquakes engender the highest public fears.
- Except for unusual drought conditions, wildland fires have their greatest potential along the ocean dunes while volcano impacts in the past have affected only East County.
- Transportation corridors and industrial sites are the most common locations for hazardous material incidents. The most serious incidents in county history have occurred offshore in the Pacific Ocean, causing tremendous damage to the ecosystem.
- Topographical and geographic considerations greatly contribute to the problems caused by many of the hazards.
- The adjacent Pacific Ocean plays a significant role in influencing hazards in the county by serving as a conduit for tsunamis, severe storms, coastal flooding, and hazardous material incidents. Ocean tides indirectly contribute to flooding in the Chehalis Basin and at the mouths of the larger tributaries in the county.

• The low gradient of the Chehalis Basin and the mouths of major tributaries contribute to flooding problems. Protecting or restoring floodplains will play a major role in mitigating or reducing the impacts of floods.

SECTION 9: COUNTY PROFILE

LOCATION

Grays Harbor County is the southwest cornerstone of the five counties making up the Olympic Peninsula. The county borders the Pacific Ocean to the west, Pacific and Lewis Counties to the south, Thurston and Mason Counties to the east, and Jefferson County to the north.

GEOGRAPHY

The county covers a land area of 1,917 square miles. The topography of the county is diverse. The Olympic Mountains form the northern border of the county, the Pacific Coastline lies to the west, and steep foothills fill the remainder of the county with the exception of six major river valleys: the Chehalis, Satsop, Wynoochee, Wishkah, Hoquiam, and Humptulips Rivers. The Grays Harbor Estuary, the mouth of the Chehalis River, is a predominate feature that extends about 25 miles inland and covers 58,000 acres.

POLITICAL JURISDICTIONS

Grays Harbor County is the largest local political entity in the county, both in land area and in population.

There are nine municipalities: Aberdeen, Cosmopolis, Elma, Hoquiam, McCleary, Montesano, Oakville, Ocean Shores, and Westport. The county seat is in Montesano. All of the municipalities operate as code cities except Aberdeen, which is a first class city.

Portions of two American Indian Reservations, the Chehalis and the Quinault, lie within the boundaries of Grays Harbor County. The Chehalis Reservation, established by Executive Order, is 6.6 square miles and is in Grays Harbor, Lewis, and Thurston Counties. The government is the Confederated Tribes of the Chehalis Reservation. A majority of the Quinault Reservation is in Grays Harbor County, with a small adjacent section lying in Jefferson County. This reservation covers 325.7 square miles, slightly over one-tenth of the total county land area. The Quinault Indian Nation is a treaty tribe and is self-governing.

Figure 3. Grays Harbor County



The regional authorities and councils operating in Grays Harbor County include the Housing Authority of Grays Harbor, the Port of Grays Harbor, the Grays Harbor Council of Governments, the Grays Harbor Economic Development Council, Grays Harbor Transit Authority, and the Columbia-Pacific Resource Conservation and Development District. There also are 14 school districts, 17 fire districts, 3 drainage districts, 1 hospital district, 1 public utility district, and 3 water districts. The Timberland Regional Library, a library district spanning four counties, covers most areas of the county.

The federal government has a major governmental presence within Grays Harbor through its landownership of the Olympic National Forest and the Olympic National Park. The Washington State Dept of Natural Resources also owns forestlands and conservation areas within the county.

TRANSPORTATION NETWORK

Grays Harbor County has a transportation network consisting of state and county roadways and rail, marine, and air services.

Roads

US Highways 12 and 101, and State Routes 8 and 105, are the main thoroughfares connecting Grays Harbor County to the east, south, and north. SR 8 crosses the Grays Harbor/ Thurston County line approximately 4 miles east McCleary and terminates in Elma at its intersection with US 12. In all, SR 8 is 10.5 miles in length within the county and had a 2008 average daily traffic volume (ADTV) of 17,000 vehicles near its intersection with US Highway 12. US Highway 12 enters the county southeast of Oakville and terminates at the US Highway 101 intersection in Aberdeen. US Highway 12 extends for 38.8 miles in the county and had a 2008 ADTV of 19,000 vehicles at milepost 12.3. US Highway 101 is 77.2 miles in length and runs from Pacific County to Jefferson County. Other lesser State Routes include 105 (23.1 mi), 107 (8 mi), 109 (40.5 mi), and 115 (2.3 mi). The Washington State Dept of Transportation reports that in 2004 \$2.95 billion total products were shipped in 170,000 truckloads on Highways 12, 8, and 101 from the coast to the I-5 corridor. Thirty-six percent of that—\$1.06 billion—were logs, wood, and products. An additional \$840 million—28 percent—was machinery². (Washington State University, Strategic Freight Transportation Analysis, 2004)

There are 560 miles of county roads that include 173 miles of principal arterials and 84 miles of minor arterials. The county owns 146 bridges. The following table lists principal arterials in the county by length. These arterials serve as critical transportation links for rural residents, timber, and agriculture.

Road Name	Length	Road Name	Length			
Brooklyn Road	7.6	North River Road	13.9			
Copalis Beach Road	4.6	Ocean Beach Road	20.1			
East Hoquiam Road Extension	2.3	Pioneer Avenue W	0.2			
Elma-McCleary Road	5.7	Porter Creek Road W	0.7			
Garrard Creek Road	4.5	Powell Road	2.1			
Hoquiam-Wishkah Road	1.7	South Bank Road	17.0			
Lambert Road	4.4	South Shore Road	7.9			
Middle Satsop Road	7.6	Keys Road	3.6			
Monte-Brady Road	0.1	Wishkah Road	8.8			
Monte-Elma Road	7.7	Wynoochee Valley Road	33.7			
Montesano Street S	1.0	Wynoochee-Wishkah Road	4.6			
Mox Chehalis Road	8.5	Youmans Road	3.0			

Table 7. Principal County Arterials

Source: 2010 Six-Year Transportation Improvement Program

² <u>Washington Transportation Plan Update Freight Movement</u> September 2008.

Marine Shipping

The Port of Grays Harbor operates four deep-water cargo terminals in Aberdeen and Hoquiam as well as the Westport Marina. The Port is currently working on several projects to address the impacts of growing rail traffic: PGH Marine Terminal Rail, Hoquiam River Rail Bridge, and Wishkah River Rail Bridge.³

Sierra Pacific Industries is also a major marine shipping point within Grays Harbor Estuary.

Airports

There are four public airfields in Grays Harbor County. Bowerman Field in Hoquiam is the largest with a 5,000-foot runway serving around 19,600 operations in 2003. Other major airfields in the county include Elma, Ocean Shores, and Westport Municipal airports. Smaller airfields are located throughout the county.

Rail

The Puget Sound and Pacific Railroad is headquartered in Elma, Washington. The PSAP interchanges with the BNSF and UP Class I railroads. The PSAP runs through the rich forest lands of Washington State and serves major lumber customers with transportation services. Freight moves over 108 miles of track in Northwest Washington.

Major commodities include lumber, logs and chemicals for the pulp and paper mills. More than 26,000 carloads moved over the PSAP in 2008.

The PSAP provides an integral service to national account lumber companies moving their products to the Class I roads for further movement throughout North America.

Located on the PSAP is the Port of Grays Harbor that is the only deep-draft shipping port on Washington's coast, only 2 hours from open sea, and centrally located between the Seattle and Portland markets. Unburdened by daily traffic jams of urban areas, companies gain efficient and cost-effective highway access via the four-lane highway from Interstate 5 or rail service provided by Puget Sound & Pacific with connections to Burlington Northern Santa Fe and Union Pacific. A continuous rail loop throughout the marine terminal complex allows the free flow of cargo in and out of the facility. The rail loop is designed to handle and store unit-trains as well as smaller sets of rail cars.

³ <u>Top Port Infrastructure Priorities 3/2010</u>





http://www.railamerica.com/railservices/PSAP.aspx

CRITICAL COMMUNITY FACILITIES

Grays Harbor County has identified 178 community facilities not under its jurisdictional control as being critical to sustaining the community. These sites include public educational facilities, public safety (fire and law enforcement), hospitals, airports/airfields, communication towers, commercial radio towers, electric substations, and all county facilities. Although many of these facilities lie within municipal boundaries, they serve important community roles for citizens living within unincorporated Grays Harbor County. In addition, special use districts are responsible for maintaining many of these facilities, such as school districts, fire districts, utility districts, etc. Table 5 lists these facilities by Commissioner District.



Figure 5. Location of Critical Community Facilities

Facility	Туре	Commissioner District
A.J. West E.S.	Public Education Facility	1
Alexander Young E.S.	Public Education Facility	1
Beacon Avenue E.S.	Public Education Facility	1
Central E.S.	Public Education Facility	1
Cosmopolis E.S.	Public Education Facility	1
Elma H.S.	Public Education Facility	1
Elma M.S.	Public Education Facility	1
Emerson E.S.	Public Education Facility	1
Grays Harbor\College	Public Education Facility	1
Harbor H.S. &\Hopkins Preschool	Public Education Facility	1

Public Education Facility

Public Education Facility

Table 8. Critical Community Facilities under Municipal, Special Use District, or Private Ownership

Hoquiam H.S.

Hoquiam M.S.

1

1
		Commissioner
Facility	Туре	District
Lincoln E.S.	Public Education Facility	1
McDermoth\E.S.	Public Education Facility	1
Miller Jr. H.S.	Public Education Facility	1
Ocean Shores\E.S.	Public Education Facility	1
Robert\Gray E.S.	Public Education Facility	1
Simpson\Avenue E.S.	Public Education Facility	1
Stevens E.S.	Public Education Facility	1
Washington E.S.	Public Education Facility	1
Weatherwax H.S.	Public Education Facility	1
Aberdeen Fire Dept.	Fire Department	1
Cosmopolis Fire Dept.	Fire Department	1
East Hoquiam Fire Station	Fire Department	1
Hoquiam Fire Dept.	Fire Department	1
Ocean Shores Fire Dept.	Fire Department	1
South Aberdeen Fire Station	Fire Department	1
Westport Fire & South Beach Ambulance	Fire Department	1
G.H. Community Hospital East	Hospital	1
G.H. Community Hospital West	Hospital	1
Bowerman Airport	Public/Private Airfield	1
Ocean Shores Municipal Airport	Public/Private Airfield	1
Westport Airport	Public/Private Airfield	1
Aberdeen Police Dept.	Law Enforcement	1
Cosmopolis Police Dept.	Law Enforcement	1
Hoquiam Police Dept.	Law Enforcement	1
Ocean Shores Police Dept.	Law Enforcement	1
Washington State Patrol	Law Enforcement	1
Westport Police Dept.	Law Enforcement	1
Aberdeen PUD Communication Tower	Communications	1
G.H. E911 Communication Tower	Communications	1
G.H. E911 Office	Communications	1
Hoguiam Radio Range Station	Communications	1
KAYO-AM/FM Badio Tower	Communications	1
KGHO-AM Radio Tower	Communications	1
KXRO-AM Radio Tower	Communications	1
O S Public Works Communication Tower	Communications	1
Aberdeen BPA Substation	Power Substation	1
Cosmopolis BPA Substation	Power Substation	1
Cosmopolis PLID Substation	Power Substation	1
Dredge Port Substation	Power Substation	1
Electric Dark DLD Substation	Power Substation	1
Grave Harbor City DLD Substation	Power Substation	1
Crave Harbor Dapor DUD Substation	Power Substation	1
	Power Substation	
Harpo PUD Substation	FOWER SUBSIDIUM	1

		Commissioner
Facility	Туре	District
Highlands PUD Substation	Power Substation	1
Market & A PUD Substation	Power Substation	1
Monroe PUD Substation	Power Substation	1
Ocean Shores PUD Substation	Power Substation	1
Scott Street PUD Substation	Power Substation	1
Seventh & N PUD Substation	Power Substation	1
State Street PUD Substation	Power Substation	1
Westhaven PUD Substation	Power Substation	1
Weyerhaeuser PUD Substation	Power Substation	1
Weyerhaeuser PUD Substation	Power Substation	1
Weyerhaeuser Sawmill PUD Substation	Power Substation	1
Fairview Reservoirs	Water Reservoir	1
Hoquiam Reservoir	Water Reservoir	1
Hoquiam Reservoir	Water Reservoir	1
Lake Quinault E.S. & H.S.	Public Education Facility	2
North Beach H.S.	Public Education Facility	2
North Beach M.S.	Public Education Facility	2
Ocosta Jr.\& Sr. H.S.	Public Education Facility	2
Ocosta\E.S.	Public Education Facility	2
Pacific\Beach E.S.	Public Education Facility	2
Taholah\E.S. & H.S.	Public Education Facility	2
Wishkan Valley E.S. & H.S.	Fire Department	2
GHFD #10 - Wishkah Fire Dept.		2
GHFD #10 - Wishkah Fire Dept.	Fire Department	2
GHFD #10 - Wishkah Fire Dept.	Fire Department	2
GHFD #11 - Grayland Fire Dept.		2
GHFD #14 - Ocosta Fire Dept.	Fire Department	2
GHFD #15 - Artic Fire Dept.	Fire Department	2
GHFD #15 - Artic Fire Dept.	Fire Department	2
GHFD #16 - Copalis Crossing Fire Dept.	Fire Department	2
GHFD #16 - Copalis Crossing Fire Dept.	Fire Department	2
GHFD #17 - Humptulips Fire Dept.	Fire Department	2
GHFD #17 - Humptulips Fire Dept.	Fire Department	2
GHFD #2 - Central Park	Fire Department	2
GHFD #4 - Lake Quinault Fire Dept.	Fire Department	2
GHFD #4 - Lake Quinault Fire Dept.	Fire Department	2
GHFD #4 - Lake Quinault Fire Dept.	Fire Department	2
GHFD #5 - Bush Creek Fire Dept.	Fire Department	2
GHFD #6 - North Hoquiam	Fire Department	2
GHFD #7 - Copalis Beach Fire Dept.	Fire Department	2
GHFD #7 - Copalis Beach Fire Dept.	Fire Department	2
GHFD #7 - Copalis Beach Fire Dept.	Fire Department	2
GHFD #8 - Pacific Beach Fire Dept.	Fire Department	2

		Commissioner
Facility	Туре	District
GHFD #8 Pacific Beach Fire Dept.	Fire Department	2
GHFD #8 Pacific Beach Fire Dept.	Fire Department	2
Quinault Reservation Fire Dept.	Fire Department	2
Banas Field	Public/Private Airfield	2
Central Park Landing Strip	Public/Private Airfield	2
Copalis State Airport	Public/Private Airfield	2
Hogans Corner Airfield	Public/Private Airfield	2
Wishkah River Ranch	Public/Private Airfield	2
Quinault Reservation Police Dept.	Law Enforcement	2
Aloha Ridge Communication Tower	Communications	2
Cosmopolis Hill Communication Tower	Communications	2
KAYO-FM Radio Tower	Communications	2
KDUX-FM Radio Tower	Communications	2
KGHO-FM Radio Tower	Communications	2
Neilton Peak Communication Tower	Communications	2
Saddle Mountain Communication Tower	Communications	2
Westport PUD Communication Tower	Communications	2
Axford Prarie PUD Substation	Power Substation	2
Bernard Creek PUD Substation	Power Substation	2
Central Park PUD Substation	Power Substation	2
Copalis Crossing PUD Substation	Power Substation	2
Crane Creek PUD Substation	Power Substation	2
East Hoquiam PUD Substation	Power Substation	2
Grayland PUD Substation	Power Substation	2
Harding Road PUD Substation	Power Substation	2
Moclips PUD Substation	Power Substation	2
Oyehut PUD Substation	Power Substation	2
Promised Land PUD Substation	Power Substation	2
Quinault PUD Substation	Power Substation	2
Satsop BPA Substation	Power Substation	2
Westport PUD Substation	Power Substation	2
McCleary E.S.	Public Education Facility	3
Montesano Jr. & Sr. H.S.	Public Education Facility	3
Oakville\E.S.	Public Education Facility	3
Oakville\H.S.	Public Education Facility	3
Central Park E.S.	Public Education Facility	3
Elma E.S.	Public Education Facility	3
Satsop E.S.	Fire Department	3
	Eiro Doportmont	3
GHFD #1 - Oakville Fire Dept.	Fire Department	3

Facility	lity Type	
GHED #12 - McCleary Fire Dept.	Fire Department	3
GHED #12 - McCleary Fire Station	Fire Department	3
GHED #2 - Brady Fire Dept.	Fire Department	3
GHED #2 - Wynoochee Fire Dent	Fire Department	3
GHED #5 - Porter Fire Dept.	Fire Department	3
GHFD #5 - Satsop Fire Dept.	Fire Department	3
GHFD #5 East Satsop Fire Station	Fire Department	3
Mark Reed Hospital	Hospital	3
Airfield	Public/Private Airfield	3
Bear Valley Skyranch	Public/Private Airfield	3
D and B Airpark	Public/Private Airfield	3
MY Airfield	Public/Private Airfield	3
Wynoochee Valley Landing Strip	Public/Private Airfield	3
Elma Police Dept.	Law Enforcement	3
Grays Harbor County Sheriffs Office	Law Enforcement	3
McCleary Police Dept.	Law Enforcement	3
Montesano Police Dept.	Law Enforcement	3
Oakville Police Dept.	Law Enforcement	3
Chehalis Reservation Police Dept.	Law Enforcement	3
Elma PUD Communication Tower	Communications	3
G.H. County Radio Shop Commication Tower	Communications	3
Chehalis Tribe Communication Tower	Communications	3
G.H. Fairgrounds Communication Tower	Communications	3
GH County Minot Peak Communication Tower	Communications	3
McCleary Water Tank Communication Tower	Communications	3
PUD Minot Peak Communication Tower	Communications	3
Satsop PDA Communication Tower	Communications	3
South Elma PUD Communication Tower	Communications	3
Elma PUD Substation	Power Substation	3
McCleary Substation	Power Substation	3
Montesano PUD Substation	Power Substation	3
Valley PUD Substation	Power Substation	3
Cedarville PUD Substation	Power Substation	3
Satsop Park PUD Substation	Power Substation	3
Satsop Park PUD Substation	Power Substation	3
South Elma PUD Substation	Power Substation	3
Montesano Reservoir	Water Reservoir	3
Total Critical Facilities		178

Table 6 below shows those critical facilities owned by Grays Harbor County.

County Facility	Eunction	Year	Building	Content/ Equipment	Total Value
3rd Phase Sewer Pumps	Function	Duiit	value	value	Total value
30A Pacific Lane	Sewer utility	1999	128,369		128,369
Copalis Shop 1623 Ocean Beach Rd Copalis Crossing, WA	Road maintenance and repair	1938	582,900	724,514	1,307,414
Coroner's Office 1006 North H Street Aberdeen, WA 98520	Public health			16,977	16,977
Cosmopolis Shop Bismarck Cosmopolis, WA	Road maintenance and repair	1954	377,272	1,729,881	2,107,153
Courthouse Annex Administration Bldg Broadway & Main Montesano, WA	Assessor's Office Auditor's Office Commissioners Off. Env. Health Planning & Bldg. Road Fund Solid Waste Mgmt. Treasurer's Office Central Services Insurance	1978	6,325,600	2,133,632	8,459,232
Crisis Clinic 615 8 th Street Hoquiam, WA	Public health and social services	1994	7,131,670		7,131,670
Elma Co-op Preschool 420 E. Young Elma, WA	Education	1930	83,515		83,515
Elma Shop 906 E. Main Elma, WA	Road maintenance and repair	1991	474,438	1,526,358	2,000,796
Facilities/Elections Corner of 1st & Spruce Montesano, WA	Janitorial Facility/ Maintenance	1961	131,880	85,215	217,095
Fairgrounds 43 Elma-McCleary Rd Elma, WA	Mobile Unit (mod.) Extension Agent Weed/ Fair/ Pavilion	1997 / 1980	6,801,97	187,773 18,500	118,546
Forestry Building 310 W. Spruce	Forestry, engineering, emergency management, equipment repair	1996	2,455,000	101,982	2,556,982
Friends Landing Katon Road Extension	Recreation, boat access		226,608		226,608

Table 9. Grays Harbor County Critical Facilities

	-	Year	Building	Content/ Equipment	-
County Facility	Function	Built	Value	Value	Total Value
Head Start Building 502 E. Young Elma, WA	Education	1998	568,219		568,219
Illahee/Oyehut 24 Kione Street Ocean Shores, WA	Water system		14,004	16,876	30,880
Juvenile Detention Facility 103 Hagara Aberdeen, WA	Public safety	1983	4,681,200	184,908 64,036	4,930,144
Misc. One-Family Residence 215 W. Spruce Montesano, WA	Public safety	1949	125,717	1,030	126,747
Modular New Sheriff's Squad Room 202 First Street N. Montesano, WA	Public safety	1999	84,872		84,872
Montesano Shop 211 First Street North Montesano, WA	Road maintenance and repair	1993	2,630,600	1,235,578 2,740,521	6,606,699
New Builders Risk Project Sewage Treatment		1998	4,000,000		4,000,000
Oakview Group Homes 407 & 409 Oakhurst Elma, WA	Public health and social services	1998	170,300 170,300		170,300 170,300
Old Courthouse 102 W. Broadway Montesano, WA	Law Library D.C. #1 / Probation Clerk's Office Superior Court Prosecutor's Office	1911/ 2001	22,363,833	316,556	22,680,389
ORV Park CG/H Thurston County Hwy 8	Recreation	1977	1,427,700	300,000	1,727,700
Otis Pump Station 4791 SR 109 Moclips, WA	Sewer utility	1998	164,440		164,440
Pacific Beach Sewer 3194 Ocean Beach Rd Pacific Beach, WA	Sewer utility	1998	1,296,420	68,626	1,507,598
Pacific Beach Sewer Extension	Sewer utility	1998	4,676,872		4,676,872
Pearsall Building Multi-Serv Ctr. & Annex 2109 Sumner Avenue Aberdeen, WA	District Court #2 Health Dept. Social Services	1980	5,194,600	489,892	7,131,670

County Facility	Function	Year Built	Building Value	Content/ Equipment Value	Total Value
Pump Station 39 S. Fourth Street Pacific Beach, WA	Sewer utility	1998	164,440		164,440
Pump Station #2 Diamond Drive Pacific Beach, WA	Sewer utility	1998	81,955		81,955
Pump Station 3094 Ocean Beach	Sewer utility	1999	122,004		122,004
Pump Station 4140 SR 109	Sewer utility	1999	206,876		206,876
Sheriff Admin. & New Jail 100 W. Broadway Montesano, WA	Public safety	1985	13,895,600	481,077 1,191,064	15,567,471
Sheriff's Detectives Squad Room/Old DCI 131 Main Street North Montesano, WA	Public safety	1948	279,600	25,750	305,350
Storage (Old Pacific Title) 123 1st Street Montesano, WA	Administration	1951	214,680	25,000	239,680
Storage Building 211 W. Spruce Montesano, WA 98563	Administration	1997	19,733		19,733
Twin Harbors Group Home	Public health and social services	1978	213,495		213,495
Vance Creek Park 76 Wenzel-Slough Rd Elma, WA	Recreation	1992	443,774		443,774

POPULATION AND SOCIAL PROFILE

Grays Harbor County ranks as the 16th largest county in population in the State of Washington. The 2009 population estimate prepared by the Office of Financial Management reported 70,900 people living in the county.

Collectively, more people live in cities, 60%, than in the unincorporated rural areas of the county. However, the number of people living in the rural areas, 27,870, is larger than the population of any single city. The nine incorporated municipalities, in the order of largest to the smallest in population, are: Aberdeen, Hoquiam, Ocean Shores, Montesano, Elma, Westport, Cosmopolis, McCleary, and Oakville.

City	2010
Aberdeen	16,450
Cosmopolis	1,645
Elma	3,120
Hoquiam	8,770
McCleary	1,565
Montesano	3,565
Oakville	715
Ocean Shores	4,940
Westport	2,345
Incorporated	43,155
Unincorporated	28,445
County	71,600

Table 10. Population of Grays Harbor County and Municipalities

Source: OFM April 1, 2010 Estimate

Population fluctuations in Grays Harbor County have mirrored local and national economic conditions. The first major countywide decline in population occurred during the Great Depression and it would take 40 years before the county fully recovered its pre-Depression population numbers. A second, smaller population downward trend began in 1980 and continued until the early 1990's. Precipitating this decline was the impact of the national recession, job losses in the timber industry, and the closure of the Washington Public Power Supply System power plant at Satsop.

Between 1990 and 2010, while the incorporated population grew by 8.0%, the unincorporated areas of the county grew by a relatively slow 10%, significantly lower than many counties in Washington. However, the Cities of Ocean Shores (90.6%), Oakville (28.5%), Montesano (11.8%), Cosmopolis (16.6%), and Westport (21.8%) showed tremendous increases in population during the same period.

The Office of Financial Management (OFM) prepared high, medium, and low population projections for Washington Counties in 2007. By 2030, OFM predicts the following resident population scenarios for the county:

- High Growth Rate: 96,670
- Medium Growth Rate: 82,448
- Low Growth Rate: 68,226

Given current economic conditions in the state and recent manufacturing losses in the county, it is likely that the low to medium growth rate will prevail over the next thirty years. Population growth in the county over the next five years probably will show marginal growth.

Age

The largest age category in Grays Harbor County's population is the 50-54 year old grouping, which makes up over 5,500 of the 2008 population total.

The next two largest groups are the 45-49 and 55-59 categories each accounting for just over 5,300 individuals, followed closely by the 15-19 year olds at a 2008 population of 5,233.

					Total
City	Under 5 yrs	5-19 yrs	20-64 yrs	65 yrs & over	Population
Aberdeen	1,237	3,720	9,204	2,300	16,461
Cosmopolis	100	353	905	237	1,595
Elma	210	780	1,621	438	3,049
Hoquiam	625	2,133	4,946	1,393	9,097
McCleary	98	294	789	273	1,454
Montesano	190	715	1,897	510	3,312
Oakville	67	176	361	71	675
Ocean Shores	170	536	2,057	1,073	3,836
Westport	103	419	1,206	409	2,137
Unincorporated County	1,385	24,048	14,780	3,617	25,578

Table 11. Age of Po	pulation (2000)	, Grays Harbor	County

Source: 2000 US Census

Race

Race generally remains less diverse in Grays Harbor County than the state as a whole. American Indian and Alaska Native people are the one exception to this rule; this group comprises 4.7% of the county's total population while statewide, they represent 1.6% of the total population.

- 82% of the County population are counted as "White Non-Hispanic"
- Minorities comprise 17.8% of the Grays Harbor County population
- Hispanics account for 7.5% of the county's population
- Of the 5,352 Hispanics in the county, 58.2% are male (2008 OFM)

Household Composition

Family households make up 62.7% of the total number of households in the county.

- 31.1% of all county households have at least one person under the age of 18 years
- Married-couples make up nearly one-half of county households (49.1%)
- 7.0% of all county households have women living with children and no husband present; this is slightly higher than the state's estimate of 6.4% of all households
- 29.7% of county households have one or more people 65 years or older; statewide the average is 21.6%
- The average household size in the county declined from 2.44 residents per household in 2006 to 2.37 in 2008. However, the average family size grew from 2.88 members in 2006 to 3.01 in 2008.

County households are smaller than the 2008 state averages of 2.51 people per household and 3.09 people per family

	Grays Harbo	Statewide	
Household by Type	Number	Percent	Percent
Total households	26,808	100%	100.0%
Family households	17,914	66.8%	66.0%
Married-couple families	13,597	50.7%	52.0%
Single female householder, children	1,973	7.4%	6.5%
Non-family households	8,894	33.2%	34.0%
Person living alone	7,166	26.7%	26.2%
Person living alone 65 years & older	3,114	11.6%	8.1%
Households individuals 65 & older	7,412	27.6%	20.4%
Average household size		2.48	2.53
Average family size		2.98	3.07

Table 12.	Households in	Grays	Harbor	County
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Source: 2000 US Census Bureau

Group quarters include all people who do not live in households. There are two types of group quarters: institutional (e.g., correctional facilities, nursing homes, and mental hospitals) and non-institutional (i.e., college dormitories, military barracks, group homes, missions, and shelters). The 2000 US Census showed only 0.7% (442) of the population living in an institutional setting and 0.3% (198) living in a non-institutional one. This was a decrease of 226 from the 1990 Census, a loss probably attributed to the closing of facilities such as Oakhurst and other smaller congregate care centers. Since conducting the 1990 Census, however, Stafford Creek Correctional Institution has fully opened, with up to 1,936 inmates.

Household Income and Poverty

The US Census estimated the median household income for Grays Harbor County in 1999 at \$34,160. This amount is 75% of the statewide median household income of \$45,776. The county ranks 11th lowest in median household income among all Washington counties and second lowest among all Western Washington counties. The Dept of Housing and Urban Development (HUD) estimated the 2002 median household income for the county to be \$38,500.

The Community Development Block Grant (CDBG) Program relies on low- and moderate-income (LMI) thresholds set by HUD to determine program eligibility. CDBG defines a household as being of "moderate-income" when its total earnings are 80% or less of the county's median income. Similarly, "low-income" is 50% of the county median household income. CDBG adjusts each income threshold by family size. HUD also uses a "very low-income" category for other programs it manages. "Very low-income is 30% of the median household income. The table below shows the 2002 limits for total household income for defining very low-, low-, and moderate-income.

Percent of	Number of People in Household							
Median Income	1	2	3	4	5	6	7	8
30%	11,650	13,500	14,950	16,600	17950	19,300	20,600	21,950
50%	19,400	22,200	24,950	27,700	29,950	32,150	34,350	36,600
80%	31,050	35,450	39,900	44,300	47,850	51,400	54,950	58,500

Table 13. 2010 Very Low-, Low-, and Moderate-Income Households Income Limits

Source: US Dept of Housing and Urban Development

The most recent hard data available for the number of LMI households in the county comes from an April 2002 telephone survey conducted in the Aberdeen local calling area by Aberdeen Neighborhood Housing Services. The 2002 survey found:

- 47.9% of all households qualified as LMI
 - > 30.9% homeowners
 - ➢ 65.7% renters

HUD has published an estimate of the number of very low-, low-, and moderate-income households for 2002 based on prorated population increases within specific communities between 1990 and 2000. It is important to note that this estimate uses family income rather than household income. The table below summarizes HUD's estimate for Grays Harbor County by renter and homeowner categories.

	Number of Households		Number of Ho	ouseholds
Household Type	Elderly Renter	Total Renters	Elderly Homeowner	Total Homeowners
Very Low-Income	607	2,338	714	1,409
Low-Income	468	1,877	1,186	1,949
Moderate-Income	374	1,952	1,666	3,181

Table 14. Number of Very Low-, Low-, and Moderate-Income Households

In 1998, the US Census Bureau regularly estimated poverty levels for Grays Harbor County:

- 16.1% of all people fell below the poverty threshold
- the statewide estimate was 9.9%

People with Special Needs

The US Census defines "disabilities" as a long-lasting physical, mental, or emotional condition. This condition can make it difficult for a person to do activities such as walking, climbing stairs, dressing, bathing, learning, or remembering. It can also impede a person from being able to go outside the home alone or to work at a job or business.

Developmentally Disabled

The Developmental <u>Disability Services program (DSHS)</u> served 410 clients within the county in the 2006-2007 Fiscal Year.

Adults with Disabilities

The 2008 American Community Survey estimate that

- 17.1% of the county population aged 18 to 64 years old has a disability
- 46.6% of adults 65 years and over has a disability

Senior Adults Receiving State Services

The <u>DSHS Aging and Adult Services Division</u> served 1,182 people in the 2006-2007 Fiscal Year. Many of these clients receive assistance through adult family homes, adult residential care, assisted living, nursing facilities, and in-home care services.

Adults with Mental Illness Receiving State Services

 The state's <u>Mental Health Services Division</u> served 2,232 clients during the 2005-2006 Fiscal Year

Language

Most county residents five years and over speak English as their only language spoken at home (93.6%). For those 4,032 (6.4%) individuals in this age group whose primary language is other than English at home:

- 1,949 or 3.9% are Spanish speakers (2.2% speak English less than "very well")
- 817 or 1.3% speak another Indo-European language
- 630 or 1.0% speak an Asian/Pacific Islander language

2000 US Census; Grays Harbor County

HOUSING AND DEVELOPMENT TRENDS

Housing Types

Single-family homes comprise 68.1% of all housing units in unincorporated Grays Harbor County in 2004 according to the Office of Financial Management. Manufactured homes, at 29.5% of all housing units, are the next largest housing type and multi-family housing follows at a distant 2.5%.

Age of Housing

The age of housing in Grays Harbor County is significantly older than the statewide average. Data from the Grays Harbor County Assessor's Office in 2010 reported 42.9% of all housing in the county was built in 1939 or earlier. The 2000 US Census reports a statewide average of 12.4% for housing built during the same period. Considering single-family homes alone in the county, 34.3% were built in 1939 or earlier.

The median year of construction for single-family homes is 1959. Hoquiam has the oldest median year of construction (1921) while Ocean Shores has the most recent (1983). The median year of construction for multi-family dwellings is 1958.

Median Year Built
1959
1969
1926
1956
1953
1921
1949
1948
1926
1983
1965

Table 15. Age of Housing

Source: Grays Harbor County Assessor

Housing Tenure: Homeowners & Renters

There is a slightly higher rate of home ownership in Grays Harbor County than the statewide average. Cosmopolis and the unincorporated areas of the county have the highest percent of homeownership while Elma and Hoquiam have the lowest.

ECONOMIC PROFILE

Grays Harbor County has experienced intrinsic changes in its economy since the mid-1970s when national economic recessions and rising interest rates decimated the timber industry. Masking this trend for a short time was the upsurge in construction employment for the Washington Public Power Supply System plant at Satsop beginning in 1976. However, with the early 1980s came the termination of Satsop and another national recession, causing the civilian labor force to decline sharply. From 1981 to 1986, the labor force declined by 9,480 workers in county, dropping it to the same level 10 years earlier.

Intrinsic changes in the timber industry also began in the 1980s. One notable transformation was how the timber industry began to restructure and modernize its plants and operations, reducing its workforce needs. Another hit on the economy came in the late 1980s and early 1990s when endangered species listings and timber-set asides cost more jobs by reducing raw log supplies, particularly on federal lands. The lumber and wood products manufacturing sector alone lost over 4,160 jobs from 1979 through the late 1990s.

Once again, in 2009, the economic downturn brought the county into shrinking payrolls and skyrocketing unemployment rates. The manufacturing sector that was helping provide materials for the residential building boom both in the state and nationally, became a victim to the housing crisis and all

the bad numbers that came with it. With unemployment in 2009 averaging nearly double what it was in 2008, the local economy took a beating when the recession came to town. In late 2008, plant closures were the rule, as lumber mills and the like closed their doors, victim first of the national and then the state economy. With the closures came the loss of hundreds of high-wage jobs and their benefits. The initial shock – once gone – left the question where to find jobs for those impacted by these closures⁴.

Employment by Industry – 2009 General Trends

- Grays Harbor County had 24,830 nonfarm jobs in 2008, up just 20 jobs from the 2007 total of 24,810.
- Between 1990 and 2008, the annual average growth rate has been less than 1.0%, with 2009 leading us into the negative.

0		1
Employer	Category	Employees
Primary Industries		
Westport Shipyard	Manufacturing	615
Simpson Door Plant	Manufacturing	255
Grays Harbor Paper	Manufacturing	230
Weyerhaeuser	Forestry	188
Ocean Gold/Ocean Cold	Food Processing (Seasonal*)	200*
Sierra Pacific Industries	Manufacturing	183
Washington Crab Producers	Food Processing	150
Briggs Nursery	Farming	136
Ocean Spray	Food Processing	135
Mary's River Lumber	Manufacturing	115
Rognlins	Construction	108
Quigg Bros.	Construction	98
Hoquiam Plywood	Manufacturing	97
Lakeside Industries	Construction	60
Rohm and Haas	Manufacturing	58
Murphy Veneer	Manufacturing	52
TMI Forest Products	Manufacturing	50
Imperium Renewables	Manufacturing	42
PanelTech	Manufacturing	42
Ocean Protein	Food Processing	35*
Secondary Industries		
G.H. Community Hospital	Medical	688
Quinault Beach Resort	Hospitality	347
Wal-Mart	Retail	287
Safeway Foods	Retail	173

Table 16. Largest Grays Harbor Employees (2008)

⁴ Grays Harbor County Profile, June 2009

Employer	Category	Employees
Swanson Foods	Retail	151
McDonald's Restaurants	Hospitality	145
The Home Depot	Retail	115
Anchor Savings Bank	Banking	110
5 Star Dealership	Retail	97
Bank of the Pacific	Banking	95
Timberland Savings Bank	Banking	90
Duffy's Restaurants	Hospitality	60
Daily World	Media	45
Social, Education & Government		
Stafford Creek Prison	Corrections	560
Aberdeen School District	Education	489
Grays Harbor County	Government	460
Quinault Indian Nation	Government	320
Grays Harbor College	Education	300
Hoquiam School District	Education	262
Grays Harbor Public Utility	Services	187
City of Aberdeen	Government	183
Coastal Community Action	Social Service	144
Dept of Social and Human Services	Government	100
City of Hoquiam	Government	85
Port of Grays Harbor	Government	33

Source: Grays Harbor Economic Development Council Survey of Employers (3/09)

Grays Harbor goods-producing employment accounted for an annual average of 6,250 jobs in 2008, with 2,140 of those in the natural resources, mining and construction sector, and 4,110 counted in manufacturing employment.

- Manufacturing employment provided an average of 4,110 jobs
- Trade, transportation and utilities accounted for an annual average of 4,290 jobs
- All Other Services category accounted for over 27.0 % of all nonfarm employment
- Government employment currently accounts for about 26.0% of nonfarm employment in Grays Harbor County.
- Between 2009 and 2016, that rate of growth will slow to a less-than-one percent gain.

CONCLUSIONS FOR HAZARD MITIGATION PLANNING

Grays Harbor County faces several significant challenges that affect its ability in preparing for disasters, responding to events, or applying assistance after a disaster.

Geography

Maintaining connections between rural areas of the county can be a challenge, especially in those areas with steep topography and water features. Hazard events that block or destroy key roads, highways, and railways can isolate large areas of the county.

Political Jurisdictions

The number of local, tribal, and federal jurisdiction with significantly different resources, regulatory framework, and administrative structures complicates coordination of disaster preparation. However, improving critical area ordinances in the county should minimize future construction in hazard prone areas.

Current Population and Trends

Demographic and economic trends in the county suggest that there will be a flat to moderate growth rate over the next five years. Population increases in the county during this time will result in negligible increases in structures and people within hazard areas.

Age and Disabilities

People with disabilities and seniors have special needs that demand careful attention in disaster preparedness. Many of these people are dependent on others for daily living activities, such as meal preparation, ambulating, toileting, transferring, bathing, and medication management. Others may have short-term acute or chronic illnesses or with disabilities who are technology dependent for a health condition. The interruption of any of these services during a disaster could be life threatening. During a disaster, a caregiver, friends, and family members may not be able to make home visits. The reality exists for some people that a disaster lasting from three to seven days may mean some people may not survive. Some disabled people may be independent in usual circumstances, but the disaster could cause physical barriers that are insurmountable.

Income and Poverty

Income levels often affect the ability of households to prepare for and react to disasters. For example, some households may lack the necessary income for assembling a disaster preparedness kits or affording repairs to damage caused by a disaster.

Language

The inability of some citizens in the county to speak the English language "very well" could hamper efforts at disaster preparedness, response, and recovery. While Spanish speakers make up the largest of these groups, it will be important to ensure that translation resources are available for other languages as well.

Housing

The number of single-family homes is growing in Grays Harbor County. Accompanying this growth is the potential for more homes locating in hazard-prone areas and a greater demand for county services over an ever-widening land area.

The large number of older homes in the county also signals the damage potential of hazard events. Older homes that do not meet modern building codes are more susceptible to damage from earthquakes, floods, fires, and windstorms.

Economy

Stagnant economic conditions, coupled with high unemployment rates, hamper the ability of county homeowners and businesses to modernize properties to withstand hazard events more effectively. Public facilities, too, fall victim to this same trend when tax revenues fail to keep pace with facility improvement needs.

The Grays Harbor economy is heavily reliant on maintaining a transportation network for commuters and the shipment of goods and services. A hazard event that disrupts highway and rail traffic will have significant impact on workers and industry.

SECTION 10: FLOOD HAZARD PROFILE

DEFINITION

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters (2) the unusual and rapid accumulation or runoff or surface waters from any source, or (3) mud flows or the collapse of shoreline land. (FEMA)

PROBABILITY OF FLOODING

Historical records indicate that the recurrence intervals for damaging flood events within Grays Harbor County occur every three to five years. Statistically, flooding in 100-year floodplains has a 1% chance of occurring annually.

FACTORS CONTRIBUTING TO FLOODING

The cause of flooding in Grays Harbor County is a combination of climate, topography, and land development.

A predominately-marine climate with mild wet winters dictates weather patterns in the County. Flood season usually begins in early November when heavy rainfall occurs. Pacific frontal systems become stationary over the region, bringing long periods of rainfall through February and often extending into March. Annual precipitation is 65" to 75" on the coast, 80" to 90" near the foothills, 125" to 150" on the windward slopes of the Olympic Mountains, and 100" for the Willapa Hills. During long periods of rainfall, river and stream channels fill to overflowing. Intense precipitation combined with mild temperatures will cause snowmelt on the south slopes of the Olympic Mountains that can also induce or increase flooding. Coastal flooding is a result of tidal fluctuations and high wind events. River floods happen most often when winter storms bring heavy rains from the southwest.

The two dominant types of flood events that happen in Grays Harbor County are river and coastal flooding. Each type of flooding usually happens simultaneously. For example, rivers in flood stage flowing into the Grays Harbor Estuary experience tidal flooding as well. Both types of flooding can influence each other during natural disaster events. Smaller, more localized flood events in the county result from intense rainfall within a short period, saturated soils, high water tables and heavy surface run-off.

Grays Harbor County has 7.5% of its uplands within floodplains, the second highest in the state. These extensive floodplains and wetlands contribute to the regional nature of flood events in the County. The Chehalis River, a dominant factor in floods in the county, meanders east to west along a broad, flat river

valley terminating in Grays Harbor. The largest tributaries of the Chehalis are the Satsop and Wynoochee Rivers originating on mountain slopes north of the river. Other significant rivers in Grays Harbor County include the Humptulips, Wishkah, and Hoquiam. Smaller rivers include the North River, Copalis, Moclips, the Johns, and Elk Rivers, which flow into the South Bay of the Grays Harbor estuary. All of these rivers terminate in the Grays Harbor estuary and are subject to serious flooding. Many smaller tributary streams associated with these rivers also contribute to flood events in the county.



Figure 6. Grays Harbor County FEMA Flood Zones

Coastal land areas in the county north and south of the mouth of Grays Harbor tend to be flat, low areas with an abundance of floodplains, wetlands, marshes, and dunes along ocean beaches. Lower elevation coastal areas adjacent to rivers are subject to tidal fluctuations. Storm tides, combined with storm surge

and high tides, will cause backwater flooding in rivers. Tidal fluctuations can influence river flooding for a significant number of miles upstream. Lowland water tables, especially in winter months, tend to produce standing water that often floods roads.

Development has affected these natural features over time as the County developed from a wilderness to the present day. Along with development came land alternations that have been a factor in increasing the magnitude and frequency of floods in the County. Encroachment on floodplains by structures and fill material reduces carrying capacity and increases flood heights and velocities. Dams alter the hydrology of a watershed and stormwater runoff from impervious surfaces contributes to the volume and velocity of floodwater.

FLOOD IMPACTS

The consequences of floods in Grays Harbor County over the years have been very costly in terms of people, property, and the economic health of the county. Significant damage occurs to both public and private investments: damaged structures; interrupted public services and schools; and closed businesses. The dollar cost of flood damages can be substantial for both the private and public sectors in the County. The table below provides five examples of reported flood losses in dollars.

Year	Cost
1975	In excess of \$2,000,000
1997	Public Sector \$1,307,000 / Private Sector \$1,203,500
1999	Grays Harbor County \$50,000 / Residential \$1,300,000
2003	Public Sector \$285,000 / Residential \$25,000
2007	\$7,984,971

Source: The Daily World, 2001 Grays Harbor Flood Management Plan and USACE, Post Flood Report, October 2003 Flood

Flooding can damage or even washout highways, roads, and bridges. An additional problem on roads is that some culverts are not adequately sized to handle peak discharge volumes, increasing flooding. This disrupts traffic flow by blocking or reducing them to one lane.

Dams on rivers and streams in the county provide multiple benefits, but it is important to note these structures present a flood risk as well. Most dam failures happen because of human error or in conjunction with a natural



disaster event such as an earthquake. The failure of any of the dams in Grays Harbor County above populated areas could generate a destructive flood.

Flooding can create power outages, contaminate water supplies, foul septic systems, and even create some loss of crops, animals, and wildlife. Power outages are common during flood events in Grays Harbor. Downed trees caused by strong winds during a flood event are the typical reason for outages.

Flooding has impacts on agricultural and forestland. Agricultural land in the Chehalis River floodplain and cranberry bogs in Grayland are subject to flooding. For example, inundation frequently affects croplands in East County. Forestland is vulnerable to floods due to erosion when river and stream banks fail and overflow. Excessive historic logging within watersheds likely affected natural runoff patterns.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

The table below provides estimates of potential damage and exposure of people for both a 100-Year flood and a 500-Year flood in Grays Harbor County.

3		
2	1	3

Table 18. Asset Vulnerability Summary for Structures and People: Flood Hazards

100-Year Flood Plain	Properties Exposed	Structures Value	People Affected
District 1	14.1%	\$147.6 M	1,812
District 2	30.6%	\$168.3 M	911
District 3	26.0%	\$111.0 M	1,494
All Commissioner Districts	21.1%	\$427.0 M	4,218



500-Year Flood Plain	Properties Exposed	Structures Value	People Affected
District 1	2.2%	\$22 M	161
District 2	6.9%	\$38 M	606
District 3	10.7%	\$45 M	708
All Commissioner Districts	5.3%	\$106 M	1,476

FLOOD EVENTS

The Washington State Hazard Mitigation Plan identifies Grays Harbor County as a "Most Vulnerable and At-Risk to Flooding" (October 2010) with a frequency rate of one every three years.

There is little record of flooding in the 1800's and it was not until the 1900's that floods become an issue. Early flood management were local efforts such as the construction of dike and levee systems. As problems increased, the United State Army Corps of Engineers (USACE) began to play an important role in supporting the county with flood management activities. In the 1930's, the USACE assisted the county with flood control to help maintain shipping channels for navigation purposes.

Year	Features
December 1926	Flooding in county after 2 weeks of rain
January 1931	Flooding at Taholah and Quinault
December 1933	Combination of high tides, heavy rains and high winds caused major flooding
January 1935	Major rains and flooding in Grays Harbor and Humptulips River Basin
December 1940	Flooding on Washington Coast
January 1953	Heavy rainfall
January 1956	Chehalis (River reached flood stage)

Table 19. Representative Floods in Grays Harbor County 1900 to 1960

Source: The Daily World; Columbia River Chronology Historical Dates, Pacific Co. Historical Society and Museum

Flooding gradually increased over the next decades. According to records, six major flood events from 1960 to 1989 in Grays Harbor were included in Federal Disaster Declarations. As damages grew larger, flood management efforts accelerated. An example of this activity was the development of Wynoochee Dam by the USACE Project in 1972. Before the dam, the Wynoochee River received peak inflows of 22,500 cfs; the dam held outflows at 200 cfs, reducing the flood stage downstream by about 3 feet.

Table 20. Declared Flood Disasters in Grays Harbor County 1960 to 1989				
Year	Fed Disaster #	Features		
December 1964	#185	Heavy floods		
January 1971	#300	Snow followed by wind and rain		
January 1972	#328	Heavy rains		
December 1975	#492	Five year record rainfall, snow, wind, widespread flooding		
December 1977	#545	Heavy rain, snowmelt runoff		
December 1979	#612	Heavy rain		

Source: Aberdeen Daily World

Grays Harbor County has experienced seven federal disaster declarations related to flooding between 1990 and 2005.

Table 21. Flood Disasters in Grays Harbor County 1990 to 2005

Year	Fed Disaster #	Features
January 1990	FEMA-852	Flooding in Chehalis Valley
November 1990	FEMA-883	Record rain
November/December 1995	FEMA-1079	Wind, heavy rain
January/February 1996	FEMA-1100	Major flooding on Chehalis River
December 1996	FEMA-1159	Heavy rain
March 1997	FEMA-1172	Heavy rainfall over 5 days
October 2003	FEMA-1499	Daily record rainfall, major flooding

Source: FEMA, National Climate Data Center, National Weather Service and Area Newspapers.

A growing concern of county officials and citizens has been the growth in the frequency of floods since 2005. Some of this rise may be related to the fact that peak flows for the Lower Chehalis River Basin increased 15% from 1990 to 2004.

lable 22. Federal Disasters 1/2005 – 5/2010			
Event	FEMA	Features	
Jan 27 – Feb 4, 2006	FEMA-1641	Severe storms, flooding, tidal surge, landslides, mudslides	
Nov 2-11, 2006	FEMA-1671	Severe Storms, Flooding, Landslides, and Mudslides	
Dec 14-15, 2006	FEMA-1682	Severe Winter Storm, Landslides, and Mudslides	
Dec 1-17, 2007	FEMA-1734	Severe Storms and Flooding \$7,984,971.00 in aid to Grays Harbor County ⁵	
Dec 12, 2008 – Jan 5, 2009	FEMA-1825	Severe Winter Storm and Record and Near Record Snow	
Jan 6-16, 2009	FEMA-1817	Severe Winter Storm, Landslides, Mudslides, and Flooding	

FEDERAL EMERGENCY MANAGEMENT AGENCY DECLARED DISASTERS SINCE 2005

FEMA 1641 Severe Storms, Flooding, Tidal Surge, Landslides, and Mudslides 01/27/2006 – 02/4/2006

The Daily World 01/31/2006 - 02/02/2006

January 2006 brought severe storms with record-breaking rainfall to Grays Harbor County. Heavy rains continued for 44 days in a 45-day period causing flooding of the Chehalis, Satsop, and Wynoochee Rivers. Rivers and retention ponds spilled over and flooded Aberdeen streets, farmland, houses, and other structures. The Grayland area experienced heavy rain, strong ocean currents, and unusually high tides.

High water and landslides forced many city and rural roads and state highways to close. Power outages were reported in Quinault, the North River areas, and Central Park.

FEMA 1671 Severe Storms, Flooding, Landslides, and Mudslides 11/02-11/2006

The Daily World 11/06/2006 – 11/08/2006

The Pineapple Express brought record-breaking rains to Grays Harbor County on November 6, 2006. Sustained coastal winds at 40 mph generated high coastal swells augmented by high tides. Wind and waves battered the marina and jetty at Westport with seawater flowing over the seawall, flooding an area of about five city blocks. Record Rainfall January 2006 Aberdeen 26.81" Hoquiam 24.21"

Strong Winds 35 mph winds 59 mph gusts

Record Rainfall November 2006

Lake Quinault 11" / 24 hrs

Aberdeen 9.2" / 12 hrs

Hoquiam 5" / 12 hrs

⁵ Washington Disaster Aid Tops \$72.5 Million

The enormous amount of water caused animals to be stranded, put lowland residents on evacuation alert, and closed schools and roads around Grays Harbor County. Mud and rockslides blocked a number of highways and delayed trains.

Hoquiam built a sand dike on Myrtle Street north of Simpson Avenue to divert floodwaters out of Fry Creek from an assisted living facility. The water rushed down Cherry Street in Aberdeen and flooded houses and other structures. Many of Aberdeen's streets were under up to a foot of water, including Oak Street, which is the only access to the Community Hospital.

FEMA 1734 Severe Storms, Flooding, Landslides, and Mudslides 12/01/2007 – 12/17/2007

The Daily World 12/01/2007 – 12/17/2007

The worst storm since the Columbus Day storm of 1963 hit the region with hurricane force winds gusting to 81 mph, heavy rain, and power outages to virtually everyone in the county. During a 24-hour period, 45-55 mph winds battered western Grays Harbor, closing highways.

Hurricane Force Winds December 2007 81 mph gusts

Power Outages 33,000 (Entire County)

1 death

Numerous injuries and one death were reported to Grays Harbor Emergency Services. A falling tree killed an Aberdeen man as he cleared downed trees. Two PUD workers were badly injured when they responded to downed trees and one of the workers fell 40 feet from the bucket from which he was working. Workers had to clear trees along Hwy 12 to clear a route for evacuation of the victim to Harborview. As workers cleared trees in front of the ambulance, more were falling behind.



All schools closed and only a handful of businesses were able to remain open. Most gas stations and grocery stores remained closed for several days. Roofs blew off dozens of homes throughout the county. Fallen trees and/or mudslides, creating extensive damage throughout the county, blocked every major road out of Aberdeen. East Hoquiam Road had 700 trees down. Vast stands of timber were toppled in the storm representing millions and millions of board feet and dollars in damages. Widespread flooding caused a section of I-5 to close for three days.

On December 3, 2007, all County offices were closed by the storm and all non-essential county employees were told to stay home as the county remained without power.

The Chehalis River flooded into fields, side roads and buildings. Floodwaters in some neighborhoods were as high as the rooflines. Several shelters were opened throughout the county. Sheriff's deputies and National Guard units were dispatched to do welfare checks, concentrating on four areas (the Wynoochee Valley along Wishkah Rd, East Hoquiam Rd, Central Park, and the Ocosta-Grayland areas). The PUD hired additional crews to repair downed lines.



By December 5, 2007, there were reports of twelve landslides. Governor Chris Gregoire assured flood victims that federal aid and services would be arriving to Grays Harbor shortly with food, medicine and other supplies.

FEMA 1817; FEMA 1825 Severe Winter Storms 12/12/2008 – 01/16/2009

Federal Emergency Management Agency

Washington was hit with back-to-back storms which resulted in two major Presidential disaster declarations for the severe winter storm and record and near record snow during the period of December 12, 2008 to January 5, 2009 and the severe winter storm, landslides, mudslides, and flooding during the period of January 6-16, 2009.

The Daily World 12/12/2008 – 12/26/2008

Grays Harbor County had high winds December 12 and 13, 2008, taking out power to more than 6,000 customers in Ocean Shores and Oyehut. Snow and ice caused dangerous road conditions with countywide auto accidents reported.

The Daily World 01/06-12/2009

Grays Harbor County was virtually under water with every river in the county on flood watch. Melting snow saturated the soil, and drenching rain created extreme risk of landslides making some roads impassable and forcing school closures. High winds blew trees into power lines all over the county knocking out power to about 5,000 customers.

Widespread Flooding December 2008 – January 2009

> Heavy Rainfall Aberdeen 7.09" / 48 hr

Lake Quinault 19.36" / 48 hr

Power Outages 5,000 Landslides closed roads throughout the county including:

- Highway 12 near Devonshire Rd.
- SR 108 at Montesano
- Hwy 101 outside Raymond in Pacific County
- Wynoochee Road
- Hicklin Underpass
- North River Road
- Wishkah Road

The Sheriff's Dept issued a Notice of Voluntary Emergency Evacuation to people living near any river.



Deputies spent the night and early morning hours evacuating about 10 people near Copalis Crossing, Humptulips and Montesano. On January 9th, many businesses were forced to close, including Grays Harbor County offices, Weyerhaeuser Sawmill in Aberdeen, and Grays Harbor College. Montesano residents and businesses reported flooding in their basements as the water rose throughout town; roads flooded in lower areas of town.

Residents on Lund Road reported the worst flooding they had ever seen, with river currents flowing across roadways and basements filled to the ceiling with water. Neighbors rescued each other with boats. More than 2,000 sand bags were placed along the Chehalis at Oakville. Oakville High School served as shelter while Grays Harbor County Fairgrounds provided animal shelter.

SECTION 11: EARTHQUAKE HAZARD PROFILE

DEFINITION

An earthquake is the sudden release of stored energy, most earthquakes occur along a fracture within the earth, called a fault. The shaking caused by this sudden shift is often very small, but occasionally large earthquakes produce very strong ground shaking. It is this strong shaking and its consequences – ground failure, landslides, liquefaction – that damages buildings and structures and upsets the regional economy.

PROBABILITY OF EARTHQUAKES

The US Geological Survey estimates that Grays Harbor County has a 40% to 50% chance of experiencing an earthquake with a magnitude of 5.0 within the next 50 years. The probability of a 7.0 magnitude is 12% to 15% during this same period.⁶ The Washington State Hazard Mitigation Plan estimates the probability of an earthquake event similar to the 2001 Nisqually earthquake, which had a noticeable impact in Grays Harbor County, is once every 35 years. A reoccurrence of an earthquake similar to the 1949 Olympia event, the largest recorded earthquake in Washington State history is once every 110 years. Estimates for the probability of a subduction quake are 10 to 14% over the next 50 years. The Washington State Hazard Mitigation Plan ranks Grays Harbor County as a "Most Vulnerable and At-Risk (October 2010)."

FACTORS CONTRIBUTING TO EARTHQUAKES

Grays Harbor County is subject to frequent earthquakes, but most of the events are small and not noticeable. However, on occasion a large earthquake will strike the county with serious repercussions.

An earthquake results when there is a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the rock to cause the shaking that we feel during an earthquake.

⁶ <u>http://geohazards.usgs.gov/eqprob/2009/</u>



Figure 7. Definition Sketch for Earthquake

Source: Tectonics and Landforms

The county is vulnerable to shallow/crustal, deep/intraplate, and subduction zone earthquakes.

Type of Earthquake	Characteristics
Shallow/crustal	These are earthquakes caused by a fault movement within the relatively thin layer of the Earth's crust. These earthquakes are shallow, usually less than a magnitude (M) of 7.5. Small, shallow earthquakes happen every day, with damaging ones occurring every few decades. Aftershocks are common. Local tsunamis are possible from landslides or from shallow earthquakes occurring in bodies of water, including lakes and rivers. Damage is most likely to occur in vulnerable structures located close to the fault.
Deep/Intraplate	These are earthquakes occurring below 18 miles in depth along fractures in the Juan de Fuca subduction plate, with an M of less than 7.5. The 2001 Nisqually quake (M 6.8) and the 1949 Olympia quake (M 6.8) are examples of these type of earthquakes. Few, if any, aftershocks occur. No tsunami is expected, although landslides could trigger local ones. Because of its depth, seismic energy disperses over a large area. Shaking occurs over a large area and is less intense near the epicenter. Damage is less than in a similar-sized
	shallow quake.
Subduction	These earthquakes happen beneath the continental North American plate, resulting in quakes as high as M 9. Depending on location, strong shaking may last several minutes and aftershocks up to M 7 are common. A destructive tsunami will quickly hit the coast.
	Injuries and fatalities could number in the thousands. Property damage may result in hundreds of buildings collapsing.

Table 23.	Types of	Earthquakes
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The major quake threat for Grays Harbor County is from the Cascadia Subduction Zone. The term "subduction zone" refers to the leading edge of the down-going slab overridden by the leading edge of the other plate. These quakes occur at the tectonic collision boundary where the Juan de Fuca plate

dives beneath the North American plate. This fault line runs offshore for 800 miles from the Brooks Peninsula on Vancouver Island to Cape Mendocino in northern California. The last known subduction earthquake in the Northwest was in January 1700.



Source: Earthquake Hazards in Washington, WDNR

EARTHQUAKE IMPACTS

An earthquake can go unnoticed or cause significant destruction. The Moment Magnitude Scale (M) measures the amount of energy released during an earthquake.⁷ The Mercalli Intensity Scale measures the perceptible moving, shaking, and local damage experienced during a quake.⁸ The table below compares the two scales and the damage potential typically experienced during quake events.

Moment Magnitude	Mercalli Intensity	Damage Potential
4.3 - 4.9	V	Very light
4.9 - 5.4	VI	Light
5.5 - 6.1	VII	Moderate
6.2 - 6.9	VIII	Moderate to heavy

Table 24. Comparison of Moment Magnitude Scale, Mercalli Intensity Scale and Damage Potential

Source: Geography Exchange

However, underlying soil conditions can cause earthquake waves to amplify, causing increased shaking and damage. The risk of amplification increases when you are on deep, soft soils, especially on valley bottoms and areas of artificial fill. Site Class C, D, and E represent those soils with the greatest risk of

⁷ The Moment Magnitude Scale, invented in 1979, has replaced the Richter Scale as the accepted method for measuring quakes.

⁸ The shaking intensity at a given spot depends on many factors, such as soil types, soil sublayers, depth, type of displacement, and range from the epicenter (not counting the complications of building engineering and architectural factors).

earthquake amplification. Site Class F soils require site-specific evaluation. Figure 9 shows the location of these soils in Grays Harbor County.



Figure 9. Site Class Map of Grays Harbor County, Washington

Sandy soils saturated with water can liquefy, or behave like a liquid, during an earthquake. This type of physical process is called liquefaction. Major earthquake damage frequently occurs on soils that are common along water bodies. The figure below shows the location of these soils in Grays Harbor County.



Figure 10. Liquefaction Susceptibility Map of Grays Harbor County, Washington

Tsunami and landslides are other impacts created by earthquakes. Sections 13 and 15 cover these physical processes in more detail.

Earthquakes affect structures given the type, frequency, and duration of shaking as well as site conditions. When the ground shakes, buildings respond to the waves transmitted from the ground through a structure's foundation. These waves cause a sheering action that place stress on weak walls or joints, resulting in failure or perhaps total collapse. Tall buildings tend to amplify the motions of longer period motions when compared with smaller buildings and structures.

Damage due to an M 5.5 earthquake may be slight-tomoderate in well-built buildings and structures, but considerable in poor construction. A building on Site Class C, D, E, and F soils will intensify from the shaking and may sustain greater damage. Shaking generally can be longer and larger in soft sediments than on a hard rock site. The distance from the quake source also makes a difference.



In addition to buildings, earthquakes can damage essential

public infrastructure. Roads, bridges, railroad lines, sewer and water lines, gas lines, and communication facilities are all susceptible to damage or complete destruction. Of special concern are towers and tanks located on steep slopes with soils subject to liquefaction.

The potential loss of life is significant as earthquakes injure or kill people from collapsing structures. People who are injured may die due to disruption of emergency services reliant on road closures, collapsed bridges, and loss of power and communications.

A major event can also have a devastating effect on the county economy due to destroyed homes and businesses. Temporary or permanent business closures due to damage can lead to loss of jobs. There can also be temporary closures of government offices, schools and businesses, loss of power, and damage to lifeline facilities such as water and sewer systems.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

Areas of the county are vulnerable to structural damage due to liquefaction and ground shaking. Damage from an earthquake occurs to structures in areas subject to liquefaction where soil, especially water-saturated soil, loses strength in response to ground shaking. These tables indicate the number of people exposed in land areas with liquefaction potential.

Damage to structures will increase based on ground shaking during an earthquake. Ground shaking will generally be stronger on soft soils or bedrock. A method for classifying the intensity of ground shaking was developed based on studies of near surface geology by Robert Borcherdt, USGS, in the mid 1990's. This methodology was simplified and the modification was implemented by the Building Seismic Safety Council and FEMA in the 1997 edition of the National Earthquake Hazard Reduction Program. The classification system is included in the 2003 International Building Code adopted for use in Washington.



Table 25. Asset Vulnerability Summary for Structures And People: Earthquakes

High to Moderate Liq.	Properties Exposed	Structures Value	People Affected
District 1	17.0%	\$178 M	2,123
District 2	39.8%	\$219 M	2,130
District 3	35.2%	\$150 M	2,287
All Commissioner Districts	27%	\$548 M	6,540

Very Low-to-Low Liq.	Properties Exposed	Structures Value	People Affected
District 1	14.1%	\$147.6 M	1,812
District 2	30.6%	\$168.3 M	911
District 3	26.0%	\$111.0 M	1,494
All Commissioner Districts	21.1%	\$427.0 M	4,218

Site Class B	Properties Exposed	Structures Value	People Affected
District 1	23.1%	\$242 M	2,489
District 2	9.6%	\$53 M	861
District 3	3.4%	\$15 M	297
All Commissioner Districts	15.3%	\$310 M	3,647

Site Class B to C	Properties Exposed	Structures Value	People Affected
District 1	0.1%	\$525,235	4
District 2	0.1%	\$641,825	13
District 3	0.8%	\$3 M	48
All Commissioner Districts	0.2%	\$4 M	65

Site Class C	Properties Exposed	Structures Value	People Affected
District 1	26.34%	\$276 M	970
District 2	58.21%	\$320 M	4,180
District 3	17.09%	\$72 M	1,041
All Commissioner Districts	33.05%	\$670 M	2,968



Site Class C to D	Properties Exposed	Structures Value	People Affected
District 1	81.5%	\$855 M	7,238
District 2	8.9%	\$49 M	734
District 3	53.3%	\$227 M	3,584
All Commissioner Districts	55.83%	\$1 B	11,556

Site Class D	Properties Exposed	Structures Value	People Affected
District 1	0.5%	\$5 M	86
District 2	14.8%	\$81 M	1,670
District 3	23.6%	\$100 M	1,718
All Commissioner Districts	9.2%	\$187 M	3,474

Site Class D to E	Properties Exposed	Structures Value	People Affected
District 1	17.0%	\$178 M	2,123
District 2	27.08%	\$149 M	472
District 3	16.4%	\$70 M	830
All Commissioner Districts	19.6%	\$397 M	3,426

County Arterials at Risk from Medium to High Liquefaction and Site Class D - E

Brooklyn Road Copalis Beach Road Elma McCleary Road Garrard Creek Road Monte Elma Road Montesano Street South Mox Chehalis Road Pioneer Avenue Porter Creek Road South Bank Road South Shore Road Wakefield Road

A complete list of county and critical facilities at risk from earthquakes follows in Section 19.

EARTHQUAKE EVENTS

Reports of earthquakes in Grays Harbor County are available from pioneer accounts in the 1800's to current real time observations found on the internet. The 1949 Olympia 7.1 magnitude earthquake was large enough to be recorded at many seismograph stations around the world.

Table 26. Representative Earthquakes, Grays Harbor County 1700 to 1989

Year	Features
January 26, 1700	Mammoth Cascadia interface event
December 12, 1880	2 shocks felt
March 27, 1884	Earthquake felt in Hoquiam
November 30, 1891	Slight earthquake felt on Grays Harbor
March 6, 1904	Washington coast all the way to Aberdeen and Hoquiam
January 11, 1909	Grays Harbor earthquake
November 13, 1939	Little damage
April 13, 1949	Magnitude 7.1
December 13, 1971	Magnitude 3.6
August 23, 1982	Magnitude 3.6

Source: Columbia River Chronology Historical Dates, Pacific County Historical Society

Year	Features
October 25, 1991	Magnitude 3.4, depth 38.7 km
August 1997	Magnitude 3.4, depth unknown
August 3,1999	Magnitude 5.8, depth 40.7 km
February 28, 2001	Magnitude 6.8, depth 52 km
June 10, 2001	Magnitude 5.0, depth 40.7 km
August 26, 2004	Magnitude 3.5, depth 12.4 km

Table 27. Representative Earthquakes, Grays Harbor County 1990 to 2004

Depth Reported in Kilometers (km) / Source: Pacific Northwest Seismic Network

The two most recent damaging earthquakes to affect Grays Harbor County were the 1999 Satsop and the 2001 Nisqually events.

A magnitude 5.8 deep earthquake occurred 11 miles north of Satsop on July 3, 1999. There were no fatalities, but there was heavy damage to the Grays Harbor County Courthouse. The PUD Station in Aberdeen, which is the main connection between Grays Harbor and the Bonneville Power Administration, was also damaged. It was the deepest earthquake in the area in 20 years. Considering the



magnitude and proximity to so many buildings and structures the total cost of damage was not very high. Costs included: County Road System, \$12,500; Public Buildings & Equipment, \$10,000,000 and damage to the private sector, \$1,115,000 for a total of \$1,457,500.

The Nisqually earthquake occurred February 2, 2001 with the epicenter about 11 miles northeast of the City of Olympia. It was a deep magnitude 6.8 event and due to extensive damage in several counties, was declared Federal Disaster #1361. Impacts included major traffic tie-ups in East County as cars were rerouted around damage in other counties, small power outages and temporary closure of state offices. Highway 12 near Porter was closed for a while and there were reports of minor buckling and cracks on local roads. Cracks in buildings and falling bricks also resulted from the shaking.

SECTION 12: SEVERE STORM HAZARD PROFILE

DEFINITION

A severe storm is defined as an atmospheric disturbance featuring sustained strong winds of 40 mph or greater and/or significant precipitation such as rain or snow that can pose risks to life or property and those that require the attention of authorities.

PROBABILITY OF SEVERE STORM

The State Hazard Mitigation Plan (October 2010) estimates that there is a 170% chance of an occurrence of at least one damaging wind event every year in Grays Harbor. Storms with snowfall or freezing rain in Grays Harbor County have an estimated 40% chance of an occurrence every two years.

FACTORS CONTRIBUTING TO SEVERE STORM EVENTS

Severe storms hit Washington's coast during the winter, bringing heavy rains, strong winds, and high waves. Storms blow in about 70 to 100 inches of rain per year, the heaviest precipitation on the continent north of Guatemala⁹. Coastal storm winds regularly top 40 mph. The annual peak speed of 55 mph can topple chimneys, utility lines, and trees. The entire county is vulnerable to wind storms. High winds are commonplace along the coast but not as frequently in East County.



Figure 11. High Wind Producing Storm Track

Source: National Weather Service, Portland Oregon Office

Storms with snowfall or freezing rain in Grays Harbor County result from atmospheric conditions due to warm high pressure from the south combining with cold low pressure from the northeast.

⁹ Washington's Coast
Grays Harbor County is vulnerable to tornadoes, but it has never experienced one causing more than minimal property damage. Currently there is no way to predict which storm-types could cause a tornado here or even those locations where one might touchdown.

Characteristics of severe storms in Grays Harbor County include:

- Prevailing southwesterly and westerly wind
- Low surface pressure
- Wind speeds of 40 mph or greater
- Gale force wind gusts along the coast
- Heavy surf due to storm surge, higher with a storm tide
- Heavy precipitation (rain, snow)
- Coastal erosion

SEVERE STORM IMPACTS

Most storms with winds of more than 40 mph can be expected to cause some damage. Damage effects based on visual clues correlated with the Beaufort wind force scale provide a useful picture of possible wind damage that could occur in Grays Harbor County.

Typical consequences of storms in the county include power outages, timber loss, property damage, transportation disruptions, beach erosion, and school closures.

Wind Speed	Damage Potential
39 – 46	Broken twigs and small branches.
47 – 54	Structural damage occurs, such as chimney covers, roofing tile blown off, and television antennas damaged. Ground littered with many small twigs and broken branches.
55 – 63	Considerable structural damage occurs, especially on roofs. Small trees may be blown over and uprooted.
64 – 75	Widespread damage occurs. Large trees blown over and uprooted.
Over 75	Considered hurricane force and can cause widespread damage.
	Source: National Weather Service

Table 28. Wind Damage Effects Based on Wind Speed in mph and Visual Observation

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

Severe weather can affect the entire county; thus all property and residents would be at risk. The analysis in the tables below represents an estimated percentage, high 5% and low 1%, of the total structures and residents in the County which may be exposed to damage by a severe winter storm.

Although summer is the height of tourist season at coastal beaches, it can also be expected there will be tourists visiting the area year round. Winter storm watching has become a popular tourist activity.

These people, of course, will be vulnerable to a wind storm, but it is not feasible to estimate the percentage given the variation in visitors by day and year.

Severe Storm High Est.	Properties Exposed	Structures Value	People Affected
District 1	5.0%	\$52 M	491
District 2	5.0%	\$28 M	209
District 3	5.0%	\$21 M	339
All Commissioner Districts	5.0%	\$101 M	1,039



3		
2	1	

Severe Storm Low Est.	Properties Exposed	Structures Value	People Affected
District 1	1.0%	\$10 M	98
District 2	1.0%	\$6 M	42
District 3	1.0%	\$4 M	67
All Commissioner Districts	1.0%	\$20 M	207

County Facilities At-Risk to Wind Storm Hazard

All county facilities are potentially at-risk to severe weather hazards.

Critical Facilities Serving County Government & Residents At-Risk to Wind Hazards

All critical facilities are potentially at-risk to severe weather hazards.

SEVERE STORM EVENTS BEFORE 2005

1800s

Records of significant severe storm hazards date back as far as the early 1850s. For example, Henry Coonse, one of the county's early settlers, described hard wind with southerly gales together with rain, hail, snow, and ice during the winter of 1852. In 1855, Michael Luark recorded "rough, squally weather on Grays Harbor, very cold, wind blowing a gale from the northwest." P. W. Gilette claimed that the hardest wind storm in 10 years occurred late December 1862. On Christmas Day 1890 a gale blew down trees in Hoquiam. More recent severe storms are catalogued below.

The Great Blow Down

In January of 1921 there was a severe wind storm which became known as the "great blow down." Wind velocity on Grays Harbor was estimated at 100 mph. Ships and river craft broke loose of moorings, in some cases smashing into bridges, and whole sections of timber were blown down all along the west side of the Olympic peninsula.

The January 1950 Blizzard

The most momentous winter storm in Grays Harbor County began on December 29, 1949, and continued throughout the month of the January 1950. The winter of 1949 and 1950 is the coldest winter on record, with snow sweeping over the entire county New Years Eve continuing throughout the next several days causing enormous damage and disruption. Snow depths ranged up to 4 inches throughout the county. Schools were closed, several Grays Harbor lumber mills were shut down, and ice flows in the south bay pounded the Elk River Bridge at Bay City. There was scattered power outage though out the county and dangerous road conditions.

FEMA 137 Severe Storms: The Columbus Day Storm

On October 12, 1962 the strongest non tropical wind storm recorded in the lower 48 states in American history struck Grays Harbor County. Peak wind gusts of 100 mph were recorded. This storm was compared to the devastating storm of 1921 and was selected the top weather event to occur in Washington State from 1900 to 1999.

There was extensive damage with power and telephone outages throughout the entire county. Trees were blown down in the North Beach area and the Markham Branch of the Northern Pacific Railroad was blocked. Many trees were blown down in Copalis beach and along the highway and the road was blocked from Montesano west to Grass Creek. An estimated 35 million board feet of timber was lost according to Wilton Vincent, Rayonier Land Dept Manager. The Grays Harbor PUD facilities damage was \$50,000 with total damages in the county reported to be approximately 2.5 million dollars.

FEMA 981 Severe Storm, High Winds: The Inauguration Day Storm

January 20, 1993 a fierce wind storm hit the entire Puget Sound Area. Five people were killed, state government was shut down, and at the height of the storm more than 750,000 residential and commercial customers were without power. Due to damages from the storm in the county, Grays Harbor was included in federal disaster declaration, #981 specified for this storm. Wind gusts of 70 mph were reported at Twin Harbors. The framework for a new Washington State Dept of Fisheries storage building at the Highway 12 and Devonshire Interchange collapsed, and a roof was torn off a mobile home in Satsop. There were widespread power outages.

SEVERE STORM EVENTS SINCE 2005

The six most recent severe storm events in Grays Harbor County to be declared Federal Disasters by FEMA brought flooding to the region. Each of these storm events is discussed at length in Section 10, Flood Hazard Profile.

Federal Disasters 1/2005 – 5/2010FEMA 1641 01/27/2006–02/4/2006, Severe Storms, Flooding, Tidal Surge, Landslides, MudslidesFEMA 1671 11/02-11/2006, Severe Storms, Flooding, Landslides, and MudslidesFEMA 1682 12/14-15/2006, Severe Winter Storm, Landslides, and MudslidesFEMA 1734 12/01/2007 – 12/17/2007, Severe Storms, Flooding, Landslides, and MudslidesFEMA 1817; FEMA 1825 12/12/2008 – 01/16/2009, Severe Winter Storms

FEMA 1682 Severe Winter Storm, Landslides, and Mudslides 12/14-15/2006

The Aberdeen Daily World December 14-15, 2006 Grays Harbor County experienced hurricane-force winds and heavy rains on the coast causing 22,000 customers to lose power; a million were without power in the State. The "Hanukkah Eve Wind Storm of 2006" downed power lines, trees, and building debris which caused many road closures and left the county in a state of emergency.



In Montesano, a roof that blew off a three-story building fell onto Pioneer Avenue, settling partially on a local bank and taking out a streetlight. Ocean Shores was also hit hard by the weather with power outages and trees across roads. A McCleary man was killed when the top of a tree snapped off in the wind and crashed into his home crushing him in his bed. A woman was injured when a gust blew a light pole down on the Chehalis River Bridge sending it crashing onto her windshield and trapping her inside her vehicle.

Aberdeen's Finance Director stated damage caused by the storm could exceed \$2 million; Hoquiam reported more than \$400,000 in damage and another \$1 million in downed trees on its watershed property.

SECTION 13: TSUNAMI HAZARD PROFILE

DEFINITION

A tsunami is a train of waves typically generated during an earthquake by sudden displacement of the sea floor or lakebed. As demonstrated on Indian Ocean shores in December 2004, tsunami can cause vast death and destruction. They are particularly dangerous close to their sources, where the first waves in the tsunami train can arrive within a few to tens of minutes of the shaking.

PROBABILITY OF TSUNAMI

A tsunami resulting from a subduction earthquake has a 10 to 14% chance of occurring over the next 50 years. Tsunamis generated by earthquakes elsewhere in the Pacific Rim strike more frequently, but with significantly less impact.

FACTORS CONTRIBUTING TO TSUNAMI

Tsunamis occur when there is a sudden raising or lowering of the sea floor or a lakebed during an earthquake. Landslides and underwater volcanic eruptions can also generate them.



Plate slips, causing the surface to move downward and releasing energy into the water.



The energy released produces tsunami waves.

Tsunamis have small wave heights and long wavelengths offshore, making then almost unnoticeable at sea. Waves in the open ocean travel nearly 600 miles per hour. As they approach land and begin to pass over shallow areas, tsunami waves gain height, slow down in speed, and compress in distance between waves.



The peak of a tsunami wave reaching shore will cause the sea level to rise in a process called run up. Run up depths can be meters in height. A large tsunami may have multiple waves over a period of hours with considerable times between wave crests. The first wave does not always have the highest run up.

There are two types of tsunamis: distance source and local source. A distance source event is a series of waves traveling great distances across the Pacific Ocean generated by an undersea disturbance such as an earthquake in Alaska or Japan. Waves from a distant source tsunami take a number of hours to reach shore and there is enough time for reasonable warning. All tsunamis that have struck the Pacific Northwest Coast in the past 100 years have been distance source events.

A local source event consists of waves caused by an undersea disturbance near the coast. These tsunamis typically cause the most severe damage and casualties due to wave heights; their short distance from their source does not allow for much loss of energy. The most likely local source tsunami would come from an earthquake in the Cascadia Subduction Zone off the coast of Washington. Wave heights generated by a magnitude 8 earthquake in the Cascadia Subduction Zone could reach 30 feet in height and take only 30 minutes to reach coastal communities in Grays Harbor County.

Characteristics of Tsunamis

- Preceded by a large undersea disturbance
- A series of wave crests
- Rapid changes in water level
- High water levels and a series of troughs with water levels
- Flooding before the first wave crest

The Washington State Hazard Mitigation Plan ranks Grays Harbor County as a "Most At-Risk and Vulnerable County" (October 2010). A Cascadia Subduction Zone generated tsunami has a one-in-ten chance of occurring over the next 50 years.

TSUNAMI IMPACTS

Tsunamis have the potential of causing significant casualties, widespread property damage, massive infrastructure loss, and long-term negative economic impacts.

People caught in the path of a tsunami often have little chance of survival. People die from drowning or debris crushing them. At-risk populations include children and the elderly, two groups that have less

mobility, strength, and endurance. Visitors to the ocean beaches may be more prone to danger, being unfamiliar with tsunami evacuation routes. The lack of capacity of existing roads to take a sudden increase in traffic as people try to escape a tsunami hazard zone may expose large numbers of people along exposed evacuation routes.

Communities subject to past tsunamis in the United States and around the world have reported wide range damages to



public and private property. Destroyed vessels and port facilities are common. Public transportation infrastructure, such as bridges, roads, and railroad lines, often suffer extensive damage. There is also a loss of above ground utility lines and possible destruction or disabling of sewage treatment plants and on-site sewage disposal systems. Saltwater intrusion of coastal aquifers can render public and private wells undrinkable for long periods after the tsunami. Tremendous quantities of disaster debris and hazardous wastes will create significant human health concerns, especially as toxic materials contaminate water supplies and soil.

Those buildings not destroyed outright often experience large-scale scouring around foundations. Substantially constructed buildings of concrete, masonry, or heavy steel frames perform fairly well in a tsunami unless compromised by earthquake shaking. Elevated buildings that allow water to flow under the structure or through the first floor do even better. Wood-frame buildings, manufactured homes, and light steel-frame structures at lower elevations close to the shoreline are likely to fare poorer in a tsunami.

Damaged critical or important community facilities, such as health clinics, fire and police stations, waste disposal, and power stations may not be able to respond to community need long after a tsunami event. Government response may be limited due to closed or destroyed assets.

Economically, a tsunami has the potential to be devastating. The short-term effect of a sea surge up the Chehalis Valley will result in a loss of crops, livestock, farm machinery, and agricultural infrastructure. Salination and debris contamination may affect the long-term fertility of the soil. Commercial and manufacturing businesses may experience short-term interruptions or even complete losses. Depending on the extent of damage, the local loss may be so extreme that there may be little chance of long-term economic recovery. Tourism likely will end for an extended period. The loss of natural resources, including timber, fish, and wildlife, will be extensive. Destruction of roads, bridges, rail lines, and port facilities will stop the flow of goods in and out of the county.

Coastal beaches are the most vulnerable areas in Grays Harbor County to the direct impacts of tsunamis, followed by the low-lying areas adjacent to the Chehalis River from its mouth to as far upstream as Porter. The long-term impact could result in the coastline subsiding as much as six feet. Figure 12 on the next page shows the tsunami inundation potential in the Grays Harbor County.



Figure 12. Grays Harbor County Tsunami Inundation Potential

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

The following tables, based on data from the Grays Harbor GIS system information, illustrate the possible damage to structures and impact on people from a tsunami. Additional people visiting the coastal area as tourists are not represented in the estimate. There is always an increase in the number of people at the beaches on any given day in the summer, especially on holiday weekends such as July 4th and Labor Day. Although the numbers will be smaller, it can also be expected there will be tourists visiting the area year round. These people, of course, will be vulnerable to a tsunami but it is not feasible to estimate the number of people given the variation in visitors by day and year.

Table 30. Asset Vulnerability Summary For Structures And People: Tsunami Events



High Potential Tsunami	Properties Exposed	Structures Value	People Affected
District 1	0.6%	\$7 M	88
District 2	37.4%	\$206 M	2,008
District 3	28.8%	\$123 M	1,697
All Commissioner Districts	16.5%	\$355 M	5,263

Low Potential Tsunami	Properties Exposed	Structures Value	People Affected
District 1	22.4%	\$1 B	9,712
District 2	61.6%	\$339 M	2,109
District 3	65.0%	\$277 M	4,205
All Commissioner Districts	81.9%	\$1 B	16,026

There are five major county arterials and 47 critical facilities at-risk to tsunami inundation. A full list follows in Section 21.

TSUNAMI EVENTS

The <u>West Coast/Alaska Tsunami Warning Center</u>¹⁰ tracks and issues warnings to threatened areas when a tsunami occurs. The Warning Center calculates the danger and notifies communities at risk. Warnings for distance tsunamis will help communities react; however, there will be little or no time to send out widespread warnings of an imminent tsunami from a substantive earthquake in the Cascadia Subduction zone.



The <u>NOAA Center for Tsunami Research</u> operates tsunami reporting buoys strategically placed throughout Pacific Ocean for detecting and estimating their time and place of arrival. Known as DART, Deep-Ocean Assessment and Reporting of Tsunami, the buoys allow NOAA to issue accurate notices for watches, warning, and evacuations.

Grays Harbor County has been vulnerable to tsunami events. There is evidence that tsunamis may have occurred along the Washington coast in the past, but there is no or little documentation describing these events. Considerable evidence suggests a large earthquake created a tsunami with wave heights of 20' just over 300 years ago. Historical records reported tsunamis occurring along the Pacific Northwest coast at Astoria in December 1853, April 1868, and August of 1872.

¹⁰ Operated by the National Weather Service, a division of the National Oceanic and Atmospheric Administration (NOAA)

The 1960 Chilean Tsunami, generated by a 9.5 magnitude earthquake, resulted in small waves within Grays Harbor and Tokeland in Pacific County.

The 1964 Alaskan earthquake generated the largest tsunami waves to occur in the county to date. The first wave crest came onshore at approximately 11:30 pm, followed by smaller waves at approximately 1:15 am. Although this tsunami resulted in relatively minor impact, it did deposit debris throughout the coastal areas, damaged two bridges on State Highway 109 at Joe Creek and Copalis River, damaged boats, and overturned four mobile homes. The Red Cross set up an evacuation center at the M. Dermoth Elementary School in Aberdeen that 40 people used. About 25 campers and trailers used the Central School parking lot in Hoquiam. Two people suffered apparent heart attacks and a camper received minor injuries, but there were no serious injury or deaths. About 75 guests were left stranded at the Iron Springs Resort. Total damages were estimated to be about \$105,000.

Table 31. Recorded Heights of Waves in Grays Harbor County from the 1964 Alaska Earthquake

Location	Height in Feet
Wreck Creek	4.5
Moclips	3.4
Ocean Shores	2.9
Taholah	0.7

On February 27, 2010, a Tsunami Advisory went into effect for the Washington coast due to an 8.8 magnitude earthquake that struck off the central Chile; however, there was only a 6-inch increase in wave height recorded from the event.

The deadly March 11, 2011 9.0 M subduction earthquake off Japan generated a tsunami that reached the Grays Harbor County shoreline just after 7 a.m. The wave measured 1.3 feet at Westport. Grays Harbor Fire District No. 8 evacuated about 60 people from low-lying areas of Moclips.

SECTION 14: HAZARDOUS MATERIALS INCIDENTS PROFILE

DEFINITION

Chemicals labeled "hazardous materials" play a valuable role in most aspects of County life. They fuel vehicles, increase farm production, make drinking and wastewater safe, serve our health care needs, and form key ingredients in many manufactured products. Considerable quantities of hazardous materials are present throughout the county at any one time without any threat to people and environment. However, accidents do happen occasionally that become "hazardous materials incidents." Hazardous materials incidents are accidental, not deliberate, and their consequences are unintentional.

Hazardous material incidents occur during the manufacture, transportation, storage, and use of hazardous materials. Hazardous materials cover a broad category of substances that pose a potential risk to life, health, the environment, or property when not properly contained. These materials may be in solid, liquid, or gaseous forms that exhibit explosive, flammable, combustible, corrosive, reactive, poisonous, biological, or radioactive characteristics.

Incidents most often occur due to human error, natural hazards, or a breakdown in equipment or monitoring systems. The widest area of vulnerability to the public occurs during airborne releases of acutely toxic gases while liquid spills create immediate concerns to the environment.

PROBABILITY OF HAZARDOUS MATERIALS INCIDENTS

While small-scale hazardous materials incidents happen regularly in Grays Harbor County, catastrophic incidents are relatively rare.

POTENTIAL SOURCES FOR HAZARDOUS MATERIALS INCIDENTS

The two areas in Grays Harbor County that present the potential for hazardous materials incidents are in fixed facilities and transportation corridors.

Fixed Facilities

Fixed facilities are buildings and other stationary structures on a single site that manufacture, produce, use, transfer, store, supply, or distribute any hazardous material. The term includes railroad yards and truck terminals, but does not include vehicles, vessels, airplanes, or other modes of transportation.

The Emergency Planning and Community Right-to-Know Act (EPCRA) and the Washington Dept of Ecology's Hazardous Wastes and Toxics Reduction Program annually requires fixed facilities with specific

threshold quantities of hazardous chemicals to submit an inventory. Federal law entitles fire departments and local emergency planning committees (LEPC) to receive these inventories.

Hazardous Materials Inventory contains information about chemicals stored or used at the facilities, including:

- The chemical name or the common name as indicated on the Materials Safety Data Sheet (MSDS);
- An estimate of the maximum amount of the chemical present at any time during the preceding calendar year and the average daily amount;
- A brief description of the manner of storage of the chemical;
- The location of the chemical at the facility; and
- An indication of whether the owner of the facility elects to withhold location information from disclosure to the public.

The most recent countywide inventory available (2002) reveals that there are 94 different hazardous materials distributed among 81 fixed facilities. Many of these sites involve the storage and use of petroleum products, such as diesel, propane, and gasoline, and other related products. However, some county major manufacturing facilities use or manufacture substances that rank as "extremely hazardous" under EPCRA.

Of these 57 facilities, 21 are physically located within unincorporated Grays Harbor County. There are 157 different chemicals stored at these facilities. A list of countywide facilities and their chemical use are included in the Section 22.

Most hazardous material incidents at fixed facilities are due to equipment failures and human error. Extreme natural hazards, such as earthquakes and tsunamis, can destroy structures with hazardous materials on site.

A new source of hazardous materials in Grays Harbor County is the growing number of illegal methamphetamine laboratories, or as they are more commonly referred to as "meth labs." The most common hazardous materials found at meth labs include flammable, volatile solvents, such as methanol, ether, benzene, methylene chloride, or trichloroethane, as well as toluene. Other common household chemicals include muriatic acid, sodium hydroxide, table salt, and ammonia.

Because of the typically careless manufacturing process used, many of the chemicals contaminate a property. Some household materials, such as carpeting, wallboard, ceiling tile, or fabric, may actually absorb spilled chemicals. Furniture or draperies may also become contaminated. Soil or groundwater (including nearby drinking water wells) may become contaminated if chemicals are dumped in a septic system or on the ground. A Washington Department of Health study found that of the total number of injuries sustained from meth labs, 38% were law enforcement officers or fire fighters, 33% were

members of the general public (most were the manufacturers of the meth), and 29% were employees of a business. The most frequent injuries involved respiratory irritation, eye irritation, and gastrointestinal problems.

Transportation Systems

Highways, railways, marine routes, and pipelines are the primary transportation corridors for transporting hazardous materials within Grays Harbor County. Each of these transportation corridors is a potential avenue for hazardous materials incidents, especially within the unincorporated areas.

Highways

The principle routes for hazardous materials include US 101, SR 12, SR 8, and SR 105. Most shipments of hazardous materials along these corridors by private trucking carriers terminate in Grays Harbor County, although conceivably there is some traffic continuing to communities beyond county lines to such destinations as Forks to the north and Raymond/South Bend to the south.

The Federal Motor Carrier Safety Administration (FMCSA) and the Washington State Patrol (WSP) Commercial Vehicle Division are the responsible agencies for regulating the carrying of hazardous materials over highways in the county. With the passage of federal legislation in 2004, the FMCSA requires Safety Permits for vehicles carrying the following hazardous materials and quantities:

Class 7 Radioactive materials – all quantities

- Explosives greater than 55 pounds
- Materials poisonous by inhalation
- Hazard Zone A one or more liters
- Hazard Zone B 119 or more gallons
- Hazard Zone C & D 3,500 or more gallons
- Compressed or refrigerated liquefied methane, liquefied natural gas, or other liquefied gas with a methane content of at least 85% 3,500 or more gallons

Under the law, private motor carriers are responsible for tracking and maintaining records of all shipments. These records must include a written route plan, the name of driver, vehicle identification, the hazardous material being transported, and the communication log. The law also requires communication between truck and the carrier at least once every two hours.

Because neither the FMCSA nor the WSP maintains databanks of issued Safety Permits, there is no available resource identifying hazardous materials or private motor carriers that carry these materials on Grays Harbor County highways. Therefore, it is safer to assume that any hazardous materials used at fixed facilities in the county may reach them via the highways.

Hazardous material incidents along highways typically result from faulty equipment that cause leaks or spills, collisions with other motor vehicles, or crashes caused by human error or weather-related conditions.

Railways

The Puget Sound and Pacific Railroad (PSAP), a subsidiary of RailAmerica, Inc., is the only rail carrier operating within Grays Harbor County. The company operates a 150-mile rail service carrying approximately 14,000 carloads annually. Based at Elma, PSAP has links to the national rail network via connections to the Burlington Northern and Santa Fe Railway (BNSF) at Centralia, Washington and the Union Pacific Railroad (UP) at Blakeslee Jct., WA. PSAP provides significant rail links to manufacturing and port facilities in the county as far west as Hoquiam as well as north to Shelton and the US Naval Facilities at Bangor, Keyport, and Bremerton.

The table below, summarized from the PSAP Hazmat Security Plan, shows the type of hazardous materials it often carries on its railways.

Hazardous Materials	No. of Cars	Normal Route
Propane	270	Centralia-Belfair-Silverdale
Ammonia Nitrate	120	Centralia-Elma
Explosives – All Classes	700	Centralia-Banger
Nuclear Material	16	Centralia-Bangor
Sodium	120	Centralia-Elma
Sodium Borohydroxide	300	Centralia-Elma
Sulfuric Acid	75	Centralia-Aberdeen
Sodium Chlorate	100	Centralia-Aberdeen
Caustic Soda	250	Centralia-Aberdeen

Table 32. Hazardous materials carried on the Puget Sound and Pacific Railroad (2003).

Source: Puget Sound and Pacific Railroad

PSAP has an extensive emergency response plan that addresses hazardous materials and natural hazards along its rail lines.

Derailments present the greatest threat of creating a hazardous material incident on railroads. These may occur because of a natural hazard (flooding, earthquake, or tsunami), equipment failures, unsuitable tracks, or collision with motor vehicles. Mechanical failures and negligence by operators can also cause rail accidents that result in hazardous material incidents.

Marine Traffic

Grays Harbor County marine waters and the Grays Harbor Estuary are vital transportation conduits for commercial shipping, commercial fishing, and recreation vessels. While the bulk of this traffic is off the Pacific coastline, many vessels use the Grays Harbor Estuary as well. Large commercial vessels rely on a dredged channel to access port facilities within the estuary.

Cargo-handling facilities include the Port of Grays Harbor facilities in Aberdeen and Hoquiam, the Weyerhaeuser facilities in Aberdeen and Cosmopolis, and the Sierra Pacific Industries in Junction City. The Port of Grays Harbor also operates the largest commercial fishing and recreational vessel marina within Westport. The US Coast Guard and other private businesses maintain smaller docking facilities within Westport, Hoquiam, and Aberdeen that serve special or limited vessel traffic. The only county commercial marine fueling facilities are Chevron Fuel Dock and Walsh Distributing in Westport.

The regulation of hazardous materials on commercial vessels falls under the jurisdiction of two bodies. The Hazardous Materials Standards Division of the US Coast Guard (USCG) develops standards and industry guidance to promote the safety of life and protection of property and the environment during marine transportation of hazardous materials. This includes transportation of bulk liquid chemicals and liquefied gases, hazardous bulk solids, and packaged hazardous cargoes as well as hazardous materials used as ships' stores and hazardous materials used for shipboard fumigation of cargo.

The division develops and maintains the safety requirements for marine vapor control systems and establishes occupational health and safety program guidance for maritime and Coast Guard personnel. Other specific functions involve the classification of new bulk liquids, gases and solid hazardous cargoes before their shipment and the issuance of special permits for transport of bulk solids, maintenance of chemical hazards and attributes databases, and publication of the Chemical Data Guide for Bulk Shipment by Water.

The International Maritime Organization Dangerous Goods (IMODG) Code, an agency of the United Nations, also regulates hazardous materials at sea handled by vessels bearing flags of member states. Like the USCG regulations, the IMODG Code covers specific issues relating to handling, packing, container traffic and stowage, and the segregation of incompatible substances.

No state or federal agency keeps a database regarding the type and quantity of hazardous material cargos of vessels passing through Grays Harbor County coastal or estuarine waters. None of the cargo facilities within the county regularly handles materials rated as hazardous, although commercial shipping vessels may already have such cargo onboard that is destined for other ports. Likewise, ships navigating waters off the Pacific coast are not required to provide information to any local, state, or federal authorities on their type and amount of cargos.

However, the one known category of hazardous materials always associated with marine traffic is petroleum products. Petroleum products, especially diesel, gasoline, and oil, are common to all ships' stores regardless of size. Barge traffic of bulk petroleum supplies is very common as well.

Weather, collisions, equipment failure, and operator error are the main causes of marine hazardous material incidents. Hazardous material incidents most often involve liquids – diesel and gasoline. Accidents in Washington Pacific coastal areas more frequently involve barges pulled by tugboats. Studies show that when petroleum spills occur, recovery rates seldom exceed 20%.

The Pacific Coast-British Columbia Oil Spill Task Force has identified the Grays Harbor coastline as being of high risk for fishing vessels up to 50 nautical miles, cargo vessels up to 25 nautical miles, and laden tank barges up to 15 nautical miles.

Pipelines

Grays Harbor County has two major underground pipelines that deliver natural gas: 1) the Northwest Pipeline (Williams Companies) Grays Harbor Lateral and the Cascade Natural Gas Vail-to-Aberdeen line.

Northwest Pipeline completed the Grays Harbor Lateral in November 2002 to serve the proposed Duke Energy Combustion Turbine Project at the Satsop Industrial Park. This 20-inch line is 49 miles long and ties into Northwest Pipeline's main interstate line near the town of Rainier in Thurston County. It is capable of transporting 161,500 dekatherms (Dth) of natural gas per day. Although the Duke Energy Plant has yet to use this supply, Northwest Pipeline manages the lateral to stockpile gas, especially in the fall and winter months to satisfy peak demands.

Northwest pipeline also extends its McCleary Lateral into Grays Harbor County for about 30 miles, whereby the gas transfers to the Cascade Natural Gas line. The Cascade natural gas line is an 8-inch line and provides natural gas to the communities of McCleary, Elma, Montesano, Aberdeen, and Hoquiam. A 4-inch line stems from the main line at Satsop to serve the Satsop Industrial Park to the south. A SCADA system monitors flows and pressures within this line. Cascade Natural Gas maintains a large network of small-diameter distribution lines throughout its service areas.

Due to security concerns, both Northwest Pipeline and Cascade Natural Gas provided limited information for this report.

Natural gas is stable, non-corrosive, and non-polymerizing. However, when released, it readily mixes with air to form a combustible atmosphere. If mixed with some strong oxidizing agents such as chlorine, bromine, pentafluoride, oxygen difluoride, and nitrogen trifluoride in a confined space, natural gas can burn or explode. It will ignite spontaneously when mixed with chlorine dioxide. Natural gas can ignite if there is a heat source from 900 – 1200 degrees Fahrenheit and if it exists at 4% to 16% of the present air by volume. If it exists at proportions below or above those limits, it will not burn or explode.

Explosion and fire are the primary hazards associated with natural gas pipeline incidents. These incidents most frequently happen due to puncture of the line during ground disturbance or construction that causes the rupture of underground lines. Other incidents may result from leaking transmission lines caused by corrosion or faulty equipment utilizing natural gas.

HAZARDOUS MATERIAL INCIDENTS IMPACTS

The presence of hazardous materials in the community does not necessarily mean that the population and the environment are at extreme risk. Risk from serious hazardous materials incidents is a function of many variables, which include:

- The likelihood of a release occurring;
- The inherent hazards of the chemical combined with the quantity released; and
- The potential impact of the release to the public and environment

For instance, the risk of a hazardous material incident is low if a release occurs frequently but the quantity of the material is typically small and does not generally migrate off-site. Such events are frequent within the urban centers of the county, especially at manufacturing plants and in situations involving the use of petroleum products. Similarly, if the probability of a catastrophic release is low, even though it could affect large numbers of people or wide areas of the environment, the overall risk remains low. Relying solely on historic evidence, it suggests that the risk of a serious hazardous material incident within the county overall is relatively low for fixed facilities but slightly higher for some transportation systems.

Regardless of the overall low risk level for hazardous material incidents within unincorporated Grays Harbor County, people, property, and the environment share varying degrees of vulnerability depending on a wide range of highly variable factors.

Fixed facilities present an overall lower vulnerability to the unincorporated county than transportation systems. The very fact that they are "fixed" in a relatively controlled environment is a benefit at reducing vulnerability through containment. Stringent regulations governing hazardous materials at fixed facilities are a mitigation measure that limits overall vulnerability. These regulations establish a thorough system from how to handle hazardous materials on a daily basis to clear and immediate response during emergencies. Fixed facilities also are highly controlled environments that have external emergency response resources immediately available during emergencies.

On the other hand, hazardous material incidents associated with transportation systems do not share the same beneficial attributes, especially containment. Rail or marine routes do not always share the same accessibility to an incident site as fixed facilities. In some situations, incident sites can be quite remote and uncontrollable, as seen in the case of the United Transportation Barge event when heavy seas, surf, and remote location made recovery slow and containment impossible, thereby expanding the vulnerability of the surrounding area. Rail lines can be highly inaccessible in certain locations, slowing recovery, which in turn increases vulnerability. Highway incidents may be more accessible, but the distance of a site from a response team can be much longer than a fixed facility, thereby increasing the potential vulnerability of people, property, and the environment to the incident. Complicating the vulnerability analysis process for hazardous material incidents is the lack of specific data associated with risk. Because the US Environmental Protection Agency does not require handlers of hazardous materials to assess the level of risk of an occurrence at fixed facilities or with transportation systems, this makes assessing vulnerability difficult. This is unlike natural hazards such as earthquakes, landslides, and tsunamis, where the production of maps and scientific data clearly delineate affected areas.

For this reason, assessing the vulnerability of people, property, and the environment in the county's unincorporated areas for hazardous material incidents is possible only in more general terms than typical for natural hazards.

Fixed Facilities

The majority of fixed facilities with significant hazardous materials countywide are within urban areas, thus reducing direct vulnerability of people, property, and environment in the unincorporated areas to a hazardous material incident. Of these fixed facilities, however, the Rohm and Haas plant within the City of Elma and the Cosmopolis Pulp Mill within the City of Cosmopolis present the most vulnerability to the unincorporated areas if a rare, catastrophic serious incident occurred. A minor gas leak require emergency services personnel to take precautionary measures for county residents and livestock up to 0.2 miles during the day and 0.8 miles during the night downwind from the incident site. A major gas leak would increase those distances to 1.5 miles during the day and 4.5 miles during the night. Isolation areas typically range from 100 to 800 feet circumference from the incident site. Rural population levels affected by major incident might number from 500 to 2,500, depending on wind and other weather factors. The transportation networks, especially highways and railways, would be vulnerable to closure at each location for a minor or major leak. Likely highway closures would include SR 12 at locations around Elma and north of Junction City. Closure of the rail line near these areas would disrupt commerce.

An accident involving significant quantities of hazardous materials in a liquid state potentially could reach unincorporated groundwater resources or waterways if on-site containment systems fail. A large diesel or gasoline storage facility collapse would be such an example. This includes any fixed facility in a city or the unincorporated areas. Unincorporated vulnerability may include wells serving rural properties, endangered livestock, and extensive damage to environmental resources affecting fish and wildlife. Short- and long-term economic impacts could be extensive, with the most significant losses focused on agricultural operations, potable water supplies, and fish and wildlife resources that support tourism.

An explosion at any fixed facility site may create collateral off-site damage. Adjacent structures and properties are most vulnerable. Explosions may increase vulnerability if they lead to a release of gaseous or liquid hazardous materials.

Transportation Systems

The majority of highway, marine, and pipeline transportation systems pass through the unincorporated areas of Grays Harbor County. Any asset, whether it involves people, property, or the environment, is vulnerable along each corridor. The extent of the vulnerability is highly variable, given the type and quantity of the material, the accessibility of the site, on-board containment systems or abilities, surrounding environmental conditions, local land uses, and weather conditions. Because of so many variables, it is safer to assume that any person in a structure or vehicle, any land use, any public infrastructure, and the environment as a whole located adjacent to a transportation corridor, is highly vulnerable to a hazardous material incident at any moment in time.

Highways and railways present the greatest range of vulnerabilities – they can pass through rural areas that are quite remote with low densities, such as north of Humptulips on US 101, to areas with large populations like Central Park. Any residences adjacent to these corridors are vulnerable to hazardous material incidents, especially involving gaseous, flammable, or explosive materials. Depending on the cargo, a worst-case scenario may involve an isolation area 1,000 feet in circumference and an area to take precautionary measures up to five miles downwind of a gas-based incident.

Rural areas that pass by highways and rail lines are especially vulnerable to liquid releases. Livestock, commercial and noncommercial fish and wildlife resources, and contamination of groundwater that supply rural residents with potable water supplies, are extremely vulnerable to liquid spills. Moving water bodies or topography can increase the distribution of hazardous liquids in some areas, which in turn can increase vulnerability to a larger area.

Properties and people near natural gas pipelines are vulnerable to explosion and/or fire at any location where a rupture occurs. Because no information is available on risk factors for either the Grays Harbor Lateral or Cascade Natural Gas pipelines, it is difficult to assess vulnerability of pipelines of this size.

Hazardous material incidents along the marine waters are unique from those shared by fixed facilities and other transportation systems. The marine coastline is particularly vulnerable to hazardous materials spilled by cargo ships and barges. This is especially true of fuel and oil spills. Spills off the Grays Harbor coastline can contaminate beaches and marine environments as far north as Vancouver Island, British Columbia. Valuable and sensitive marine environments critical to fish and wildlife, commercial fish and shellfish businesses, property values, and tourism are all vulnerable to the impacts of spills. Because only 20% of spill material is typically recoverable in marine waters, it can take many years for these environments to recover. Average cost estimates for oil spills run as follows: clean up - \$369 per gallon, natural resource damage - \$112 per gallon, and economic claims - \$429 per gallon.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

All county facilities are potentially at-risk to hazardous materials incidents.

HAZARDOUS MATERIAL INCIDENTS

Hazardous material incidents occur in Grays Harbor County frequently. However, the vast majority of these incidents involves small quantities or happen at a fixed facility with very limited to no impact to people or the environment. However, the vast majority of these reports were minor and not what the Department of Transportation's Office of Hazardous Materials Safety (OHMS) would define as a "serious incident," which entails:

- A fatality or major injury caused by the release of hazardous material;
- The evacuation of 25 or more people as a result of a release of hazardous material or exposure • to fire:
- A release or exposure to fire which results in the closure of a major transportation artery;
- The alteration of an aircraft flight plan or operation; •
- The release of radioactive materials from Type B packaging; •
- The release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant; or •
- The release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material •

In fact, "serious" hazardous material incidents on this scale are both rare and infrequent. Most hazardous waste enforcement actions in Grays Harbor County have focused on small, routine, or periodic releases beyond what a state or federal permit allows. For instance, this has happens frequently with several local manufacturing firms who exceed their air and water pollution control permit standards.

Many reported hazardous material incidents involve small-scale spills and atmospheric releases of hazardous materials due to human error or equipment failure that require minimal response. Between 1995 and 2004, the Department of Ecology received reports of over 1,200 such incidents. While the cumulative consequences of small toxic releases into the environment can be extremely dangerous to humans and the environment over the long-term, they are not equivalent to a serious one-time hazardous materials incident.

Information about serious hazardous material incidents in Grays Harbor County is available through the county records, state documents, and archived newspapers. The following tables provide a summary of known incidents.

		Table 33. Fixed Facilities
Site(s)	Date	Description of Incident
Weyerhaeuser Pulp Mill	7/11/02	Release of 50-55 pounds of chlorine dioxide into the
Cosmopolis		atmosphere. The cloud eventually dissipated as it traveled
		southeast of the mill. Portions of the mill as well as the
		Highlands Golf Course and 10 residents were evacuated for
		three hours. US 101 was closed between the Cosmopolis-

-----.

Site(s)	Date	Description of Incident
		Aberdeen city line and the junction with SR 107. No injuries.
		Damage estimated at \$10,000. Weyco staff contained the leak.
		Weyco fined \$10,000.
Weyerhaeuser Pulp Mill	5/27/04	353 lbs. of sulfur dioxide released into the atmosphere.
Cosmopolis		
Weyerhaeuser Pulp Mill	7/17/04	Approximately 29,000 gallons of sulfur dioxide leaked into the
Cosmopolis		plant's sewer system. Contained and no injuries.
Contaminated properties from	2004	The Washington Department of Health reports that 20
Clandestine Drug Labs (CDL)		properties in Grays Harbor County, four of which are in the
		unincorporated areas of the county, are listed as CDL
		contaminated sites.

	Table	e 34. Transportation Systems
Site(s)	Date	Description of Incident
United Transportation	3/11/64	A 200-foot fuel barge towed by the Seattle tug Neptune,
Barge		carrying 2,352,000 gallons of gasoline, diesel, and stove oil,
		drifted ashore between Moclips and Pacific Beach. Spill of 1.2
		million gallons destroyed all beach life for a 10-mile area and
		severely affected sea life along the beaches to the north on the
		Quinault Reservation.
Nestucca Barge (Sause	12/23/88	The Nestucca barge and its tender Ocean Service collided at the
Towing)		mouth of Grays Harbor. 231,000 gallons of fuel oil spilled from
		the ruptured barge, killing 3,500 sea birds and other sea life
		from Grays Harbor to Vancouver Island. The total cost of the
		clean-up cost was \$27.68 million (1997 dollars).
Reinhard Petroleum Truck	11/27/03	A tanker truck carrying 11,000 gallons of gasoline overturned
Explosion		and exploded on Highway 8 mp 1 eastbound. The cause of the
		accident was driver error due to icy road conditions. The truck
		and fuel burned for hours, forcing closure of Highway 8 and
		requiring a detour on county roads.

Of all the serious hazardous material incidents that have occurred in Grays Harbor County, the United Transportation and Nestucca incidents rank as having the most significant impact to the environment and the highest monetary cost. Both incidents account for being in the top five oil spills of all time within Washington waters. The Nestucca case in particular spurred the Washington State legislature soon afterwards to establish an innovative spill prevention and response program.

To date, there have been no serious hazardous material incidents involving railways or pipelines.

SECTION 15: LANDSLIDE HAZARD PROFILE

DEFINITION

Landslide is the movement of rock, soil and debris down a hillside. Landslides take lives, destroy buildings, interrupt transportation systems, damage utilities, and cover marine habitat.

PROBABILITY OF LANDSLIDES

While landslides happen frequently in Grays Harbor County, there is no reliable method to forecast their occurrence.

FACTORS CONTRIBUTING TO LANDSLIDES

The term landslide covers a wide range of ground movement. Landslides vary in size and can travel at a rate of a few inches per month to many feet per second depending on slope, type of materials, and moisture content. Geology, topography, weather and other disasters, such as earthquakes or floods, contribute to landslides. Determining the probability of landslide events is difficult because so many factors can contribute to the cause of a ground failure.

Because there is a history of landslides in unincorporated Grays Harbor County in the past, it is safe to assume they will occur in the future. Landslides in Grays Harbor County are normally associated with intense or prolonged rain. A combination of precipitation and slopes weakened by heavy rain creating saturated soils is one stimulus. Another is wave or stream action with bank undercutting during periods of intense precipitation. Earthquakes of a magnitude of 4.0 or greater can also induce landslides on susceptible slopes.

Table 35. Landslide Characteristics in Grays Harbor County

- Steep and/or unstable slopes
- Heavy precipitation, rain and/or snowmelt, or an earthquake of 4.0+
- Soils near to saturation
- Saturated bluffs undercut by waves
- Erosion on river and/or stream banks
- Flooding

The primary types of landslides that occur in the County are debris flows and earth flows. Debris flows are also called mudslides, mudflows, or debris avalanches. They are rivers of a combination of loose soil, rock, organic matter, water, and air that flow downhill. As they continue downhill they tend to grow in volume with the addition of water, soil, boulders and other materials. When the flow reaches flatter ground, it can spread over a large area. Earth flows usually occur in fine-grained materials or clay

bearing rocks on moderate slopes. The slope's material liquefies and forms a bowl shape depression at the source area.



Figure 13. Types of Typical Landslides in Grays Harbor County

Source: USGS Fact Sheet 2004-3072, p.3

The area's most vulnerable to landslide in the County are the slopes of the Olympic range, the coastal shoreline, and Highways 101 and 12. Landslides might occur on a moderate slope anywhere in the county if soils become saturated.

Generally landslide in Grays Harbor County will develop at the base or top of a steep cut slope; on developed hillsides or coastal bluffs; from activities that disturb slopes such as construction, road building and logging; and on old existing landslides. Other factors inducing landslides can be poorly located septic systems that contribute to slope unsuitability, areas where surface water is channeled along roads and below culverts, water leakage from utilities, vegetation removal and paths or trails down a bluff leading to beach access.



Figure 14. Grays Harbor County Landslide Hazards

LANDSLIDE IMPACTS

Normally, landslides in Grays Harbor County have resulted in traffic problems on both state highways and county roads and property damage on the coast. There have been ongoing traffic blockages in the unincorporated county due to landslides. The series of landslides on Highway 12 in the City of Aberdeen caused major disruptions for a lengthy period. Road cuts are very susceptible to landslides and a slide can happen during milder rainfall conditions then would be expected for a major event. A large slide closing Highway 12 or Highway 101 for a considerable length of time would be expected to have a devastating effect on the County's economy. It would also be a threat to public health due to problems of access to medical services. Expanded development will increase the incidence of landslides, especially on steep slopes and bluffs. Often these areas are the most desirable building sites due to views and/or access to ocean beaches. Debris flow on natural slopes is a threat to timber harvest and fisheries. Landslides because of flooding will extend the spread of debris, increase property damages due to weakened structures, and may seriously restrict provision of emergency services.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

The tables below provide an estimate of the number of structures and people exposed to landslides in Grays Harbor County.

			-
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1	1	3	5
	1	2)	52

Table 36. Asset Vulnerability Summary For Structures And People: Landslides

Landslides	Properties Exposed	Structures Value	People Affected
District 1	0.4%	\$4 M	68
District 2	0.1%	\$803,915	10
District 3	0.1%	\$248,920	10
All Commissioner Districts	0.2%	\$5 M	88

LANDSLIDE EVENTS

The Washington State Hazard Mitigation Plan identified Grays Harbor County as a "Vulnerable County" to landslides (October 2010). This included specific areas with documented areas of known landslide locations.

The following examples are representative of the type of landslide events experienced in Grays Harbor County. In December of 1977, there were several slides: a mudslide blocked Highway 107 south of Montesano; there was mud covering one lane on Highway 109 about a mile south of Pacific Beach; and small mudslides covered portions of Highway 101 south of Cosmopolis. In February 1982, several mudslides occurred when more than 10" of rain fell over a weekend: the Moclips Bridge on Highway 109 was damaged; and there was a massive slide blocking both lanes of Highway 12 just south of Porter. Another landslide completely blocked Highway 12 below the Aberdeen Bluff for one week in December 1996 during a period of intense snow and rainfall.

In April 1997, a major slide blocked the flow of water at the north end of the West Fork of the Satsop River. On April 23, 1998, rain and wind caused a mudflow that blocked one lane of traffic on Highway 12 near Porter, and in November 1998 a mudslide blocked access to several homes at Lake Quinault.

Numerous small-scale landslides, in combination with serious flooding, have been included as part of the damages in the following Federal Disaster Declarations for Grays Harbor County. Each storm event summary can be accessed through the hyperlinks below.

Federal	Disasters 1/2005 – 5/2010
#545	December 1977
#852	January 1990
#1159	December 1996 – February 1997
FEMA 1	641 01/27/2006–02/4/2006, Severe Storms, Flooding, Tidal Surge, Landslides, Mudslides
FEMA 1	671 11/02-11/2006, Severe Storms, Flooding, Landslides, and Mudslides
FEMA 1	682 12/14-15/2006, Severe Winter Storm, Landslides, and Mudslides
FEMA 1	734 12/01/2007 – 12/17/2007, Severe Storms, Flooding, Landslides, and Mudslides
FEMA 1	<u>817; FEMA 1825</u> 12/12/2008 – 01/16/2009, Severe Winter Storms

SECTION 16 VOLCANO HAZARD PROFILE

DEFINITION

A volcano is a vent in the earth's crust that ejects magma, rock fragments, gasses and ash from the earth's interior. Over time, accumulations of these erupted products on the earth's surface create a volcanic mountain.





Source: USGS Fact Sheet 002-97

PROBABILITY OF VOLCANO HAZARDS

Grays Harbor County has less than a 0.01% annual probability of receiving 10 or more centimeters of ash accumulation.

FACTORS CONTRIBUTING TO VOLCANO HAZARDS

There are no volcanoes in Grays Harbor County, but volcanoes dominate the Cascade Mountain Range approximately 60 miles to the east. Mt. Rainier is considered the "giant" of the Cascade Range volcanoes and the consequences of a major eruption would be cataclysmic for the entire Pacific Northwest. Mt. St. Helens, located in southwest Washington State, is currently the most active volcano in the Cascade Range. An eruption from either Mt. Rainier or Mt. St. Helens could be expected to affect the County to some degree, how much depends on the magnitude of the eruption, size of the eruption column and prevailing winds. Based on a history of intermittent activity at Mt. St. Helens, scientists feel the mountain poses a hazard for the foreseeable future.

A large-scale volcanic eruption is extremely rare and Grays Harbor County is not vulnerable to any direct impacts from an initial blast or mud flows; however, impacts related to ash fall from a large eruption could be widespread based on the direction of prevailing winds. The immediate danger area around a volcano is approximately 20 miles, however, ash fall problems may occur as much as 100 miles or more from a volcano's location. Ash fall, while a secondary impact, is the factor of most concern to Grays Harbor County.

Grays Harbor County is vulnerable to ash fall from a volcanic plume. Wind direction and speed influence the dispersal pattern of falling ash.

Characteristics of Volcanic Eruption

- Prevailing high altitude winds from the southeast or east
- Slight to heavy ash fall
- Ash accumulation
- Reduced Visibility

Generally, wind patterns along the coastal plain toward the Cascade Range

are south and southwest that would direct an ash cloud from a volcanic eruption in the Cascade Range toward the east. Winds from the southeast or east would carry ash fall to the county.

The amount of ash fall is directly related to the size of an eruption. Volcanic ash is composed of tiny pieces of rock and glass. The size of ash particles and the thickness of deposits decrease in size as they spread farther from the erupting volcano. Falling ash initially appears as a dusty haze, often a murky yellow or gray color and can even turn daylight into darkness. Ash fall will progress from east to west over the county.

VOLCANO IMPACTS

The expected consequence of a major volcanic eruption with prevailing winds from the east on Grays Harbor County is ash fall. Any accumulations of volcanic ash can create traffic problems, damage machinery and electronics, clog sewage disposal systems, and contaminate water treatment plants. Ash particles can affect public health and, in extreme cases, cause death. Several of the deaths from the Mt. St. Helens eruption of 1980 were attributed to ash inhalation. Additionally, ash is very difficult to clean up. There can be impacts without ash fall that are likely to involve services such as traffic management and temporary shelters as highways and institutions closer to an eruption can be overwhelmed.

There was no direct impact to Grays Harbor County from the May 18, 1980 eruption of Mt. St. Helens; however, there were immediate effects. As the realization of the catastrophic nature of the eruption become clear, one of the necessary actions taken by state officials was to divert traffic. There were traffic jams in Montesano and Oakville due to the rerouting of Interstate 5. Traffic from Portland was rerouted to Astoria and then north adding to congestion on Highways 101 and 12 as people tried to reach destinations in the Puget Sound region.

Also of immediate concern was the potential need to house evacuees from the Longview Kelso area. Cowlitz County Emergency Services Director, Bill Langford, estimated there could be as many as 50,000 people in need of shelter. The local Red Cross made preparations to house evacuees at the Grays Harbor Fairgrounds and the old Armory in Aberdeen, but these facilities were not needed.

Ash fall from the May 25, 1980 eruption caused power outages, hazardous traveling conditions and stranded tourists. Rainfall helped keep the dust down minimizing damage to engines; although, it made many roads very slippery and muddy. The ash hit residents of East County the hardest. Oakville received 3/4 inch of ash. In McCleary, an accumulation of ash of up to 1/4 inch mixed with rain, coating the streets and creating hazardous driving conditions.

Traveling conditions were dangerous not only from slippery ash deposits, but also for a time, reduced visibility and speed limits were lowered on roads. Six school districts in East County were closed because of muddy roads and ash covered playgrounds. Sgt. John Weaver of the Washington State Patrol estimated there were up to 50,000 tourists celebrating Memorial Day at the coastal beaches. People choosing to leave the beaches on Sunday (the day of the eruption) caused significant traffic jams, especially along Highway 12.

East County farmland received 1/2 to 3/4 inches of ash according to reports. Farmers, in the midst of harvesting cattle feed crops, were concerned the ash would cause problems with their machinery as well as limit yields. Some clover fields were knocked down, but other crops were not damaged. Milk production dropped, but this was only a temporary issue. Ash created a massive cleanup problem for officials at the Satsop nuclear project. No damage was reported, but clean up took several days before construction could resume.

A number of people with chronic respiratory ailments were seen at the Grays Harbor Community Hospital. Initial health concerns did not materialize and no deaths were reported due to ash fall inhalation in the County.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

The tables below provide an estimate of the number of structures and people exposed to volcanoes in Grays Harbor County.

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Table 37. Asset Vulnerability Summary For Structures And People: Volcanoes

Volcanic Ash Fall	Properties Exposed	Structures Value	People Affected
District 1	2.0%	\$20 M	196
District 2	2.0%	\$11 M	84
District 3	2.0%	\$8 M	136
All Commissioner Districts	2.0%	\$40 M	416

Catastrophic Ash Fall	Properties Exposed	Structures Value	People Affected
District 1	5.0%	\$52 M	491
District 2	5.0%	\$27 M	209
District 3	5.0%	\$21 M	339
All Commissioner Districts	5.0%	\$101 M	1,039

EVENTS

Mt. St. Helens

Observations by local Indians, early settlers, and scientific studies indicate Mt. St. Helens has been active over time. Explorers, traders, and missionaries all heard reports of a major explosive eruption about 1800.

Date	Activity
1480	Pumice, pyroclastic flows, lava, and mudflows
1600 - 1700	Voluminous flow of lava
1800 - 1802	Explosive volcanic event
1831	Steam and ash eruption
1835	Steam and ash eruption
1842 - 1844	Mud flows, pumice and lava flows
1947 – 1854	Intermittent steam and ash eruptions
1957	Last 19 th century eruption
05/18/1980	Eruption

Table 38. Historical Reports of Volcanic Activity on Mt. St. Helens

Source: Columbia River Chronology, Historical Dates. Pacific County Historical Society and Museum

An eruption of Mt. St. Helens in 1980 is the only completely documented volcanic event to affect Grays Harbor County. After about a 150-year time span, a catastrophic eruption occurred on May 18, 1980.

A new period of unrest began in September of 2004. Initial increases in seismic activity were followed by magma rising to the surface on September 23rd. After 14 days, new lava was visible and seismic activity and dome building continues to the date of this report.

The May 18, 1980 eruption carried huge amounts of ash to the east all the way to the State of Montana in a matter of hours. Grays Harbor County escaped the initial ash fall because of prevailing wind direction; however, a smaller but significant eruption on May 25, 1980, affected the county for a short period. Prevailing winds from the southeast during this eruption deposited ash from the volcanic plume over Grays Harbor County from east to west.

SECTION 17: WILDLAND FIRE HAZARD PROFILE

DEFINITION

Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property.

PROBABILITY OF WILDLAND FIRES

There are Wildland Urban Interface Communities at Risk of high fire danger annually in Grays Harbor County. The Washington State Hazard Mitigation Plan shows that East Grays Harbor County has a fire frequency rate of 35 to 100+ years and West Grays Harbor County has a frequency rate of 200+ years.

FACTORS CONTRIBUTING TO WILDLAND FIRES

Forestland wildland fires are very unusual events in Grays Harbor County, normally occurring during years of drought periods when fuel is dry and precipitation is below normal. The county is not a high risk for wildland fire in the Washington State Hazard Mitigation Plan, but the potential does exist, as discussed in the Grays Harbor County Comprehensive Emergency Management Plan. This plan suggests a moderate probability for a wildland fire within forestlands, although historical evidence suggests the possibility of a large wildland fire is quite low. Fire concerns do exist along dune lands where grasses and invasive plant species such as scotch broom, have high combustibility during drier periods.

Characteristics of Wildland Fires

- Very Dry to drought conditions
- Reduced moisture content in vegetation
- Accumulation of drv fuel on forest

Wildfires depend on four factors: available fuel, moisture, terrain, and an ignition source. There is ample available fuel in both forestlands and on beach dunes, but the annual precipitation in Grays Harbor County keeps moisture content high in vegetation. During very dry years, fuels that dry out can ignite easily.

Both natural forces and human causes produce wildfires. Lightening in combination with an accumulation of fuels on the forest floor and very dry conditions is the most likely natural cause of a wildland fire in Grays Harbor County. Wildland fires attributed to human behavior include recreational fires, arson, or burning debris.

Strong dry east winds in late summer and early fall combined with several years of below average precipitation can make forestlands on the slopes of the Olympic Mountains vulnerable to wildland fire if fuels are dry. The beach grasses on dunes are also vulnerable to wildland fire if very dry.



Figure 16: Wildland Urban Interface Communities at Risk in Grays Harbor County

The Washington Department of Natural Resources reports that areas within the county classified as "wildland-urban interface communities" susceptible to high fires risk include Montesano, Porter, the Capitol Forest, and west Grays Harbor County.

WILDFIRE IMPACTS

The Grays Harbor economy is largely dependent on the forest industry. A large-scale wildfire would destroy timber and logging equipment. The economy could suffer from loss of supply for local industries dependent on raw logs to process. There is no history of wildfire fatalities in the county, but loss of life is a possibility. A significant fire in forestlands would produce heavy smoke, a known health risk. Secondary impacts include erosion on burned slopes leading to runoff and contributing to flooding, landslides, and impacts to salmon-bearing streams. Wildfires in dune grass could destroy homes, hotels, restaurants and other tourist facilities while wildfires in farmlands could destroy crops, farms, and structures.

ASSET VULNERABILITY SUMMARY FOR STRUCTURES AND PEOPLE

The tables below provide an estimate of the number of structures and people exposed to wildfires.

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Table 39. Asset Vulnerability Summary For Structures And People: Wildfires

Wildland Fire Properties Exposed Structures Value People Affected District 1 1.0% \$10 M 98 1.0% District 2 \$6 M 42 District 3 1.0% \$4 M 67 All Commissioner Districts 1.0% \$20 M 207

WILDLAND FIRE EVENTS

In the late 1800's, driftwood fires destroyed extensive woodpiles along beaches in southwest Washington State. The removal of this natural wood barrier eventually caused significant changes in the coastal shoreline. Sand dunes built up where none had been before, covering most of the coastal prairie. The destruction of the driftwood barricade also removed an effective obstacle against ocean winds and tide surges.

The famous fire of 1902 "crept to the outskirts of Elma and Montesano. Sweeping from Summit to Satsop, it cut a swath 13 miles long and from one to two miles wide, leaving a strip of charred and burning ruins. A dam on the west branch of the Hoquiam (River) burned and the New London community was destroyed. Travel on the Wishkah road was impossible. The White Star mill and 1 million board feet of lumber turned into smoke. Telephone and telegraph lines to Puget Sound were cut

by burning and falling timber. The smoke was so thick it blocked out the sun and sent the county into darkness." $^{\rm 11}$

Year	Features
Mid 1800's	Multiple driftwood fires
Summer/Fall 1867	Forest fires and smoke
September 1902	Massive forest fire
July 1910	Forest fires, drought
August 1939	Forest fires, especially near Copalis
June-August, 1941	Forest fires
July 1945	Forest fires
August 1951	Wildfire near Grayland

Table 40. Significant Wildland Fire in Grays Harbor County

Source: Columbia River Chronology, Historical Dates,

Pacific County Historical Society and Museum and They Tried to Cut It All.

¹¹ They Tried to Cut It All p. 192

ASSET VULNERABILITY APPENDIX

SECTION 18: FLOOD HAZARD ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide estimates of potential damage and exposure of people for both a 100-Year flood and a 500-Year flood in Grays Harbor County.

100-YEAR FLOODPLAIN



		Properties	Structures	People
-	100-Year Flood Plain	Exposed	Value	Affected
-	District 1	14.1%	\$147.6 M	1,812
	District 2	30.6%	\$168.3 M	911
	District 3	26.0%	\$111.0 M	1,494
	All Commissioner Districts	21.1%	\$427.0 M	4,218

100-YEAR FLOODPLAIN, COMMISSIONER DISTRICT 1

	Number of Structures		Value of S	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	867	18.5%	505,132,275	83,367,958	16.5%
Manufacturing	25	10	40.0%	88,385,803	6,876,941	7.8%
Transportation	27	9	33.3%	339,539,062	5,624,025	1.7%
Trade	35	11	31.4%	8,783,375	3,654,390	41.6%
Services	83	8	9.6%	34,201,025	3,353,325	9.8%
Recreation	30	12	40.0%	14,701,500	3,207,500	21.8%
Agriculture	604	512	84.8%	37,355,315	31,173,900	83.5%
Forestry	1702	489	28.7%	21,554,705	8,420,730	39.1%
TOTALS	7,199	1,918	0	1,049,653,060	147,595,754	14.1%
Estimated residential nonulation exposed to hazard: 1 812						

100-YEAR FLOODPLAIN, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	2000	436	21.8%	178,610,582	41,463,610	23.2%	
Manufacturing	12	11	91.7%	103,354,547	102,706,547	99.4%	
Transportation	18	7	38.9%	7,424,295	4,118,655	55.5%	
Trade	35	7	20.0%	4,823,450	575,000	11.9%	
Services	55	22	40.0%	236,169,015	11,258,970	4.8%	
Recreation	20	9	45.0%	8,212,285	1,697,860	20.7%	
Agriculture	104	78	75.0%	4,349,335	2,630,100	60.5%	
Forestry	606	210	34.7%	7,195,095	3,370,770	46.8%	
TOTALS	2,853	783	27.4%	550,612,604	168,295,512	30.6%	
Estimated residential population exposed to hazard: 911							

100-YEAR FLOODPLAIN, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	715	22.0%	316,559,411	81,197,651	25.7%
Manufacturing	47	7	14.9%	10,135,914	2,481,200	24.5%
Transportation	99	12	12.1%	23,759,070	9,114,700	38.4%
Trade	192	11	5.7%	7,711,675	1,611,085	20.9%
Services	101	11	10.9%	41,723,225	1,310,980	3.1%
Recreation	45	26	57.8%	13,474,170	7,990,500	59.3%
Agriculture	78	49	62.8%	3,409,550	1,534,120	45.0%
Forestry	2091	483	23.1%	9,083,125	4,771,895	52.5%
TOTALS	5,902	1,316	22.3%	426,755,040	110,911,031	26.0%
Estimated residential population exposed to hazard: 1,494						

100-YEAR FLOODPLAIN, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	9936	2018	20.3%	1,000,302,268	206,029,219	20.6%	
Manufacturing	84	28	33.3%	201,876,264	112,064,688	55.5%	
Transportation	144	28	19.4%	370,722,427	18,857,380	5.1%	
Trade	262	29	11.1%	21,318,500	5,840,475	27.4%	
Services	239	41	17.2%	312,093,265	15,923,275	5.1%	
Recreation	95	47	49.5%	36,387,955	12,895,860	35.4%	
Agriculture	786	639	81.3%	45,114,200	35,338,120	78.3%	
Forestry	4399	1182	26.9%	37,832,925	16,563,395	43.8%	
TOTALS	15954	4017	25.2%	2,027,020,704	426,802,297	21.1%	
Estimated residential population exposed to hazard: 4,218							

			Properties	Structures	People
500-YEAR	3	500-Year Flood Plain	Exposed	Value	Affected
		District 1	2.2%	\$22 M	161
FLOODPLAIN	2 1	District 2	6.9%	\$38 M	606
		District 3	10.7%	\$45 M	708
		All Commissioner Districts	5.3%	\$106 M	1,476

500-YEAR FLOODPLAIN, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	77	1.6%	505,132,275	8,478,535	1.7%
Manufacturing	25	0	0.0%	88,385,803	0	0.0%
Transportation	27	1	3.7%	339,539,062	4,720,000	1.4%
Trade	35	0	0.0%	8,783,375	0	0.0%
Services	83	1	1.2%	34,201,025	8,371,000	24.5%
Recreation	30	0	0.0%	14,701,500	0	0.0%
Agriculture	604	9	1.5%	37,355,315	858,230	2.3%
Forestry	1702	6	0.4%	21,554,705	155,670	0.7%
TOTALS	7,199	94	1.3%	1,049,653,060	22,583,435	2.2%
Estimated residential population exposed to hazard: 161						
500-VEAR		COMMISSIONER	DISTRICT 2			
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JUU-TEAK	FLOODFLAIN,	COMMINISSIONER	DISTRICTZ			

	Number of Structures			Value of S	Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	2000	290	14.5%	178,610,582	27,094,075	15.2%			
Manufacturing	12	0	0.0%	103,354,547	0	0.0%			
Transportation	18	2	11.1%	7,424,295	57,000	0.8%			
Trade	35	1	2.9%	4,823,450	4,725	0.1%			
Services	55	2	3.6%	236,169,015	9,664,175	4.1%			
Recreation	20	7	35.0%	8,212,285	1,328,860	16.2%			
Agriculture	104	0	0.0%	4,349,335	0	0.0%			
Forestry	606	2	0.3%	7,195,095	19,215	0.3%			
TOTALS	2,853	304	10.7%	550,612,604	38,168,050	6.9%			
Estimated residential population exposed to hazard: 606									

500-YEAR FLOODPLAIN, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars					
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	3246	339	10.4%	316,559,411	30,544,730	9.6%			
Manufacturing	47	0		10,135,914	0	0.0%			
Transportation	99	3	3.0%	23,759,070	198,000	0.8%			
Trade	192	4	2.1%	7,711,675	367,840	4.8%			
Services	101	9	8.9%	41,723,225	10,084,260	24.2%			
Recreation	45	17	37.8%	13,474,170	4,638,000	34.4%			
Agriculture	78	1	1.3%	3,409,550	0	0.0%			
Forestry	2091	1	0.0%	9,083,125	0	0.0%			
TOTALS	5,902	374	6.3%	426,755,040	45,832,830	10.7%			
Estimated residential population exposed to hazard: 708									

500-YEAR FLOODPLAIN, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of S	Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	9936	706	7.1%	1,000,302,268	66,117,340	6.6%			
Manufacturing	84	0	0.0%	201,876,264	0	0.0%			
Transportation	144	6	4.2%	370,722,427	4,975,000	1.3%			
Trade	262	5	1.9%	21,318,500	372,565	1.7%			
Services	239	12	5.0%	312,093,265	28,119,435	9.0%			
Recreation	95	24	25.3%	36,387,955	5,966,860	16.4%			
Agriculture	786	10	1.3%	45,114,200	858,230	1.9%			
Forestry	4399	9	0.2%	37,832,925	174,885	0.5%			
TOTALS	15954	772	4.8%	2,027,020,704	106,584,315	5.3%			
Estimated residential population exposed to hazard: 1,476									

The following lists county and community facilities at risk to flood hazards, their 2010 building and content value as well as major county roads at risk.

County Facility	Function	Yr Built	Building Value	Content Value	Equipment Value	Total Value
Pearsall Building 2109 Sumner Ave., Aberdeen	District Court #2 Health Dept. & Social Services	1980	5,194,600	27,888 355,294	106,710	5,684,492
Juvenile Detention Facility 103 Hagara, Aberdeen,		1983	4,681,200	184,908	64,036	4,930,144
Crisis Clinic 615 8 th Street, Hoquiam		1994	7,131,670			7,131,670
Vance Creek Park & Mobile Unit 76 Wenzel-Slough Rd, Elma		1992	443,774 63,544			507,318
Friends Landing Katon Road Extension			226,608			226,608
TOTALS			17,741,396	568,090	170,746	18,480,232

Facility	Туре	Location	100-Yr Flood	500-Yr Flood
A.J. West E.S.	6	City	•	
Alexander Young E.S.	6	City	•	
Central E.S.	6	City	•	
Emerson E.S.	6	City	•	
Harbor H.S. &\Hopkins Preschool	6	City	•	
Lincoln E.S.	6	City	•	
Miller Jr. H.S.	6	City	•	
Oakville\E.S.	6	City	•	
Washington E.S.	6	City	•	
Aberdeen Fire Dept.	10	City	•	
East Hoquiam Fire Station	10	City	•	
GHFD #1 – Oakville Fire Dept.	10	City	•	
Hoquiam Fire Dept.	10	City	•	
South Aberdeen Fire Station	10	City	•	
Westport Fire & South Beach Ambulance	10	City	•	
Ocean Shores Municipal Airport	14	City	•	
Westport Airport	14	City	•	
Aberdeen Police Dept.	18	City	•	
Hoquiam Police Dept.	18	City	•	
Oakville Police Dept.	18	City	•	
Washington State Patrol	18	City	•	
Westport Police Dept.	18	City	•	
Aberdeen PUD Communication Tower	20	City	•	
Hoquiam Radio Range Station	20	City	•	
KAYO-AM/FM Radio Tower	20	City	•	
KGHO-AM Radio Tower	20	City	•	
KXRO-AM Radio Tower	20	City	•	

Facility	Туре	Location	100-Yr Flood	500-Yr Flood
Dredge Port Substation	23	City	•	
Grays Harbor Paper PUD Substation	23	City	•	
Market & A PUD Substation	23	City	•	
Monroe PUD Substation	23	City	•	
Scott Street PUD Substation	23	City	•	
State Street PUD Substation	23	City	•	
Valley PUD Substation	23	City	•	
Westhaven PUD Substation	23	City	•	
Weyerhaeuser Sawmill PUD Substation	23	City	•	
GHFD #15 – Artic Fire Dept.	10	County	•	
Copalis State Airport	14	County	•	
D and B Airpark	14	County	•	
Elma Municipal Airport	14	County	•	
Wishkah River Ranch	14	County	•	
Chehalis Reservation Police Dept.	18	County	•	
Chehalis Tribe Communication Tower	20	County	•	
East Hoquiam PUD Substation	23	County	•	
Promised Land PUD Substation	23	County	•	
Weyerhaeuser PUD Substation	23	City		•
Weyerhaeuser PUD Substation	23	City		•
Elma Elementary School	6	County		•

Major County Arterials					
Elma Gate Road	North River Road				
Elma McCleary Road	Ocean Beach Road				
Garrard Creek Road	Porter Creek Road				
Hoquiam-Wishkah Road	South Bank Road				
Howanut Road	Wakefield Road				
Monte-Elma Road	Wishkah Road				
Mox-Chehalis Road	Youmans Road				

SECTION 19: EARTHQUAKE HAZARD ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide estimates of potential damage and exposure of people for earthquakes in Grays Harbor County.

AREAS OF MODERATE-TO-HIGH LIQUEFACTION



	High to Moderate Liquefaction	Properties Exposed	Structures Value	People Affected
Ļ	District 1	17.0%	\$178 M	2,123
	District 2	39.8%	\$219 M	2,130
	District 3	35.2%	\$150 M	2,287
	All Commissioner Districts	27%	\$548 M	6,540

AREAS OF MODERATE-TO-HIGH LIQUEFACTION, COMMISSIONER DISTRICT 1

	Number of Structures			Value o	Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	4690	1016	21.7%	505,132,275	101,730,114	20.1%			
Manufacturing	25	12	48.0%	88,385,803	10,583,941	12.0%			
Transportation	27	9	33.3%	339,539,062	5,624,025	1.7%			
Trade	35	12	34.3%	8,783,375	5,535,390	63.0%			
Services	83	18	21.7%	34,201,025	9,806,860	28.7%			
Recreation	30	14	46.7%	14,701,500	3,641,500	24.8%			
Agriculture	604	522	86.4%	37,355,315	31,475,600	84.3%			
Forestry	1702	598	35.1%	21,554,705	9,940,095	46.1%			
TOTALS	7,199	2,202	30.6%	1,049,653,060	178,337,525	17.0%			
Estimated residential population exposed to hazard: 2,123									

AREAS OF MODERATE-TO-HIGH LIQUEFACTION, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	2000	1019	51.0%	178,610,582	80,176,730	44.9%		
Manufacturing	12	11	91.7%	103,354,547	102,706,547	99.4%		
Transportation	18	8	44.4%	7,424,295	4,620,640	62.2%		
Trade	35	26	74.3%	4,823,450	3,259,450	67.6%		
Services	55	41	74.5%	236,169,015	14,475,550	6.1%		
Recreation	20	15	75.0%	8,212,285	6,656,825	81.1%		
Agriculture	104	81	77.9%	4,349,335	3,455,845	79.5%		
Forestry	606	215	35.5%	7,195,095	3,469,285	48.2%		
TOTALS	2,853	1,418	49.7%	550,612,604	219,259,872	39.8%		
Estimated residential population exposed to hazard: 2,130								

	Number of Structures			Value of Structures in Dollars					
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	3246	1094	33.7%	316,559,411	102,693,091	32.4%			
Manufacturing	47	6	12.8%	10,135,914	2,443,200	24.1%			
Transportation	99	9	9.1%	23,759,070	9,126,860	38.4%			
Trade	192	17	8.9%	7,711,675	1,173,585	15.2%			
Services	101	27	26.7%	41,723,225	24,145,890	57.9%			
Recreation	45	26	57.8%	13,474,170	7,727,000	57.3%			
Agriculture	78	34	43.6%	3,409,550	521,235	15.3%			
Forestry	2091	259	12.4%	9,083,125	1,479,130	16.3%			
TOTALS	5,902	1,473	25.0%	426,755,040	150,203,991	35.2%			
Estimated residential population exposed to hazard: 2,287									

AREAS OF MODERATE-TO-HIGH LIQUEFACTION, COMMISSIONER DISTRICT 3

AREAS OF MODERATE-TO-HIGH LIQUEFACTION, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	3129	31.5%	1,000,302,268	284,599,935	28.5%
Manufacturing	84	29	34.5%	201,876,264	115,733,688	57.3%
Transportation	144	26	18.1%	370,722,427	19,371,525	5.2%
Trade	262	55	21.0%	21,318,500	9,968,425	46.8%
Services	239	86	36.0%	312,093,265	48,428,300	15.5%
Recreation	95	55	57.9%	36,387,955	18,025,325	49.5%
Agriculture	786	637	81.0%	45,114,200	35,452,680	78.6%
Forestry	4399	1072	24.4%	37,832,925	14,888,510	39.4%
TOTALS	15954	5093	31.9%	2,027,020,704	547,801,388	27.0%
Estimated residential po						

AREAS OF VERY	3	Very Low-to-Low Liquefaction	Properties Exposed	Structures Value	People Affected
LOW-TO-LOW	2 1	District 1 District 2	14.1% 30.6%	\$147.6 M \$168.3 M	1,812 911
LIQUEFACTION		District 3	26.0%	\$111.0 M	1,494
		All Commissioner Districts	21.1%	\$427.0 M	4,218

AREAS OF VERY LOW-TO-LOW LIQUEFACTION, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	0	0.0%	505,132,275	0	0.0%
Manufacturing	25	0	0.0%	88,385,803	0	0.0%
Transportation	27	0	0.0%	339,539,062	0	0.0%
Trade	35	0	0.0%	8,783,375	0	0.0%
Services	83	1	1.2%	34,201,025	3,391,050	9.9%
Recreation	30	0	0.0%	14,701,500	0	0.0%
Agriculture	604	0	0.0%	37,355,315	0	0.0%
Forestry	1702	11	0.6%	21,554,705	0	0.0%
TOTALS	7,199	12	0.2%	1,049,653,060	3,391,050	0.3%
Estimated residential po	pulation exposed to					

			,			
	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	382	19.1%	178,610,582	36,753,735	20.6%
Manufacturing	12	2	16.7%	103,354,547	46,181,485	44.7%
Transportation	18	4	22.2%	7,424,295	2,527,600	34.0%
Trade	35	4	11.4%	4,823,450	530,000	11.0%
Services	55	4	7.3%	236,169,015	221,148,000	93.6%
Recreation	20	1	5.0%	8,212,285	157,000	1.9%
Agriculture	104	21	20.2%	4,349,335	922,530	21.2%
Forestry	606	283	46.7%	7,195,095	2,333,795	32.4%
TOTALS	2,853	702	24.6%	550,612,604	310,662,145	56.4%
Estimated residential	population exposed	to hazard: 798				

AREAS OF VERY LOW-TO-LOW LIQUEFACTION, COMMISSIONER DISTRICT 2

AREAS OF VERY LOW-TO-LOW LIQUEFACTION, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	134	4.1%	316,559,411	8,155,330	2.6%
Manufacturing	47	4	8.5%	10,135,914	228,000	2.2%
Transportation	99	2	2.0%	23,759,070	456,000	1.9%
Trade	192	8	4.2%	7,711,675	5,455,000	70.7%
Services	101	2	2.0%	41,723,225	172,000	0.4%
Recreation	45	4	8.9%	13,474,170	1,162,000	8.6%
Agriculture	78	0	0.0%	3,409,550	0	0.0%
Forestry	2091	25	1.2%	9,083,125	88,000	1.0%
TOTALS	5,902	179	3.0%	426,755,040	15,716,330	3.7%
Estimated residential po	pulation exposed to					

AREAS OF VERY LOW-TO-LOW LIQUEFACTION, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	9936	516	5.2%	1,000,302,268	44,909,065	4.5%	
Manufacturing	84	6	7.1%	201,876,264	46,409,485	23.0%	
Transportation	144	6	4.2%	370,722,427	2,983,600	0.8%	
Trade	262	12	4.6%	21,318,500	5,985,000	28.1%	
Services	239	7	2.9%	312,093,265	224,711,050	72.0%	
Recreation	95	5	5.3%	36,387,955	1,319,000	3.6%	
Agriculture	786	21	2.7%	45,114,200	922,530	2.0%	
Forestry	4399	319	7.3%	37,832,925	2,421,795	6.4%	
TOTALS	15954	893	5.6%	2,027,020,704	329,769,525	16.3%	
Estimated residential population exposed to hazard: 1,078							

SITE CLASS B



		Properties	Structures	People
	Site Class B	Exposed	Value	Affected
	District 1	23.1%	\$242 M	2,489
1	District 2	9.6%	\$53 M	861
	District 3	3.4%	\$15 M	297
	All Commissioner Districts	15.3%	\$310 M	3,647

SITE CLASS B, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	1191	25.4%	505,132,275	132,538,640	26.2%
Manufacturing	25	12	48.0%	88,385,803	82,747,222	93.6%
Transportation	27	6	22.2%	339,539,062	512,255	0.2%
Trade	35	5	14.3%	8,783,375	718,000	8.2%
Services	83	5	6.0%	34,201,025	837,510	2.4%
Recreation	30	6	20.0%	14,701,500	1,458,000	9.9%
Agriculture	604	82	13.6%	37,355,315	6,883,545	18.4%
Forestry	1702	1455	85.5%	21,554,705	16,415,380	76.2%
TOTALS	7,199	2,764	38.4%	1,049,653,060	242,110,552	23.1%
Estimated residential p	opulation exposed	to hazard: 2,48	9			

SITE CLASS B, COMMISSIONER DISTRICT 2

	Number of Structures			of Structures Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	412	20.6%	178,610,582	37,447,202	21.0%
Manufacturing	12	0	0.0%	103,354,547	0	0.0%
Transportation	18	7	38.9%	7,424,295	4,168,555	56.1%
Trade	35	3	8.6%	4,823,450	630,000	13.1%
Services	55	10	18.2%	236,169,015	1,481,565	0.6%
Recreation	20	3	15.0%	8,212,285	3,774,115	46.0%
Agriculture	104	16	15.4%	4,349,335	661,740	15.2%
Forestry	606	321	53.0%	7,195,095	4,841,900	67.3%
TOTALS	2,853	772	27.1%	550,612,604	53,005,077	9.6%
Estimated residential po	opulation exposed to	o hazard: 861				

SITE CLASS B, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	142	4.4%	316,559,411	12,592,595	4.0%
Manufacturing	47	1	2.1%	10,135,914	438,000	4.3%
Transportation	99	1	1.0%	23,759,070	85,045	0.4%
Trade	192	0	0.0%	7,711,675	0	0.0%
Services	101	2	2.0%	41,723,225	227,600	0.5%
Recreation	45	1	2.2%	13,474,170	21,000	0.2%
Agriculture	78	12	15.4%	3,409,550	242,810	7.1%
Forestry	2091	351	16.8%	9,083,125	1,112,795	12.3%
TOTALS	5,902	510	8.6%	426,755,040	14,719,845	3.4%
Estimated residential pop	pulation exposed to					

SITE CLASS B, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	1745	17.6%	1,000,302,268	182,578,437	18.3%
Manufacturing	84	13	15.5%	201,876,264	83,185,222	41.2%
Transportation	144	14	9.7%	370,722,427	4,765,855	1.3%
Trade	262	8	3.1%	21,318,500	1,348,000	6.3%
Services	239	17	7.1%	312,093,265	2,546,675	0.8%
Recreation	95	10	10.5%	36,387,955	5,253,115	14.4%
Agriculture	786	110	14.0%	45,114,200	7,788,095	17.3%
Forestry	4399	2127	48.4%	37,832,925	22,370,075	59.1%
TOTALS	15954	4046	25.4%	2,027,020,704	309,835,474	15.3%
Estimated residential	population expose					

SITE CLASS B TO C



ted
335

SITE CLASS B TO C, COMMISSIONER DISTRICT 1

	Number of Structures			Value of	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	2	0.0%	505,132,275	525,235	0.1%	
Manufacturing	25	0	0.0%	88,385,803	0	0.0%	
Transportation	27	0	0.0%	339,539,062	0	0.0%	
Trade	35	0	0.0%	8,783,375	0	0.0%	
Services	83	0	0.0%	34,201,025	0	0.0%	
Recreation	30	0	0.0%	14,701,500	0	0.0%	
Agriculture	604	0	0.0%	37,355,315	0	0.0%	
Forestry	1702	3	0.2%	21,554,705	0	0.0%	
TOTALS	7,199	5	0.1%	1,049,653,060	525,235	0.1%	
Estimated residential population exposed to hazard: 4							

SITE CLASS B TO C, COMMISSIONER DISTRICT 2

	Number of Structures			Value of	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	2000	6	0.3%	178,610,582	641,825	0.4%	
Manufacturing	12	0	0.0%	103,354,547	0	0.0%	
Transportation	18	0	0.0%	7,424,295	0	0.0%	
Trade	35	0	0.0%	4,823,450	0	0.0%	
Services	55	0	0.0%	236,169,015	0	0.0%	
Recreation	20	0	0.0%	8,212,285	0	0.0%	
Agriculture	104	0	0.0%	4,349,335	0	0.0%	
Other Resources	3	0	0.0%	474,000	0	0.0%	
TOTALS	2,853	22	0.8%	550,612,604	641,825	0.1%	
Estimated residential population exposed to hazard: 13							

SITE CLASS B TO C, COMMISSIONER DISTRICT 3

	Number of Structures			Value of	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	3246	23	0.7%	316,559,411	3,123,875	1.0%	
Manufacturing	47	0	0.0%	10,135,914	0	0.0%	
Transportation	99	0	0.0%	23,759,070	0	0.0%	
Trade	192	0	0.0%	7,711,675	0	0.0%	
Services	101	0	0.0%	41,723,225	0	0.0%	
Recreation	45	0	0.0%	13,474,170	0	0.0%	
Agriculture	78	0	0.0%	3,409,550	0	0.0%	
Forestry	2091	22	1.1%	9,083,125	141,700	1.6%	
TOTALS	5,902	45	0.8%	426,755,040	3,265,575	0.8%	
Estimated residential population exposed to hazard: 48							

SITE CLASS B TO C, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	31	0.3%	1,000,302,268	4,290,935	0.4%
Manufacturing	84	0	0.0%	201,876,264	0	0.0%
Transportation	144	0	0.0%	370,722,427	0	0.0%
Trade	262	0	0.0%	21,318,500	0	0.0%
Services	239	0	0.0%	312,093,265	0	0.0%
Recreation	95	0	0.0%	36,387,955	0	0.0%
Agriculture	786	0	0.0%	45,114,200	0	0.0%
Forestry	4399	41	0.9%	37,832,925	141,700	0.4%
TOTALS	15954	72	0.5%	2,027,020,704	4,432,635	0.2%
Estimated residential	population exposed t	o hazard: 65				

SITE CLASS C

	Site Class C	Properties Exposed	Structures Value	People Affected
3	District 1	26.34%	\$276 M	970
2 1	District 2	58.21%	\$320 M	4,180
•	District 3	17.09%	\$72 M	1,041
	All Commissioner Districts	33.05%	\$670 M	2,968

SITE CLASS C, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	464	9.89%	505,132,275	44,906,630	8.89%	
Manufacturing	25	1	4.00%	88,385,803	648,000	0.73%	
Transportation	27	4	14.81%	339,539,062	2,527,600	0.74%	
Trade	35	4	11.43%	8,783,375	530,000	6.03%	
Services	83	6	7.23%	34,201,025	221,319,000	647.11%	
Recreation	30	2	6.67%	14,701,500	527,000	3.58%	
Agriculture	604	29	4.80%	37,355,315	1,268,320	3.40%	
Forestry	1702	484	28.44%	21,554,705	4,751,635	22.04%	
TOTALS	7,199	994	13.81%	1,049,653,060	276,478,185	26.34%	
Estimated residential population exposed to hazard: 970							

SITE CLASS C, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	2000	2000	458	178,610,582	43,911,005	24.58%		
Manufacturing	12	12	2	103,354,547	46,181,485	44.68%		
Transportation	18	18	4	7,424,295	2,527,600	34.04%		
Trade	35	35	4	4,823,450	530,000	10.99%		
Services	55	55	5	236,169,015	221,180,000	93.65%		
Recreation	20	20	2	8,212,285	527,000	6.42%		
Agriculture	104	104	26	4,349,335	1,068,245	24.56%		
Forestry	606	606	402	7,195,095	4,568,495	63.49%		
TOTALS	2,853	2,853	903	550,612,604	320,493,830	58.21%		
Estimated residential po	Estimated residential population exposed to hazard: 4,180							

SITE CLASS C, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	3246	498	15.34%	316,559,411	45,823,900	14.48%	
Manufacturing	47	7	14.89%	10,135,914	289,825	2.86%	
Transportation	99	4	4.04%	23,759,070	16,882,695	71.06%	
Trade	192	4	2.08%	7,711,675	505,585	6.56%	
Services	101	8	7.92%	41,723,225	2,982,275	7.15%	
Recreation	45	1	2.22%	13,474,170	255,000	1.89%	
Agriculture	78	24	30.77%	3,409,550	1,559,110	45.73%	
Forestry	2091	632	30.22%	9,083,125	4,635,625	51.04%	
TOTALS	5,902	1,178	19.96%	426,755,040	72,934,015	17.09%	
Estimated residential population exposed to hazard: 1,041							

SITE CLASS C, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value o	Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	9936	1420	14.29%	1,000,302,268	134,641,535	13.46%		
Manufacturing	84	10	11.90%	201,876,264	47,119,310	23.34%		
Transportation	144	12	8.33%	370,722,427	21,937,895	5.92%		
Trade	262	12	4.58%	21,318,500	1,565,585	7.34%		
Services	239	19	7.95%	312,093,265	445,481,275	142.74%		
Recreation	95	5	5.26%	36,387,955	1,309,000	3.60%		
Agriculture	786	79	10.05%	45,114,200	3,895,675	8.64%		
Forestry	4399	1518	34.51%	37,832,925	13,955,755	36.89%		
TOTALS	15954	3,075	19.27%	2,027,020,704	669,906,030	33.05%		
Estimated residential population exposed to hazard: 2,968								

SITE CLASS C TO D



	Properties	Structures	People
Site Class C to D	Exposed	Value	Affected
District 1	81.5%	\$855 M	7,238
District 2	8.9%	\$49 M	734
District 3	53.3%	\$227 M	3,584
All Commissioner Districts	55.83%	\$1 B	11,556

SITE CLASS C TO D, COMMISSIONER DISTRICT 1

	Number of Structures			Value o	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	3463	73.8%	505,132,275	381,876,987	75.6%	
Manufacturing	25	13	52.0%	88,385,803	55,863,647	63.2%	
Transportation	27	15	55.6%	339,539,062	333,692,782	98.3%	
Trade	35	25	71.4%	8,783,375	5,426,985	61.8%	
Services	83	70	84.3%	34,201,025	31,762,625	92.9%	
Recreation	30	19	63.3%	14,701,500	12,868,000	87.5%	
Agriculture	604	246	40.7%	37,355,315	21,211,730	56.8%	
Forestry	1702	605	35.5%	21,554,705	12,278,530	57.0%	
TOTALS	7,199	4,458	61.9%	1,049,653,060	854,981,286	81.5%	
Estimated residential population exposed to hazard: 7,238							

SITE CLASS C TO D, COMMISSIONER DISTRICT 2

	Num	per of Structure	s	Value o	of Structures in Dol	ars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	2000	351	17.6%	178,610,582	41,834,290	23.4%	
Manufacturing	12	0	0.0%	103,354,547	0	0.0%	
Transportation	18	0	0.0%	7,424,295	0	0.0%	
Trade	35	4	11.4%	4,823,450	714,000	14.8%	
Services	55	3	5.5%	236,169,015	1,234,900	0.5%	
Recreation	20	2	10.0%	8,212,285	3,129,275	38.1%	
Agriculture	104	2	1.9%	4,349,335	966,235	22.2%	
Forestry	606	21	3.5%	7,195,095	1,314,835	18.3%	
TOTALS	2,853	383	13.4%	550,612,604	49,193,535	8.9%	
Estimated residential population exposed to hazard: 734							

SITE CLASS C TO D, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	3246	1715	52.8%	316,559,411	172,591,560	54.5%		
Manufacturing	47	35	74.5%	10,135,914	7,381,719	72.8%		
Transportation	99	23	23.2%	23,759,070	6,536,375	27.5%		
Trade	192	48	25.0%	7,711,675	6,238,090	80.9%		
Services	101	74	73.3%	41,723,225	20,213,585	48.4%		
Recreation	45	30	66.7%	13,474,170	9,902,170	73.5%		
Agriculture	78	21	26.9%	3,409,550	1,175,490	34.5%		
Forestry	2091	1383	66.1%	9,083,125	3,394,270	37.4%		
TOTALS	5,902	3,331	56.4%	426,755,040	227,438,159	53.3%		
Estimated residential population exposed to hazard: 3,584								

SITE CLASS C TO D, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value	Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	9936	5529	55.6%	1,000,302,268	596,302,837	59.61%		
Manufacturing	84	48	57.1%	201,876,264	63,245,366	31.33%		
Transportation	144	38	26.4%	370,722,427	340,229,157	91.77%		
Trade	262	77	29.4%	21,318,500	12,379,075	58.07%		
Services	239	147	61.5%	312,093,265	53,211,110	17.05%		
Recreation	95	51	53.7%	36,387,955	25,899,445	71.18%		
Agriculture	786	269	34.2%	45,114,200	23,353,455	51.77%		
Forestry	4399	2009	45.7%	37,832,925	16,987,635	44.90%		
TOTALS	15954	8172	51.2%	2,027,020,704	1,131,612,980	55.83%		
Estimated residential population exposed to hazard: 11,556								

SITE CLASS D



	Properties	Structures	People
Site Class D	Exposed	Value	Affected
District 1	0.5%	\$5 M	86
District 2	14.8%	\$81 M	1,670
District 3	23.6%	\$100 M	1,718
All Commissioner Districts	9.2%	\$187 M	3,474

SITE CLASS D, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	4690	41	0.9%	505,132,275	4,528,780	0.9%		
Manufacturing	25	0	0	88,385,803	0	0.0%		
Transportation	27	0	0	339,539,062	0	0.0%		
Trade	35	0	0	8,783,375	0	0.0%		
Services	83	0	0	34,201,025	0	0.0%		
Recreation	30	0	0	14,701,500	0	0.0%		
Agriculture	604	5	0.8%	37,355,315	334,695	0.9%		
Forestry	1702	48	2.8%	21,554,705	90,880	0.4%		
TOTALS	7,199	94	1.3%	1,049,653,060	4,954,355	0.5%		
Estimated residentia	Estimated residential population exposed to hazard: 86							

SITE CLASS D, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	2000	799	40.0%	178,610,582	60,338,215	33.8%		
Manufacturing	12	0	0.0%	103,354,547	0	0.0%		
Transportation	18	5	27.8%	7,424,295	650,640	8.8%		
Trade	35	23	65.7%	4,823,450	2,770,450	57.4%		
Services	55	30	54.5%	236,169,015	12,599,780	5.3%		
Recreation	20	12	60.0%	8,212,285	3,198,000	38.9%		
Agriculture	104	49	47.1%	4,349,335	1,546,135	35.5%		
Forestry	606	20	3.3%	7,195,095	289,000	4.0%		
TOTALS	2,853	938	32.9%	550,612,604	81,392,220	14.8%		
Estimated residential population exposed to hazard: 1,670								

Number of Structures			Value of Structures i	n Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	3246	822	25.3%	316,559,411	77,011,281	24.3%		
Manufacturing	47	0	0.0%	10,135,914	0	0.0%		
Transportation	99	7	7.1%	23,759,070	373,860	1.6%		
Trade	192	12	6.3%	7,711,675	624,000	8.1%		
Services	101	18	17.8%	41,723,225	16,579,620	39.7%		
Recreation	45	22	48.9%	13,474,170	6,119,000	45.4%		
Agriculture	78	2	2.6%	3,409,550	22,400	0.7%		
Forestry	2091	8	0.4%	9,083,125	70,730	0.8%		
TOTALS	5,902	891	15.1%	426,755,040	100,800,891	23.6%		
Estimated residential population exposed to hazard: 1,718								

SITE CLASS D, COMMISSIONER DISTRICT 3

SITE CLASS D, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structure		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	1662	16.7%	1,000,302,268	141,878,276	14.2%
Manufacturing	84	0	0.0%	201,876,264	0	0.0%
Transportation	144	12	8.3%	370,722,427	1,024,500	0.3%
Trade	262	35	13.4%	21,318,500	3,394,450	15.9%
Services	239	48	20.1%	312,093,265	29,179,400	9.3%
Recreation	95	34	35.8%	36,387,955	9,317,000	25.6%
Agriculture	786	56	7.1%	45,114,200	1,903,230	4.2%
Forestry	4399	76	1.7%	37,832,925	450,610	1.2%
TOTALS	15954	1923	12.1%	2,027,020,704	187,147,466	9.2%
Estimated residential po	opulation exposed t	o hazard: 3,474				

SITE CLASS D TO E

7	1	1	

Properties	Structures	People
Exposed	Value	Affected
17.0%	\$178 M	2,123
27.08%	\$149 M	472
16.4%	\$70 M	830
19.6%	\$397 M	3,426
	Properties Exposed 17.0% 27.08% 16.4% 19.6%	Properties Structures Exposed Value 17.0% \$178 M 27.08% \$149 M 16.4% \$70 M 19.6% \$397 M

SITE CLASS D TO E, COMMISSIONER DISTRICT 1

I

	Number of Structures			Value of Structures in Dollars					
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed			
Residential	4690	1016	21.7%	505,132,275	101,730,114	20.1%			
Manufacturing	25	12	48.0%	88,385,803	10,583,941	12.0%			
Transportation	27	9	33.3%	339,539,062	5,624,025	1.7%			
Trade	35	12	34.3%	8,783,375	5,535,390	63.0%			
Services	83	18	21.7%	34,201,025	9,806,860	28.7%			
Recreation	30	14	46.7%	14,701,500	3,641,500	24.8%			
Agriculture	604	522	86.4%	37,355,315	31,475,600	84.3%			
Forestry	1702	598	35.1%	21,554,705	9,940,095	46.1%			
TOTALS	7,199	2,202	30.6%	1,049,653,060	178,337,525	17.0%			
Estimated residential	Estimated residential population exposed to hazard: 2,123								

SITE CLASS D TO E, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	2000	226	11.3%	178,610,582	20,911,020	11.7%		
Manufacturing	12	11	91.7%	103,354,547	102,706,547	99.4%		
Transportation	18	3	16.7%	7,424,295	3,970,000	53.5%		
Trade	35	3	8.6%	4,823,450	489,000	10.1%		
Services	55	12	21.8%	236,169,015	11,517,770	4.9%		
Recreation	20	3	15.0%	8,212,285	3,458,825	42.1%		
Agriculture	104	32	30.8%	4,349,335	1,909,710	43.9%		
Forestry	606	219	36.1%	7,195,095	3,180,285	44.2%		
TOTALS	2,853	511	17.9%	550,612,604	148,582,157	27.0%		
Estimated residential population exposed to hazard: 472								

SITE CLASS D TO E, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	397	12.2%	316,559,411	45,370,280	14.3%
Manufacturing	47	7	14.9%	10,135,914	2,598,370	25.6%
Transportation	99	2	2.0%	23,759,070	8,753,000	36.8%
Trade	192	5	2.6%	7,711,675	549,585	7.1%
Services	101	9	8.9%	41,723,225	7,566,270	18.1%
Recreation	45	4	8.9%	13,474,170	1,608,000	11.9%
Agriculture	78	35	44.9%	3,409,550	498,835	14.6%
Forestry	2091	272	13.0%	9,083,125	1,949,850	21.5%
TOTALS	5,902	732	12.4%	426,755,040	69,788,190	16.4%
Estimated residential p	opulation exposed f	to hazard: 830				

SITE CLASS D TO E, ALL COMMISSIONER DISTRICTS

	Number of Struct	ures		Value of Structure	Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	9936	1639	16.5%	1,000,302,268	168,011,414	16.8%		
Manufacturing	84	30	35.7%	201,876,264	115,888,858	57.4%		
Transportation	144	14	9.7%	370,722,427	18,347,025	4.9%		
Trade	262	20	7.6%	21,318,500	6,573,975	30.8%		
Services	239	39	16.3%	312,093,265	28,890,900	9.3%		
Recreation	95	21	22.1%	36,387,955	8,708,325	23.9%		
Agriculture	786	589	74.9%	45,114,200	33,884,145	75.1%		
Forestry	4399	1089	24.8%	37,832,925	15,070,230	39.8%		
TOTALS	15954	3445	21.6%	2,027,020,704	396,707,872	19.6%		
Estimated residential po	opulation exposed t	o hazard: 3,426						

Grays Harbor County Buildings & Facilities At-Risk to Earthquake Hazards (Updated 7/23/2010)

County Facility & Function	Function	Year Built	Building Value	Content/ Equipment Value	Total Value	M-H Liquefaction	Site Class D-E	Site Class D	Site Class C-D
Old Courthouse 102 W. Broadway Montesano, WA	Law Library D.C. #1 / Probation Clerk's Office Superior Court Prosecutor's Office	1911/ 2001	22,363,833	316,556	22,680,389				•
Sheriff Admin. & New Jail 100 W. Broadway Montesano, WA		1985	13,895,600	481,077 1,191,064	15,567,471				•
Sheriff's Detectives Squad Room/Old DCI 131 Main Street North Montesano, WA		1948	279,600	25,750	305,350				•
Courthouse Annex Administration Bldg Broadway & Main Montesano, WA	Assessor's Office Auditor's Office Commissioners Off. Env. Health Planning & Bldg. Road Fund Solid Waste Mgmt. Treasurer's Office Central Services Insurance	1978	6,325,600	2,133,632	8,459,232				•
Facilities/Elections Corner of 1st & Spruce Montesano, WA	Janitorial Facility/ Maintenance	1961	131,880	85,215	217,095				•
Pearsall Building Multi-Serv Ctr. & Annex 2109 Sumner Avenue Aberdeen, WA	District Court #2 Health Dept. & Social Srvcs	1980	5,194,600	383,182 106,710	5,684,492	•		•	
Juvenile Detention Facility 103 Hagara Aberdeen, WA		1983	4,681,200	184,908 64,036	4,930,144	•		•	
Crisis Clinic 615 8th Street Hoquiam, WA		1994	7,131,670		7,131,670	•		•	
Fairgrounds 43 Elma-McCleary Rd Elma, WA	Mobile Unit (mod.) Extension Agent Weed/ Fair/ Pavilion	1997 / 1980	6,801,97	187,773 18,500	118,546				•
Vance Creek Park 76 Wenzel-Slough Rd Elma, WA		1992	443,774		443,774	•		•	
Montesano Shop 211 First Street North Montesano, WA		1993	2,630,600	1,235,578 2,740,521	6,606,699				•
Cosmopolis Shop Bismarck Cosmopolis, WA		1954	377,272	1,729,881	2,107,153	•		•	
Elma Shop		1991	474,438	1,526,358	2,000,796				•

County Facility & Function	Function	Year Built	Building Value	Content/ Equipment Value	Total Value	M-H Liquefaction	Site Class D-E	Site Class D	Site Class C-D
906 E. Main									
Conalis Shon		1938	582 900	72// 51//	1 307 /11/				
1623 Ocean Beach Rd		1550	302,500	, 24,314	1,507,414				•
Copalis Crossing, WA									
Pacific Beach Sewer		1998	1,296,420	68,626	1,507,598				
3194 Ocean Beach Rd									•
Pacific Beach, WA				10.077	10.077				
1006 North H Street				16,977	16,977	•			
Aberdeen, WA 98520									
Illahee/Oyehut			14,004	16,876	30,880				
24 Kione Street								•	
Ocean Shores, WA									
Storage		1951	214,680	25,000	239,680				
									•
Montesano, WA									
Oakview Group Homes		1998	170,300		170,300				
407 & 409 Oakhurst			170,300		170,300				•
Elma, WA									
Head Start Building		1998	568,219		568,219				
Fima WA									•
Elma Co-op Preschool		1930	83.515		83.515				
420 E. Young			,		,				•
Elma, WA									
Forestry Building		1996	2,455,000	101,982	2,556,982				•
310 W. Spruce									
Storage Building		1997	19,/33		19,/33				•
Montesano, WA 98563									•
Friends Landing			226,608		226,608				
Katon Road Extension			•		•	•	•		
Pacific Beach Sewer		1998	4,676,872		4,676,872				•
Extension									
New Builders Risk Project		1998	4,000,000		4,000,000				
Misc One-Eamily Residence		10/0	125 717	1 030	126 7/7				
215 W. Spruce		1949	125,717	1,030	120,747				
Montesano, WA									
Otis Pump Station		1998	164,440		164,440				
4791 SR 109									•
IVIOCIIPS, WA		1000	104 440		104 440				
39 S Fourth Street		1998	164,440		164,440				
Pacific Beach, WA									
Pump Station		1998	81,955		81,955				
#2 Diamond Drive									•
Pacific Beach, WA									

County Facility & Function	Function	Year Built	Building Value	Content/ Equipment Value	Total Value	M-H Liquefaction	Site Class D-E	Site Class D	Site Class C-D
3rd Phase Sewer Pumps 30A Pacific Lane		1999	128,369		128,369				•
Pump Station 3094 Ocean Beach		1999	122,004		122,004				•
Pump Station 4140 SR 109		1999	206,876		206,876				•
Modular New Sheriff's Squad Room 202 First Street N. Montesano, WA		1999	84,872		84,872				•
Twin Harbors Group Home		1978	213,495		213,495				
ORV Park CG/H Thurston County Hwy 8		1977	1,427,700	300,000	1,727,700				•

County Arterials at Risk from Medium to High Liquefaction and Site Class D - E

- Brooklyn Road Copalis Beach Road Elma McCleary Road Garrard Creek Road
- Monte Elma Road Montesano Street South Mox Chehalis Road Pioneer Avenue
- Porter Creek Road South Bank Road South Shore Road Wakefield Road

Critical Facilities Serving County Government & Residents At-Risk to Earthquake Hazards

			M-H	Site Class	Site Class	Site Class C-	Site Class
Facility	Туре	Location	Liquefaction	D-E	D	D	С
KAYO-AM/FM Radio Tower	20	City					•
East Hoquiam PUD Substation	23	County					•
Wishkah Valley E.S. & H.S.	6	County					•
GHFD #10 - Wishkah	10	County					•
GHFD #10 - Wishkah	10	County					•
GHFD #14 - Ocosta	10	County					•
Central E.S.	6	City	•	•			
A.J. West E.S.	6	City	•	•			
Alexander Young E.S.	6	City	•	•			
Emerson E.S.	6	City	•	•			
Harbor H.S. &\Hopkins Preschool	6	City	•	•			
Lincoln E.S.	6	City	•	•			
Miller Jr. H.S.	6	City	•	•			
Washington E.S.	6	City	•	•			
Aberdeen Fire Dept.	10	City	•	•			
East Hoquiam Fire Station	10	City	•	•			
Hoquiam Fire Dept.	10	City	•	•			
South Aberdeen Fire Station	10	City	•	•			
Aberdeen Police Dept.	18	City	•	•			

Facility	Turne	Location	M-H	Site Class	Site Class	Site Class C-	Site Class
Haquiam Police Dont	19PE	City		 ●	U	U	L
Washington State Datrol	10	City	•	•			
Abordoon BLID Communication Towor	20	City	•	•			
KGHO-AM Radio Tower	20	City	•	•			
KYRO-AM Radio Tower	20	City	•	•			
Grave Harbor Paper PLID Substation	20	City	•	•			
Market & A PUD Substation	23	City	•	•			
Monroe PUD Substation	23	City	•	•			
Scott Street PLID Substation	23	City	•	•			
State Street PUD Substation	23	City	•	•			
Weverbacuser Sawmill PLID Substation	23	City	•	•			
Weverbaeuser PLID Substation	23	City	•	•			
Weverbaeuser PLID Substation	23	City	•	•			
Cosmonolis E S	6	City	•	•			
Gravs Harbor\College	6	City	•	•			
Hoguiam H S	6	City	•	•			
Hoquiam M S	6	City	•	•			
McDermoth\F S	6	City	•	•			
Robert\Grav E S	6	City	•	•			
Stevens E S	6	City	•	•			
Weatherwax H S	6	City	•	•			
Cosmonolis Fire Dent	10	City	•	•			
Bowerman Airport	14	City	•	•			
Cosmonolis Police Dent	18	City	•	•			
Cosmonolis BPA Substation	23	City	•	•			
Cosmopolis PUD Substation	23	City	•	•			
Electric Park PUD Substation	23	City	•	•			
Grave Harbor City PUD Substation	23	City	•	•			
Harpo PUD Substation	23	City	•	•			
Highlands PUD Substation	23	City	•	•			
Seventh & N PUD Substation	23	City	•	•			
GHFD #15 - Artic	10	County	•	•			
D and B Airpark	14	County	•	•			
Elma Municipal Airport	14	County	•	•			
Chehalis Reservation Police Dept.	18	County	•	•			
Chehalis Tribe Communication Tower	20	County	•	•			
Taholah\E.S. & H.S.	6	County	•	•			
GHFD #15 - Artic	10	County	•	•			
GHFD #5 East Satsop	10	County	•	•			
GHFD #6 - North Hoguiam	10	County	•	•			
Quinault Reservation Fire Dept.	10	County	•	•			
Airfield	14	, County	•	•			
Banas Field	14	County	•	•			
Quinault Reservation Police Dept.	18	County	•	•			
Bernard Creek PUD Substation	23	County	•	•			
Harding Road PUD Substation	23	County	•	•			

Facility	Τνρε	Location	M-H Liquefaction	Site Class D-E	Site Class D	Site Class C- D	Site Class C
Westport Fire & S Beach Ambulance	10	City	•		•		
Ocean Shores Municipal Airport	14	City	•		•		
Westport Airport	14	City	•		•		
Westport Police Dept.	18	City	•		•		
Hoguiam Radio Range Station	20	City	•		•		
Westhaven PUD Substation	23	City	•		•		
Ocean Shores\E.S.	6	City	•		•		
Ocean Shores Fire Dept.	10	City	•		•		
Ocean Shores Police Dept.	18	City	•		•		
O.S. Public Works Communication		, i					
Tower	20	City	•		•		
Ocean Shores PUD Substation	23	City	•		•		
Copalis State Airport	14	County	•		•		
North Beach H.S.	6	County	•		•		
North Beach M.S.	6	County	•		•		
Ocosta Jr.\& Sr. H.S.	6	County	•		•		
Ocosta\E.S.	6	County	•		•		
GHFD #11 - Grayland	10	County	•		•		
Westport PUD Communication Tower	20	County	•		•		
Grayland PUD Substation	23	County	•		•		
Westport PUD Substation	23	County	•		•		
Oakville\E.S.	6	City				•	
GHFD #1 - Oakville	10	City				•	
Oakville Police Dept.	18	City				•	
Beacon Avenue E.S.	6	City				•	
Elma H.S.	6	City				•	
Elma M.S.	6	City				•	
McCleary E.S.	6	City				•	
Montesano Jr. & Sr. H.S.	6	City				•	
Oakville\H.S.	6	City				•	
Simpson\Avenue E.S.	6	City				•	
Elma Fire Dept.	10	City				•	
McCleary Fire Dept.	10	City				•	
Montesano Fire Dept.	10	City				•	
Elma Police Dept.	18	City				•	
Grays Harbor County Sheriffs Office	18	City				•	
McCleary Police Dept.	18	City				•	
Montesano Police Dept.	18	City				•	
Elma PUD Communication Tower	20	City				•	
G.H. County Radio Shop						•	
Communications Tower	20	City					
Elma PUD Substation	23	City				•	
McCleary Substation	23	City				•	
Montesano PUD Substation	23	City				•	
Promised Land PUD Substation	23	County				•	
Elma E.S.	6	County				•	

			M-H	Site Class	Site Class	Site Class C-	Site Class
Facility	Туре	Location	Liquefaction	D-E	D	D	С
Lake Quinault E.S. & H.S.	6	County				•	
Pacific\Beach E.S.	6	County				•	
Satsop E.S.	6	County				•	
GHFD #1 - Oakville	10	County				•	
GHFD #12 - McCleary	10	County				•	
GHFD #12 - McCleary	10	County				•	
GHFD #16 - Copalis Crossing	10	County				•	
GHFD #16 - Copalis Crossing	10	County				•	
GHFD #17 - Humptulips	10	County				•	
GHFD #17 - Humptulips	10	County				•	
GHFD #2 - Brady	10	County				•	
GHFD #2 - Central Park	10	County				•	
GHFD #4 - Lake Quinault	10	County				•	
GHFD #4 - Lake Quinault	10	County				•	
GHFD #5 - Bush Creek	10	County				•	
GHFD #5 - Satsop	10	County				•	
GHFD #7 - Copalis Beach	10	County				•	
GHFD #7 - Copalis Beach	10	County				•	
GHFD #7 - Copalis Beach	10	County				•	
GHFD #8 - Pacific Beach	10	County				•	
GHFD #8 Pacific Beach	10	County				•	
GHFD #8 Pacific Beach	10	County				•	
Bear Valley Skyranch	14	County				•	
Central Park Landing Strip	14	County				•	
Hogans Corner Airfield	14	County				•	
MY Airfield	14	County				•	
Wynoochee Valley Landing Strip	14	County				•	
Aloha Bidge Communication Tower	20	County				•	
G.H. Fairgrounds Communication							
Tower	20	County				•	
Saddle Mtn Communication Tower	20	County				•	
S Elma PUD Communication Tower	20	County				•	
Axford Prarie PUD Substation	23	County				•	
Cedarville PUD Substation	23	County				•	
Central Park PUD Substation	23	County				•	
Copalis Crossing PUD Substation	23	County				•	
Crane Creek PUD Substation	23	County				•	
Moclips PUD Substation	23	County				•	
Oyehut PUD Substation	23	County				•	
Quinault PUD Substation	23	County				•	
Satsop BPA Substation	23	County				•	
Satsop Park PUD Substation	23	County				•	
Satsop Park PUD Substation	23	County				•	
South Elma PUD Substation	23	County				•	
Dredge Port Substation	23	City					

SECTION 20: SEVERE STORM HAZARDS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide estimates of potential damage and exposure of people for severe storms in Grays Harbor County.

SEVERE STORM HIGH ESTIMATE



	Severe Storm	Properties	Structures	People
	High Estimate	Exposed	Value	Affected
5	District 1	5.0%	\$52 M	491
	District 2	5.0%	\$28 M	209
	District 3	5.0%	\$21 M	339
	All Commissioner Districts	5.0%	\$101 M	1,039

SEVERE STORM HIGH ESTIMATE, COMMISSIONER DISTRICT 1

	Number of Struct	ures	Value of Structures in	Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	235	5.0%	505,132,275	25,256,614	5.0%	
Manufacturing	25	1	5.0%	88,385,803	4,419,290	5.0%	
Transportation	27	1	5.0%	339,539,062	16,976,953	5.0%	
Trade	35	2	5.0%	8,783,375	439,169	5.0%	
Services	83	4	5.0%	34,201,025	1,710,051	5.0%	
Recreation	30	2	5.0%	14,701,500	735,075	5.0%	
Agriculture	604	30	5.0%	37,355,315	1,867,766	5.0%	
Forestry	1702	85	5.0%	21,554,705	1,077,735	5.0%	
TOTALS	7,199	360	5.0%	1,049,653,060	52,482,653	5.0%	
Estimated residential	population exposed	to hazard: 49	1				

SEVERE STORM HIGH ESTIMATE, COMMISSIONER DISTRICT 2

	Number of Struct	ures		Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	2000	100	5.0%	178,610,582	8,930,529	5.0%	
Manufacturing	12	1	5.0%	103,354,547	5,167,727	5.0%	
Transportation	18	1	5.0%	7,424,295	371,215	5.0%	
Trade	35	2	5.0%	4,823,450	241,173	5.0%	
Services	55	3	5.0%	236,169,015	11,808,451	5.0%	
Recreation	20	1	5.0%	8,212,285	410,614	5.0%	
Agriculture	104	5	5.0%	4,349,335	217,467	5.0%	
Forestry	606	30	5.0%	7,195,095	359,755	5.0%	
TOTALS	2,853	143	5.0%	550,612,604	27,530,630	5.0%	
Estimated residential po	pulation exposed t	o hazard: 209					

	Number of Struct	ures		Value of Structure	Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	3246	162	5.0%	316,559,411	15,827,971	5.0%		
Manufacturing	47	2	5.0%	10,135,914	506,796	5.0%		
Transportation	99	5	5.0%	23,759,070	1,187,954	5.0%		
Trade	192	10	5.0%	7,711,675	385,584	5.0%		
Services	101	5	5.0%	41,723,225	2,086,161	5.0%		
Recreation	45	2	5.0%	13,474,170	673,709	5.0%		
Agriculture	78	4	5.0%	3,409,550	170,478	5.0%		
Forestry	2091	105	5.0%	9,083,125	454,156	5.0%		
TOTALS	5,902	295	5.0%	426,755,040	21,337,752	5.0%		
Estimated residential p	opulation exposed t	o hazard: 339						

SEVERE STORM HIGH ESTIMATE, COMMISSIONER DISTRICT 3

SEVERE STORM HIGH ESTIMATE, ALL COMMISSIONER DISTRICTS

	Number of Struct	ures		Value of Structure	es in Dollars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	497	5.0%	1,000,302,268	50,015,113	5.0%
Manufacturing	84	4	5.0%	201,876,264	10,093,813	5.0%
Transportation	144	7	5.0%	370,722,427	18,536,121	5.0%
Trade	262	13	5.0%	21,318,500	1,065,925	5.0%
Services	239	12	5.0%	312,093,265	15,604,663	5.0%
Recreation	95	5	5.0%	36,387,955	1,819,398	5.0%
Agriculture	786	39	5.0%	45,114,200	2,255,710	5.0%
Forestry	4399	220	5.0%	37,832,925	1,891,646	5.0%
TOTALS	15,954	798	5.0%	2,027,020,704	101,351,035	5.0%
Estimated residential po	opulation exposed t	o hazard: 1,03	9			

SEVERE STORM LOW ESTIMATE



Severe Storm	Properties	Structures	People
Low Estimate	Exposed	Value	Affected
District 1	1.0%	\$10 M	98
District 2	1.0%	\$6 M	42
District 3	1.0%	\$4 M	67
All Commissioner Districts	1.0%	\$20 M	207

SEVERE STORM LOW ESTIMATE, COMMISSIONER DISTRICT 1

	Number of Struct	ures		Value of Structures	in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	47	1.0%	505,132,275	5,051,323	1.0%	
Manufacturing	25	0	1.0%	88,385,803	883,858	1.0%	
Transportation	27	0	1.0%	339,539,062	3,395,391	1.0%	
Trade	35	0	1.0%	8,783,375	87,834	1.0%	
Services	83	1	1.0%	34,201,025	342,010	1.0%	
Recreation	30	0	1.0%	14,701,500	147,015	1.0%	
Agriculture	604	6	1.0%	37,355,315	373,553	1.0%	
Forestry	1702	17	1.0%	21,554,705	215,547	1.0%	
TOTALS	7,199	72	1.0%	1,049,653,060	10,496,531	1.0%	
Estimated residential population exposed to hazard: 98							

Number of Structures				Value of Structure	es in Dollars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	20	1.0%	178,610,582	1,786,106	1.0%
Manufacturing	12	0	1.0%	103,354,547	1,033,545	1.0%
Transportation	18	0	1.0%	7,424,295	74,243	1.0%
Trade	35	0	1.0%	4,823,450	48,235	1.0%
Services	55	1	1.0%	236,169,015	2,361,690	1.0%
Recreation	20	0	1.0%	8,212,285	82,123	1.0%
Agriculture	104	1	1.0%	4,349,335	43,493	1.0%
Forestry	606	6	1.0%	7,195,095	71,951	1.0%
TOTALS	2,853	29	1.0%	550,612,604	5,506,126	1.0%
Estimated residential population exposed to hazard: 42						

SEVERE STORM LOW ESTIMATE, COMMISSIONER DISTRICT 2

SEVERE STORM LOW ESTIMATE, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	32	1.0%	316,559,411	3,165,594	1.0%
Manufacturing	47	0	1.0%	10,135,914	101,359	1.0%
Transportation	99	1	1.0%	23,759,070	237,591	1.0%
Trade	192	2	1.0%	7,711,675	77,117	1.0%
Services	101	1	1.0%	41,723,225	417,232	1.0%
Recreation	45	0	1.0%	13,474,170	134,742	1.0%
Agriculture	78	1	1.0%	3,409,550	34,096	1.0%
Forestry	2091	21	1.0%	9,083,125	90,831	1.0%
TOTALS	5,902	59	1.0%	426,755,040	4,267,550	1.0%
Estimated residential po	pulation exposed to	o hazard: 67				

SEVERE STORM LOW ESTIMATE, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	9936	99	1.0%	1,000,302,268	10,003,023	1.0%	
Manufacturing	84	1	1.0%	201,876,264	2,018,763	1.0%	
Transportation	144	1	1.0%	370,722,427	3,707,224	1.0%	
Trade	262	3	1.0%	21,318,500	213,185	1.0%	
Services	239	2	1.0%	312,093,265	3,120,933	1.0%	
Recreation	95	1	1.0%	36,387,955	363,880	1.0%	
Agriculture	786	8	1.0%	45,114,200	451,142	1.0%	
Forestry	4399	44	1.0%	37,832,925	378,329	1.0%	
TOTALS	15,954	160	1.0%	2,027,020,704	20,270,207	1.0%	
Estimated residential po	pulation exposed to	o hazard: 207					

SECTION 21: TSUNAMI HAZARDS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide estimates of potential damage and exposure of people for tsunami events in Grays Harbor County.

The following Tables, based on data from the Grays Harbor GIS system information, illustrate the possible damage to structures and impact on people from a tsunami. Additional people visiting the coastal area as tourists are not represented in the estimate. There is always an increase in the number of people at the beaches on any given day in the summer, especially on holiday weekends such as July 4th and Labor Day. Although the numbers will be smaller, it can also be expected there will be tourists visiting the area year round. These people, of course, will be vulnerable to a tsunami but it is not feasible to estimate the number of people given the variation in visitors by day and year.

HIGH POTENTIAL TSUNAMI



	Properties	Structures	People
High Potential Tsunami	Exposed	Value	Affected
District 1	0.6%	\$7 M	88
District 2	37.4%	\$206 M	2,008
District 3	28.8%	\$123 M	1,697
All Commissioner Districts	16.5%	\$355 M	5,263
	High Potential Tsunami District 1 District 2 District 3 All Commissioner Districts	High Potential TsunamiExposedDistrict 10.6%District 237.4%District 328.8%All Commissioner Districts16.5%	PropertiesStructuresHigh Potential TsunamiExposedValueDistrict 10.6%\$7 MDistrict 237.4%\$206 MDistrict 328.8%\$123 MAll Commissioner Districts16.5%\$355 M

HIGH POTENTIAL TSUNAMI, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	42	0.9%	505,132,275	4,687,260	0.9%	
Manufacturing	25	1	4.0%	88,385,803	725,000	0.8%	
Transportation	27	2	7.4%	339,539,062	252,000	0.1%	
Trade	35	0	0.0%	8,783,375	0	0.0%	
Services	83	0	0.0%	34,201,025	0	0.0%	
Recreation	30	1	3.3%	14,701,500	3,000	0.0%	
Agriculture	604	16	2.6%	37,355,315	887,345	2.4%	
Forestry	1702	24	1.4%	21,554,705	137,195	0.6%	
TOTALS	7,199	86	1.2%	1,049,653,060	6,691,800	0.6%	
Estimated residential population exposed to hazard: 88							

HIGH POTENTIAL TSUNAMI, COMMISIONER DISTRICT 2

	Number of Stru	ctures		Value of Struc	tures in Dollars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	961	48.1%	178,610,582	71,358,985	40.0%
Manufacturing	12	11	91.7%	103,354,547	102,706,547	99.4%
Transportation	18	9	50.0%	7,424,295	4,224,025	56.9%
Trade	35	28	80.0%	4,823,450	3,504,450	72.7%
Services	55	41	74.5%	236,169,015	14,962,550	6.3%
Recreation	20	15	75.0%	8,212,285	5,943,825	72.4%
Agriculture	104	67	64.4%	4,349,335	2,097,415	48.2%
Forestry	606	51	8.4%	7,195,095	409,635	5.7%
TOTALS	2,853	1,186	41.6%	550,612,604	205,681,432	37.4%
Estimated residential population exposed to hazard: 2.008						

	=			0		
Number of Structures				Value of Struct	ures in Dollars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	812	25.0%	316,559,411	81,708,566	25.8%
Manufacturing	47	1	2.1%	10,135,914	13,000	0.1%
Transportation	99	12	12.1%	23,759,070	5,515,960	23.2%
Trade	192	19	9.9%	7,711,675	1,488,340	19.3%
Services	101	31	30.7%	41,723,225	24,578,165	58.9%
Recreation	45	28	62.2%	13,474,170	8,160,500	60.6%
Agriculture	78	9	11.5%	3,409,550	722,250	21.2%
Forestry	2091	66	3.2%	9,083,125	616,940	6.8%
TOTALS	5,902	979	16.6%	426,755,040	122,808,621	28.8%
Estimated residential	population exposed	to hazard: 1,69) 7			

HIGH POTENTIAL TSUNAMI, COMMISSIONER DISTRICT 3

HIGH POTENTIAL TSUNAMI, ALL COMMISSIONER DISTRICTS

	Numl	ber of Structure	!S	Value	of Structures in D	ollars
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	1815	18.3%	1,000,302,268	157,754,811	15.8%
Manufacturing	84	13	15.5%	201,876,264	103,444,547	51.2%
Transportation	144	23	16.0%	370,722,427	9,991,985	2.7%
Trade	262	47	17.9%	21,318,500	4,992,790	23.4%
Services	239	72	30.1%	312,093,265	39,540,715	12.7%
Recreation	95	44	46.3%	36,387,955	14,107,325	38.8%
Agriculture	786	92	11.7%	45,114,200	3,707,010	8.2%
Forestry	4399	141	3.2%	37,832,925	1,163,770	3.1%
TOTALS	15954	2251	14.1%	2,027,020,704	335,181,853	16.5%
Estimated residentia	al population exposed	d to hazard: 5,2	263			

LOW POTENTIAL TSUNAMI



	Properties	Structures	People
Low Potential Tsunami	Exposed	Value	Affected
District 1	22.4%	\$1 B	9,712
District 2	61.6%	\$339 M	2,109
District 3	65.0%	\$277 M	4,205
All Commissioner Districts	81.9%	\$1 B	16,026

LOW POTENTIAL TSUNAMI, COMMISSIONER DISTRICT 1

	Numb	per of Structure	S	Value of	Structures in Dolla	ars
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	4647	99.1%	505,132,275	500,400,185	46.6%
Manufacturing	25	25	18588.0%	88,385,803	87,705,633	266.3%
Transportation	27	25	17211.1%	339,539,062	339,287,062	69.3%
Trade	35	35	13277.1%	8,783,375	8,783,375	2680.2%
Services	83	83	5598.8%	34,201,025	34,201,025	688.3%
Recreation	30	29	15490.0%	14,701,500	14,698,500	1601.3%
Agriculture	604	588	769.4%	37,355,315	36,467,970	630.2%
Forestry	1702	1678	273.0%	21,554,705	21,417,510	1092.1%
TOTALS	7,199	7113	64.6%	1,049,653,060	1,042,961,260	22.4%
Estimated residential	population exposed	to hazard: 9,72	12			

	Num	Number of Structures		Value of Structures in Dollars		Dollars
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	1009	50.5%	178,610,582	102,041,642	57.1%
Manufacturing	12	1	8.3%	103,354,547	648,000	0.6%
Transportation	18	7	38.9%	7,424,295	2,759,270	37.2%
Trade	35	8	22.9%	4,823,450	1,327,000	27.5%
Services	55	14	25.5%	236,169,015	221,206,465	93.7%
Recreation	20	5	25.0%	8,212,285	2,268,460	27.6%
Agriculture	104	37	35.6%	4,349,335	2,251,920	51.8%
Forestry	606	555	91.6%	7,195,095	6,785,460	94.3%
TOTALS	2,853	1,636	57.3%	550,612,604	339,288,217	61.6%
Estimated residential population exposed to hazard: 2,109						

LOW POTENTIAL TSUNAMI, COMMISSIONER DISTRICT 2

LOW POTENTIAL TSUNAMI, COMMISSIONER DISTRICT 3

	Numb	er of Structures	5	Value	of Structures in D	ollars
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	2012	62.0%	316,559,411	213,267,965	67.4%
Manufacturing	47	45	95.7%	10,135,914	9,989,914	98.6%
Transportation	99	19	19.2%	23,759,070	17,946,110	75.5%
Trade	192	42	21.9%	7,711,675	5,741,585	74.5%
Services	101	57	56.4%	41,723,225	12,811,675	30.7%
Recreation	45	16	35.6%	13,474,170	5,532,670	41.1%
Agriculture	78	69	88.5%	3,409,550	2,687,300	78.8%
Forestry	2091	2012	96.2%	9,083,125	8,343,185	91.9%
TOTALS	5,902	4,274	72.4%	426,755,040	277,214,404	65.0%
Estimated residential population exposed to hazard: 4,205						

LOW POTENTIAL TSUNAMI, ALL COMMISSIONER DISTRICTS

	Numb	per of Structure	s	Value o	f Structures in Doll	ars
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	7668	77.2%	1,000,302,268	815,709,792	81.5%
Manufacturing	84	71	84.5%	201,876,264	98,343,547	48.7%
Transportation	144	51	35.4%	370,722,427	359,992,442	97.1%
Trade	262	85	32.4%	21,318,500	15,851,960	74.4%
Services	239	154	64.4%	312,093,265	268,219,165	85.9%
Recreation	95	50	52.6%	36,387,955	22,499,630	61.8%
Agriculture	786	694	88.3%	45,114,200	41,407,190	91.8%
Forestry	4399	4245	96.5%	37,832,925	36,546,155	96.6%
TOTALS	15954	13023	81.6%	2,027,020,704	1,659,463,881	81.9%
Estimated residential population exposed to hazard: 16,026						

Asset Vulnerability Analysis for County and Critical Facilities: Tsunami Hazard

(Updated 7/23/2010)

County Facility	Function	Year Built	Building Value	Content/ Equipment Value	Total Value
Pearsall Building Multi-Serv Ctr. & Annex 2109 Sumner Avenue Aberdeen, WA	District Court #2 Health Dept. Social Services	1980	5,194,600	489,892	7,131,670
Juvenile Detention Facility 103 Hagara Aberdeen, WA		1983	4,681,200	184,908 64,036	4,930,144
Crisis Clinic 615 8 th Street Hoquiam, WA		1994	7,131,670		7,131,670
Cosmopolis Shop Bismarck Cosmopolis, WA		1954	377,272	1,729,881	2,107,153
Copalis Shop 1623 Ocean Beach Rd Copalis Crossing, WA		1938	582,900	724,514	1,307,414
Pacific Beach Sewer 3194 Ocean Beach Rd Pacific Beach, WA		1998	1,296,420	68,626	1,507,598
Coroner's Office 1006 North H Street Aberdeen, WA 98520				16,977	16,977
Illahee/Oyehut 24 Kione Street Ocean Shores, WA			14,004	16,876	30,880
Friends Landing Katon Road Extension			226,608		226,608
Pacific Beach Sewer Extension		1998	4,676,872		4,676,872
Misc. One-Family Residence 215 W. Spruce Montesano, WA		1949	125,717	1,030	126,747
Otis Pump Station 4791 SR 109 Moclips, WA		1998	164,440		164,440
Pump Station 39 S. Fourth Street Pacific Beach, WA		1998	164,440		164,440
Pump Station #2 Diamond Drive Pacific Beach, WA		1998	81,955		81,955
3 rd Phase Sewer Pumps 30A Pacific Lane			128,369		128,369

County Facility	Function	Year Built	Building Value	Content/ Equipment Value	Total Value
Pump Station 3094 Ocean Beach			122,004		122,004
Pump Station 4140 SR 109			206,876		206,876

Major County Arterials At-Risk to Tsunami

Monte Brady Road Monte Elma Road Montesano Street South Bank Road Wakefield Road

Critical Facilities Serving County Government & Residents At-Risk to Tsunami

Facility	Туре	Location	Med.Threat	High Threat
A.J. West E.S.	6	City		•
Alexander Young E.S.	6	City		•
Central E.S.	6	City		•
Elma M.S.	6	City		•
Emerson E.S.	6	City		•
Harbor H.S. &\Hopkins Preschool	6	City		•
Hoquiam M.S.	6	City		•
McDermoth\E.S.	6	City		•
Ocean Shores\E.S.	6	City		•
Stevens E.S.	6	City		•
Washington E.S.	6	City		•
Aberdeen Fire Dept.	10	City		•
East Hoquiam Fire Station	10	City		•
Hoquiam Fire Dept.	10	City		•
Montesano Fire Dept.	10	City		•
Ocean Shores Fire Dept.	10	City		•
South Aberdeen Fire Station	10	City		•
Westport Fire & South Beach Ambulance	10	City		•
Bowerman Airport	14	City		•
Ocean Shores Municipal Airport	14	City		•
Westport Airport	14	City		•

Facility	Туре	Location	Med.Threat	High Threat
Aberdeen Police Dept.	18	City		•
Hoquiam Police Dept.	18	City		•
Ocean Shores Police Dept.	18	City		•
Washington State Patrol	18	City		•
Westport Police Dept.	18	City		•
Aberdeen PUD Communication Tower	20	City		•
Hoquiam Radio Range Station	20	City		•
KAYO-AM/FM Radio Tower	20	City		•
KGHO-AM Radio Tower	20	City		•
KXRO-AM Radio Tower	20	City		•
O.S. Public Works Communication Tower	20	City		•
Dredge Port Substation	23	City		•
Grays Harbor Paper PUD Substation	23	City		•
Harpo PUD Substation	23	City		•
Market & A PUD Substation	23	City		•
Montesano PUD Substation	23	City		•
Ocean Shores PUD Substation	23	City		•
Scott Street PUD Substation	23	City		•
Seventh & N PUD Substation	23	City		•
State Street PUD Substation	23	City		•
Valley PUD Substation	23	City		•
Westhaven PUD Substation	23	City		•
Weyerhaeuser PUD Substation	23	City		•
Weyerhaeuser PUD Substation	23	City		•
Weyerhaeuser Sawmill PUD Substation	23	City		•
Elma E.S.	6	County		•
North Beach H.S.	6	County		•
North Beach M.S.	6	County		•
Ocosta Jr.\& Sr. H.S.	6	County		•
Ocosta\E.S.	6	County		•
Satsop E.S.	6	County		•
Taholah\E.S. & H.S.	6	County		•
GHFD #11 – Grayland Fire Dept.	10	County		•
GHFD #2 – Brady Fire Dept.	10	County		•

Facility	Туре	Location	Med.Threat	High Threat
GHFD #5 – Satsop Fire Dept.	10	County		•
Quinault Reservation Fire Dept.	10	County		•
Copalis State Airport	14	County		•
D and B Airpark	14	County		•
Elma Municipal Airport	14	County		•
Quinault Reservation Police Dept.	18	County		•
South Elma PUD Communication Tower	20	County		•
Westport PUD Communication Tower	20	County		•
Grayland PUD Substation	23	County		•
South Elma PUD Substation	23	County		•
Westport PUD Substation	23	County		•
GHFD #7 – Copalis Beach Fire Dept.	10	County	•	
GHFD #7 – Copalis Beach Fire Dept.	10	County	•	
GHFD #8 – Pacific Beach Fire Dept.	10	County	•	
Oyehut PUD Substation	23	County	•	

SECTION 22: HAZARDOUS MATERIAL INCIDENTS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

County Facilities At-Risk to Hazard Materials Incidents

All county facilities are potentially at-risk to hazardous materials incidents.

Critical Facilities Serving County Government & Residents At-Risk to Hazard Materials Incidents

All critical facilities are potentially at-risk to hazardous materials incidents.

Facility	Location(s)	Chemical(s)
AirGas Nor Pac	Aberdeen Elma	Anhydrous ammonia, chlorine , sulfur dioxide Nitrogen
Amerigas	Aberdeen	Propane
Applied Technical	Elma	Oxygen
CenturyTel*	Elma Humptulips* Quinault* McCleary Montesano Pacific Beach*	Sulfuric acid Sulfuric acid Sulfuric acid Sulfuric acid Sulfuric acid Sulfuric acid
City of Aberdeen	Water shop	Diesel fuel #2, gasoline, liquid propane caustic soda, chlorine gas, citric acid, phosphonic acid, sodium fluoride, aluminum, chlorhydrate, sulfur dioxide
City of Aberdeen	Water treatment plant*	Aluminum chlorhydrate, chlorine gas, citric acid, diesel fuel #2, phosphonic acid, sodium fluoride, sodium hydroxide
City of Aberdeen	Wishkah headworks*	Liquid propane gas
City of Aberdeen	Wynoochee intake*	Liquid propane gas
City of Aberdeen	Wastewater treatment plant	Chlorine, chlorine gas, sodium hydroxide, sulfur dioxide,
Ferrell Gas	Cosmopolis	Liquefied petroleum gas
Ferrell Gas	Elma	Liquefied petroleum gas
Ferrell Gas	Quinault*	Liquefied petroleum gas
Grays Harbor Energy Facility	Elma*	Aqua ammonia, battery electrolyte, carbon dioxide, diesel fuel #2, lead, mineral oil, sodium hydroxide, sodium hypochlorite, sulfuric acid
Grays Harbor Paper	Hoquiam	1,2,4 trichlorbenzene, aluminum sulfate, burner fuel #6, calcium carbonate, calcium oxide, diesel fuel #2, # 6 industrial burner fuel
Hoquiam Plywood	Hoquiam	Formaldehyde
Imperium Grays Harbory	Hoquiam	Canola oil, conola methylester, crude glycerin 2, liquid nitrogen, methanol, nitrogen, sodieum methylate, sulfuric acid, therminol 55
Lakeside Industries	2400 Sargent Rd, Aberdeen	Asphalt, asphalt emulsifier, diesel fuel #2, gasoline
Masco Petroleum	Aberdeen	Fuel oil, gasoline
Masco Petroleum	Westport	Diesel fuel #1 and #2, gasoline, hydraulic and lube oils, hydraulic fluid

(*Indicates locations within unincorporated Grays Harbor County)

Facility	Location(s)	Chemical(s)
Masco Petroleum	Montesano	Fuel oil, gasoline
Ocean Cold	Westport	Chlorodifluoromethane
Ocean Protein	Hoquiam	Sulfuric acid, sodium hypochloride, sodium hydroxide, linear alkyloxalate, hydrogen peroxide, 1-hydroxyethyliden-1
Rohm and Haas	Elma	Boric acid, borol solution, carbon dioxide, diesel fuel #2, ethylene glycol, isopropylamine, methanol, nitrogen, orex, potassium borohydride, potassium, sodium, sodium borohydride, sodium hydride dispersion, sodium hydride (60%), sodium hydroxide, sulfuric acid, trimethyl borate, venpure 20/20 solution, water rex, white mineral oil
Ocean Spray Cranberries	Markham*	Anhydrous ammonia, diesel fuel #2,nitrogen, urea
Pacific Bottling	Elma*	Propane
OfficeMax Homeplate Siding	Elma*	Diesel fuel #2, heat transfer oil, hydraulic fluid, paint, wood dust
Pacific Veneer	Aberdeen	Caustic soda, diesel fuel #2, heat transfer fluid, hydraulic fluid
Panel Tech International	Hoquiam	Assure, caustic soda, diethylamine, ethylene glycol, formaldehyde, methanol
Pettit Oil	Aberdeen	gasoline, hydraulic fluid, motor oil, transmission fluid, lubrication oil, cleaning solvent, industrial oil, toluene
Pettit Oil	Elma*	Diesel fuels #2, gasoline
Pettit Oil	Hoquiam	Acetone, diesel fuel #2, fuel oil #1, gasoline, lacquer thinner, MEK, Petroleum naphtha
Propane Etc.	Aberdeen	Propane
Puget Sound & Pacific RR	Elma	Crystaline silica, crystaline silica quartz
Grays Harbor PUD 1	Aberdeen	Petroleum,petroleum hydrocarbon
Qwest Corporation	Aberdeen	Diesel, lead, sulfuric acid
Qwest Corporation	Ocean Shores	Diesel #2, lead, sulfuric acid
Satsop Development Park	Elma*	Diesel fuel #2, gasoline, lead, sulfuric acid
Sierra Pacific Industries	Aberdeen*	Ammonia, anhydrous ammonia, diesel, hydraulic oil
Simpson Door Company	McCleary	Diesel fuel #2, polyvinyl acetate
Tacoma Power & Utilities	Wynoochee Dam*	Diesel fuel #2, gasoline, hydraulic fluid
Home Depot	Aberdeen	Lead, sulfuric acid
USCG Station	Westport	Diesel fuel #2, diesel red dyed #2
Verizon NW	Westport	Sulfuric acid, lead acid battery
Verizon NW	Ocean Shores	Sulfuric acid
Verizon NW	Grayland	Sulfuric acid
Verizon NW	Elma	Sulfuric acid
WDFW Fish Hatcheries	Elma*	Parasite S
WDFW Fish Hatcheries	Humptulips*	Parasite S

Facility	Location(s)	Chemical(s)
WDFW Fish Hatcheries	Lk. Aberdeen, Aberdeen*	Parasite S
WDOC Stafford Creek	Aberdeen*	Diesel Fuel#2, gasoline
Washington Crab Producers	Westport	Ammonia anhydrous, nitrogen, propane
Westport Shipyard	Westport & Hoquiam	Acetone, styrene, isopropanol, diesel, liquefied petroleum gas
Weyerhaeuser Sawmill	Aberdeen	Diesel, diesel fuel #2, hydraulic fluid, gasoline, kerosene, oil, wood dust
Weyerhaeuser Pulp Mill	Aberdeen	Aqua ammonia, avjet A, berol 509, borol solution, chlorine dioxide, defoamer parafree 410, diesel fuel #2,fuel oil #6, gasoline, grease, hydrochloric acid, liquid oxygen, lubrication oil, magnafloc 1598C polymer, magnesium hydroxide, methanol, monamid sheet softner, Nalco 1720, 1826, 22105, 8795, nitric acid, oxygen, parafree defoamer, phosphoric acid, polycarboxylic acid, propane, sodium chlorate, sodium hydroxide, sodium hypochlorate, sulfur molten, sulfur dioxide, surfactant, unleaded gasoline
WSDOT	Amanda Park*	Diesel fuel #2
WSDOT	Central Park*	Diesel fuel #2, gasoline
WSDOT	Elma	Diesel fuel #2, gasoline

Source: Washington State Department of Ecology, Hazardous Waste and Toxics Reduction Program, August 2010

SECTION 23: LANDSLIDE HAZARDS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide an estimate of the number of structures and people exposed to landslides in Grays Harbor County.

LANDSLIDES HAZARDS



		Properties	Structures	People
	Landslides	Exposed	Value	Affected
Ļ	District 1	0.4%	\$4 M	68
	District 2	0.1%	\$803,915	10
	District 3	0.1%	\$248,920	10
	All Commissioner Districts	0.2%	\$5 M	88

LANDSLIDES HAZARDS, COMMISIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	4690	32	0.7%	505,132,275	2,413,405	0.5%		
Manufacturing	25	0	0.0%	88,385,803	0	0.0%		
Transportation	27	0	0.0%	339,539,062	0	0.0%		
Trade	35	0	0.0%	8,783,375	0	0.0%		
Services	83	0	0.0%	34,201,025	0	0.0%		
Recreation	30	0	0.0%	14,701,500	0	0.0%		
Agriculture	604	3	0.5%	37,355,315	457,705	1.2%		
Forestry	1702	253	14.9%	21,554,705	1,126,315	5.2%		
TOTALS	7,199	288	4.0%	1,049,653,060	3,997,425	0.4%		
Estimated residential population exposed to hazard: 68								

LANDSLIDE HAZARDS, COMMISSIONER DISTRICT 2

	Number of Structures		Value of Structures in Dollars					
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	2000	5	0.3%	178,610,582	666,190	0.4%		
Manufacturing	12	0	0.0%	103,354,547	0	0.0%		
Transportation	18	1	5.6%	7,424,295	55,500	0.7%		
Trade	35	1	2.9%	4,823,450	8,000	0.2%		
Services	55	1	1.8%	236,169,015	12,000	0.0%		
Recreation	20	0	0.0%	8,212,285	0	0.0%		
Agriculture	104	0	0.0%	4,349,335	0	0.0%		
Forestry	606	86	14.2%	7,195,095	62,225	0.9%		
TOTALS	2,853	94	3.3%	550,612,604	803,915	0.1%		
Estimated residential population exposed to hazard: 10								

LANDSLIDE	HAZARDS.	COMMISSIONER	DISTRICT 3
	117 (27 (11 (2)),	COMMISSIONEN	DISTINCT S

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	5	0.2%	316,559,411	248,920	0.1%
Manufacturing	47	0	0.0%	10,135,914	0	0.0%
Transportation	99	0	0.0%	23,759,070	0	0.0%
Trade	192	0	0.0%	7,711,675	0	0.0%
Services	101	0	0.0%	41,723,225	0	0.0%
Recreation	45	0	0.0%	13,474,170	0	0.0%
Agriculture	78	0	0.0%	3,409,550	0	0.0%
Forestry	2091	6	0.3%	9,083,125	0	0.0%
TOTALS	5,902	11	0.2%	426,755,040	248,920	0.1%
Estimated residential	population exposed	to hazard: 10				

LANDSLIDE HAZARDS, ALL COMMISSIONER DISTRICTS

	Number of Structures		S	Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	42	0.4%	1,000,302,268	3,328,515	0.3%
Manufacturing	84	0	0.0%	201,876,264	0	0.0%
Transportation	144	1	0.7%	370,722,427	55,500	0.0%
Trade	262	1	0.4%	21,318,500	8,000	0.0%
Services	239	1	0.4%	312,093,265	12,000	0.0%
Recreation	95	0	0.0%	36,387,955	0	0.0%
Agriculture	786	3	0.4%	45,114,200	457,705	1.0%
Forestry	4399	345	7.8%	37,832,925	1,188,540	3.1%
TOTALS	15954	393	2.5%	2,027,020,704	5,050,260	0.2%
Estimated residential po	pulation exposed t	to hazard: 88				

County Facilities At-Risk to Landslide Hazard

No county facilities are potentially at-risk to landslide hazards. The Washington State Dept of Transportation indicates that sections of US Highways 8, 12, and 101 are prone to landslides. No county arterials cross landslide zones according to county maps.

Critical Facilities Serving County Government & Residents At-Risk to Landslide Hazards

No critical facilities are potentially at-risk to landslide hazards.

SECTION 24: VOLCANO HAZARDS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide an estimate of the number of structures and people exposed to volcanoes in Grays Harbor County.

VOLCANIC ASH FALL



	Properties	Structures	People
Volcanic Ash Fall	Exposed	Value	Affected
District 1	2.0%	\$20 M	196
District 2	2.0%	\$11 M	84
District 3	2.0%	\$8 M	136
All Commissioner Districts	2.0%	\$40 M	416

VOLCANIC ASH FALL, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	4690	94	2.0%	505,132,275	10,102,646	2.0%		
Manufacturing	25	1	2.0%	88,385,803	1,767,716	2.0%		
Transportation	27	1	2.0%	339,539,062	6,790,781	2.0%		
Trade	35	1	2.0%	8,783,375	175,668	2.0%		
Services	83	2	2.0%	34,201,025	684,021	2.0%		
Recreation	30	1	2.0%	14,701,500	294,030	2.0%		
Agriculture	604	12	2.0%	37,355,315	747,106	2.0%		
Forestry	1702	34	2.0%	21,554,705	431,094	2.0%		
TOTALS	7,199	144	2.0%	1,049,653,060	20,993,061	2.0%		
Estimated residential population exposed to hazard: 196								

VOLCANIC ASH FALL, COMMISSIONER DISTRICT 2

	Number of Strue			Value o	Value of Structures in Dollars	
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	40	2.0%	178,610,582	3,572,212	2.0%
Manufacturing	12	0	2.0%	103,354,547	2,067,091	2.0%
Transportation	18	0	2.0%	7,424,295	148,486	2.0%
Trade	35	1	2.0%	4,823,450	96,469	2.0%
Services	55	1	2.0%	236,169,015	4,723,380	2.0%
Recreation	20	0	2.0%	8,212,285	164,246	2.0%
Agriculture	104	2	2.0%	4,349,335	86,987	2.0%
Forestry	606	12	2.0%	7,195,095	143,902	2.0%
TOTALS	2,853	57	2.0%	550,612,604	11,012,252	2.0%
Estimated residential po	pulation exposed to	o hazard: 84				
VOLCANIC ASH FALL, COMMISSIONER DISTRICT 3

	Number of Structures			Value of	Structures in D	ollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	3246	65	2.0%	316,559,411	6,331,188	2.0%		
Manufacturing	47	1	2.0%	10,135,914	202,718	2.0%		
Transportation	99	2	2.0%	23,759,070	475,181	2.0%		
Trade	192	4	2.0%	7,711,675	154,234	2.0%		
Services	101	2	2.0%	41,723,225	834,465	2.0%		
Recreation	45	1	2.0%	13,474,170	269,483	2.0%		
Agriculture	78	2	2.0%	3,409,550	68,191	2.0%		
Forestry	2091	42	2.0%	9,083,125	181,663	2.0%		
TOTALS	5,902	118	2.0%	426,755,040	8,535,101	2.0%		
Estimated residential	Estimated residential population exposed to hazard: 136							

VOLCANIC ASH FALL, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	199	2.0%	1,000,302,268	20,006,045	2.0%
Manufacturing	84	2	2.0%	201,876,264	4,037,525	2.0%
Transportation	144	3	2.0%	370,722,427	7,414,449	2.0%
Trade	262	5	2.0%	21,318,500	426,370	2.0%
Services	239	5	2.0%	312,093,265	6,241,865	2.0%
Recreation	786	16	2.0%	45,114,200	902,284	2.0%
Agriculture	4399	88	2.0%	37,832,925	756,659	2.0%
Forestry	9	0	2.0%	1,372,900	27,458	2.0%
TOTALS	15,954	319	2.0%	2,027,020,704	40,540,414	2.0%
Estimated residential po	pulation exposed to	o hazard: 416				

CATASTROPHIC VOLCANIC ASH FALL



Catastrophic Volcanic	Properties	Structures	People
Ash Fall	Exposed	Value	Affected
District 1	5.0%	\$52 M	491
District 2	5.0%	\$27 M	209
District 3	5.0%	\$21 M	339
All Commissioner Districts	5.0%	\$101 M	1,039

CATASTROPHIC VOLCANIC ASH FALL, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	4690	235	5.0%	505,132,275	25,256,614	5.0%
Manufacturing	25	1	5.0%	88,385,803	4,419,290	5.0%
Transportation	27	1	5.0%	339,539,062	16,976,953	5.0%
Trade	35	2	5.0%	8,783,375	439,169	5.0%
Services	83	4	5.0%	34,201,025	1,710,051	5.0%
Recreation	30	2	5.0%	14,701,500	735,075	5.0%
Agriculture	604	30	5.0%	37,355,315	1,867,766	5.0%
Forestry	1702	85	5.0%	21,554,705	1,077,735	5.0%
TOTALS	7,199	360	5.0%	1,049,653,060	52,482,653	5.0%
Estimated residential	population exposed	to hazard: 491	L			

		,					
	Num	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	2000	100	5.0%	178,610,582	8,930,529	5.0%	
Manufacturing	12	1	5.0%	103,354,547	5,167,727	5.0%	
Transportation	18	1	5.0%	7,424,295	371,215	5.0%	
Trade	35	2	5.0%	4,823,450	241,173	5.0%	
Services	55	3	5.0%	236,169,015	11,808,451	5.0%	
Recreation	20	1	5.0%	8,212,285	410,614	5.0%	
Agriculture	104	5	5.0%	4,349,335	217,467	5.0%	
Forestry	606	30	5.0%	7,195,095	359,755	5.0%	
TOTALS	2,853	143	5.0%	550,612,604	27,530,630	5.0%	
Estimated residential	population exposed t	o hazard: 209					

CATASTROPHIC VOLCANIC ASH FALL, COMMISSIONER DISTRICT 2

Catastrophic Volcanic Ash Fall, Commissioner District 3

	Numb	per of Structures		Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	3246	162	5.0%	316,559,411	15,827,971	5.0%
Manufacturing	47	2	5.0%	10,135,914	506,796	5.0%
Transportation	99	5	5.0%	23,759,070	1,187,954	5.0%
Trade	192	10	5.0%	7,711,675	385,584	5.0%
Services	101	5	5.0%	41,723,225	2,086,161	5.0%
Recreation	45	2	5.0%	13,474,170	673,709	5.0%
Agriculture	78	4	5.0%	3,409,550	170,478	5.0%
Forestry	2091	105	5.0%	9,083,125	454,156	5.0%
TOTALS	5,902	295	5.0%	426,755,040	21,337,752	5.0%
Estimated residential po	pulation exposed to	o hazard: 339				

CATASTROPHIC VOLCANIC ASH FALL, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	497	5.0%	1,000,302,268	50,015,113	5.0%
Manufacturing	84	4	5.0%	201,876,264	10,093,813	5.0%
Transportation	144	7	5.0%	370,722,427	18,536,121	5.0%
Trade	262	13	5.0%	21,318,500	1,065,925	5.0%
Services	239	12	5.0%	312,093,265	15,604,663	5.0%
Recreation	95	5	5.0%	36,387,955	1,819,398	5.0%
Agriculture	786	39	5.0%	45,114,200	2,255,710	5.0%
Forestry	4399	220	5.0%	37,832,925	1,891,646	5.0%
TOTALS	15,954	798	5.0%	2,027,020,704	101,351,035	5.0%
Estimated residential population exposed to hazard: 1,039						

County Facilities and Major Arterials At-Risk to Volcano Hazards

All county facilities and major arterials are potentially at-risk to volcano ash fall.

Critical Facilities Serving County Government & Residents At-Risk to Volcano Hazards

All critical facilities are potentially at-risk to volcano ash fall.

SECTION 25: WILDFIRE HAZARDS ASSET VULNERABILITY ASSESSMENT FOR STRUCTURES, PEOPLE, AND CRITICAL FACILITIES

The tables below provide an estimate of the number of structures and people exposed to wildfires in Grays Harbor County.

WILDLAND FIRE



		Properties	Structures	People
	Wildland Fire	Exposed	Value	Affected
	District 1	1.0%	\$10 M	98
3	District 2	1.0%	\$6 M	42
1	District 3	1.0%	\$4 M	67
	All Commissioner Districts	1.0%	\$20 M	207

WILDLAND FIRE, COMMISSIONER DISTRICT 1

	Number of Structures			Value of Structures in Dollars			
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed	
Residential	4690	47	1.0%	505,132,275	5,051,323	1.0%	
Manufacturing	25	0	1.0%	88,385,803	883,858	1.0%	
Transportation	27	0	1.0%	339,539,062	3,395,391	1.0%	
Trade	35	0	1.0%	8,783,375	87,834	1.0%	
Services	83	1	1.0%	34,201,025	342,010	1.0%	
Recreation	30	0	1.0%	14,701,500	147,015	1.0%	
Agriculture	604	6	1.0%	37,355,315	373,553	1.0%	
Forestry	1702	17	1.0%	21,554,705	215,547	1.0%	
TOTALS	7,199	72	1.0%	1,049,653,060	10,496,531	1.0%	
Estimated residential	population exposed	to hazard: 98					

WILDLAND FIRE, COMMISSIONER DISTRICT 2

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	2000	20	1.0%	178,610,582	1,786,106	1.0%
Manufacturing	12	0	1.0%	103,354,547	1,033,545	1.0%
Transportation	18	0	1.0%	7,424,295	74,243	1.0%
Trade	35	0	1.0%	4,823,450	48,235	1.0%
Services	55	1	1.0%	236,169,015	2,361,690	1.0%
Recreation	20	0	1.0%	8,212,285	82,123	1.0%
Agriculture	104	1	1.0%	4,349,335	43,493	1.0%
Forestry	606	6	1.0%	7,195,095	71,951	1.0%
TOTALS	2,853	29	1.0%	550,612,604	5,506,126	1.0%
Estimated residential po	pulation exposed to	o hazard: 42				

WILDLAND FIRE, COMMISSIONER DISTRICT 3

	Number of Structures			Value of Structures in Dollars				
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed		
Residential	3246	32	1.0%	316,559,411	3,165,594	1.0%		
Manufacturing	47	0	1.0%	10,135,914	101,359	1.0%		
Transportation	99	1	1.0%	23,759,070	237,591	1.0%		
Trade	192	2	1.0%	7,711,675	77,117	1.0%		
Services	101	1	1.0%	41,723,225	417,232	1.0%		
Recreation	45	0	1.0%	13,474,170	134,742	1.0%		
Agriculture	78	1	1.0%	3,409,550	34,096	1.0%		
Forestry	2091	21	1.0%	9,083,125	90,831	1.0%		
Other Resources	3	0	1.0%	898,900	8,989	1.0%		
TOTALS	5,902	59	1.0%	426,755,040	4,267,550	1.0%		
Estimated residential po	Estimated residential population exposed to hazard: 67							

WILDLAND FIRE, ALL COMMISSIONER DISTRICTS

	Number of Structures			Value of Structures in Dollars		
Land Use	Total Parcels	# Exposed	% Exposed	Total Value	# Exposed	% Exposed
Residential	9936	99	1.0%	1,000,302,268	10,003,023	1.0%
Manufacturing	84	1	1.0%	201,876,264	2,018,763	1.0%
Transportation	144	1	1.0%	370,722,427	3,707,224	1.0%
Trade	262	3	1.0%	21,318,500	213,185	1.0%
Services	239	2	1.0%	312,093,265	3,120,933	1.0%
Recreation	95	1	1.0%	36,387,955	363,880	1.0%
Agriculture	786	8	1.0%	45,114,200	451,142	1.0%
Forestry	4399	44	1.0%	37,832,925	378,329	1.0%
Other Resources	9	0	1.0%	1,372,900	13,729	1.0%
TOTALS	15,954	160	1.0%	2,027,020,704	20,270,207	1.0%
Estimated residential population exposed to hazard: 207						

A wildland fire can occur almost anywhere in the county thus all property and residents would be at risk. A wildfire can be expected to be confined to a local area rather then spread throughout the County, but it can be assumed about the same percent of damage would occur. A reasonable estimate assumes not more than 1% of structures and people might be exposed to damaging impacts by a major wildland fire.

County Facilities and Major Arterials At-Risk to Wildland Fire Hazards

No county facilities are potentially at-risk to wildland fire hazards.

Critical Facilities Serving County Government & Residents At-Risk to Wildland Fire Hazards

No critical facilities are potentially at-risk to wildland fire hazards.

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SECTION 27 PUBLIC PARTICIPATION DOCUMENTATION

The public had the opportunity to participate in the development of the Grays Harbor Hazard Mitigation Plan through public meetings and on-line.

The county's Division of Emergency Management (DEM) issued three press releases during the planning period. The first, dated July 16, 2010 informed the public on the update process. The second, issued August 25, 2010 focused on the three open house events held in Grayland, Pacific Beach, and Elma. The third was released on May 2, 2011 to invite the public to attend a draft plan presentation and comment opportunity. DEM sent the press releases to local newspapers and radio stations. Copies of the press releases follow on the next page.





Presentation Wednesday night on Hazard Mitigation Plan

The Daily World

Tuesday, May 10, 2011 - 12:03

Whether it's helping homeowners elevate their homes in areas with frequent flooding or retrofitting schools or fire halls to reduce the threat of collapse during earthquakes, the county's 2011-2016 Hazard Mitigation Plan is the key document that will help with disaster funds.

On Wednesday, the county will conduct a public meeting to present and take comment on its hazard mitigation plan. The meeting is set for 6 p.m. in the Commissioner's Meeting Room at 100 West Broadway in Montesano.

The disasters covered in the plan include floods, severe storms, earthquakes, tsunamis, landslides, wildland fire, volcanoes, and hazardous materials incidents.

Projects mentioned in the county's Hazards Mitigation Plan are eligible for Hazard Mitigation grants through the Federal Emergency Management Agency as well as other state and federal grant programs.

The format of the public meeting will include a presentation about the plan, a question and answer period, and an opportunity to leave comments at hazard workstations.

Copies of the plan are available on-line at http://www.co.graysharbor.wa.us/GHCoHazardsMitigation/ or by calling the office at 249-3911. The website also includes additional information about hazard mitigation planning.

Another avenue used by the county's DEM was to announce schedules for public workshops and meetings on its website. The final public meeting was available on-line; the final public meeting remains accessible for viewing through the On-Line Audio/Visual Library.

While attendance at the Hazard Mitigation Planning Team level was good, public participation during the Open House events was poor despite media coverage. At the Open House in Grayland, three people

Article published in *The Daily World,* May 10, 2011 edition. attended; their comments focused on the need to replace the fire station. At Pacific Beach, the two individuals who attended stated their interest in two projects: relocating the public radio to a location on higher ground so it would stay functional during a tsunami event and retrofitting the Moclips Bridge to ensure a safe evacuation route from the North Beach area. There were no comments provided at the Elma Open House.

Listen Live Tune in to KBKW NOW!	KBKW Locally Owned, Totally Involved! Listen to Station ON NOW: M Michael Medved Show (1 hour remaining) Powered by TuneI	Aberdeen, WA
Report from KBKW Radio in Aberdeen	< >	Aberdeen 57°F AccuWeather.com Weather Forecast
Grays Harbor County to Discuss Hazard Mitigation Plan		
Posted by David Haviland on April 25, 2011 at 1:49 pm		
Montesano, WA - Grays Harbor County will hold a public meeting to present and take comment on its draft of the 2011-2016 Hazard Mitigation Plan. The meeting will begin at 6 PM, May 11, 2011, in the Commissioner's Meeting Room at 100 West Broadway in Montesano. The 2011-2016 Hazard Mitigation Plan focuses on programs and projects aimed at reducing the impacts of disaster events before they happen. The disasters covered in the plan include floods, severe storms, earthquakes, tsunamis, landslides, wildland fire, volcanoes, and hazardous materials incidents.		

Public attendance at the final public comment meeting was similarly poor despite an article in the regional newspaper. Several Hazard Mitigation Planning Team members showed and a representative from the county's Public Health and Social Services Department were the only attendees. The county did not receive any comments through its on-line response line either.



Excerpt from the May 11, 2011 Audio-Visual Library presentation.

GRAYS HARBOR COUNTY EMERGENCY MANAGEMENT

310 W. Spruce Street Suite 2012 Montesano, WA 98563 Phone (360) 249-3911

Press Release

Contact: Charles Wallace Phone: (360) 249-3911 FOR IMMEDIATE RELEASE 9 A.M. PDT, July 16, 2010

GRAYS HARBOR COUNTY TO UPDATE HAZARD MITIGATION PLAN

What is the best way to prevent the loss of life from buildings collapsing during an earthquake?

You identify the most vulnerable buildings and make them earthquake proof before the disaster happens.

This is just one of the goals of the Grays Harbor County All Hazards Mitigation Plan. The plan identifies critical projects and programs that protect lives, property, and economic security from the impacts of disasters before they happen. Along with earthquakes, the plan also explores how to mitigate the impacts of floods, severe storms, tornados, landslides, volcanoes, wildfire, and hazardous materials.

The plan looks at five ways to protect people, property, and the local economy:

- Prevention actions that influence construction practices and use of property;
- Property protection efforts that modify existing building or infrastructure to make it more resistant to disasters;
- Public education and awareness about disaster risks;
- Natural resource actions that preserve and restore natural systems that mitigate disasters like floods; and
- Structural projects such as stormwater control, floodwalls, and tsunami evacuation areas.

To prepare the plan, the county has enlisted the help of a local planning team consisting of representatives from county government, industry, health care, agriculture, utilities, schools, housing, and economic development. The team is learning about each disaster impact and identifying strategies and projects to mitigate them.

The public will have a chance to learn about disaster impacts and share their ideas at three evening Open House Events scheduled in September. The events will happen in Elma on September 1, South Beach on September 7, and North Beach on September 9. More details about the times and locations of these events will be announced soon.

For more information about the Hazard Mitigation Plan and process, please check with the Grays Harbor County Emergency Management web page at: <u>www.co.grays-harbor.wa.us/info/DEM/Index.asp</u>.

310 W. Spruce Street Suite 2012 Montesano, WA 98563 Phone (360) 249-3911

Press Release

Contact: Charles Wallace Phone: (360) 249-3911 FOR IMMEDIATE RELEASE 9 A.M. PDT, August 25, 2010

GRAYS HARBOR COUNTY TO HOST HAZARD MITIGATION OPEN HOUSE EVENTS

Grays Harbor County will host three Hazard Mitigation open house events to listen to citizens ideas about how to reduce the impacts of disasters before they happen. Citizens can drop by at each open house event anytime from 4 to 7 PM to look at displays, share their opinions and ideas, and chat with county representatives.

The open house events will be at the Grayland Community Hall on September 1, the Elma Timberland Library on September 7, and the Fire District 8 Station in Pacific Beach on September 9.

The open house events are part of the Hazard Mitigation Plan update currently underway at Grays Harbor County. This plan focuses on programs and projects aimed at reducing the impacts of disaster events before they happen.

One example of a hazard mitigation program is helping homeowners elevate their homes in areas with frequent flooding. Elevating homes will prevent costly flood damage when floods do happen. Another example is retrofitting schools or fire halls to reduce the threat of collapse during earthquakes.

Projects mentioned in the county's Hazards Mitigation Plan make them eligible for Hazard Mitigation Grants through the Federal Emergency Management Agency (FEMA) as well as other state and federal grant programs.

The disasters covered in the plan and at the open house events will include floods, earthquakes, tsunamis, severe storm, landslide, volcano, wildland fire, and hazardous materials incidents.

For more information about the open house events and hazard mitigation planning, citizens can check out Grays Harbor County's Emergency Management website at <u>www.co.grays-harbor.wa.us/info/DEM</u>, or by calling the office at 249-3911.

GRAYS HARBOR COUNTY EMERGENCY MANAGEMENT

310 W. Spruce Street Suite 2012 Montesano, WA 98563 Phone (360) 249-3911

Press Release

Contact: Charles Wallace Phone: (360) 249-3911 FOR IMMEDIATE RELEASE 9 A.M. PDT, May 2, 2011

GRAYS HARBOR COUNTY TO PRESENT HAZARD MITIGATION PLAN

Grays Harbor County will hold a public meeting to present and take comment on its draft of the 2011-2016 Hazard Mitigation Plan. The meeting will begin at 6 PM, May 11, 2011, in the Commissioner's Meeting Room at 100 West Broadway in Montesano.

The 2011-2016 Hazard Mitigation Plan focuses on programs and projects aimed at reducing the impacts of disaster events before they happen. The disasters covered in the plan include floods, severe storms, earthquakes, tsunamis, landslides, wildland fire, volcanoes, and hazardous materials incidents.

One example of a hazard mitigation program is helping homeowners elevate their homes in areas with frequent flooding. Elevating homes will prevent costly flood damage when floods do happen. Another example is retrofitting schools or fire halls to reduce the threat of collapse during earthquakes.

Projects mentioned in the county's Hazards Mitigation Plan make them eligible for Hazard Mitigation Grants through the Federal Emergency Management Agency (FEMA) as well as other state and federal grant programs.

The format of the public meeting will include a presentation about the plan, a question and answer period, and an opportunity to leave comments at hazard workstations.

Copies of the plan are available on-line at <u>http://www.co.grays-harbor.wa.us/GHCoHazardsMitigation/</u> or by calling the office at 249-3911. The website also includes additional information about hazard mitigation planning.