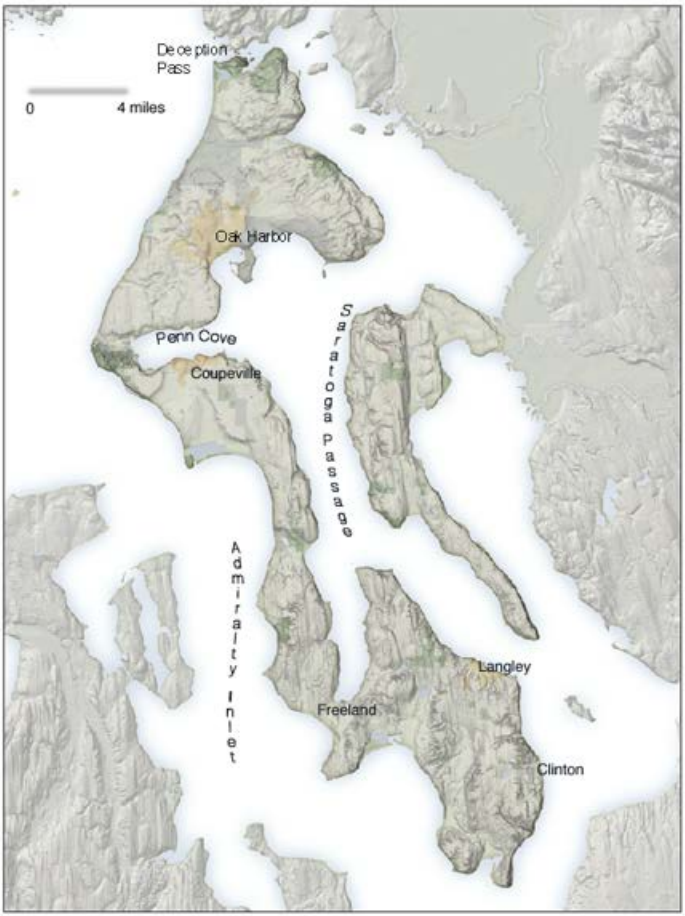
Natural Hazards on Whidbey Island

Protect and prepare your family and your home — a guide for surviving disasters caused by earthquakes, landslides, wildland fires, tsunamis, and windstorms

Island County, Washington
Department of Emergency Management



Digital elevation map of Island County (Jessica Larson)

Dealing with Natural Hazards on Whidbey Island

This is a guide to the natural hazards that could affect you, your family, and your property. It offers a brief description of the ways you can prepare your home and family to survive disasters caused by earthquakes, landslides, wildland fires, tsunamis, and windstorms.

Power outages caused by windstorms during the winter of 2006-2007 — as well as numerous other events in prior and more recent years — have made most residents of Whidbey Island amply aware of the difficulties of being without light, heat, water, and the ability to prepare meals or use health-related equipment. Although most of us have experienced being without power for less than a week, we have still been able to travel to a grocery, a hospital, or the mainland. Friends across the island could help each other.

But what if there were a major natural disaster that cut off the island from the mainland and we were entirely on our own for two or three weeks? A truly large storm or an earthquake could destroy or damage docks at the Clinton and Coupeville ferries systems and seriously compromise footings of the Deception Pass bridge, disrupting delivery of food, water, fuel, emergency services, and many other vitally necessary elements of our Island life. These realities are even more evident recently as we have had record rains, experienced more landslides, and observed the damage suffered by the islands of New Zealand and Japan.

This pamphlet consists of 33 articles, originally published in the *Whidbey Marketplace & News* in 2009/2010 and edited in 2014, which provided readers with basic information on the causes and effects of natural disasters, their frequencies, and the risks that accompany such events. The articles suggest multiple ways to prepare the readers, their families, and their homes for a natural disaster. Using this information as well as some careful

planning, you can mitigate the risks from these disasters and prepare yourselves and your families to be more self-sufficient for the two to three weeks that might intervene before Whidbey Island receives substantial external help. We thank the *Rotary Club of South Whidbey Island* and the *Whidbey Marketplace and News* (now the *Whidbey Weekly*) for supporting this public service.

These articles are meant to supplement information and training already available to Whidbey Island residents from Island County Government, the American Red Cross, and Community Emergency Response Teams (CERT). If you have access to the internet, you'll find additional information on preparing for emergencies from Island County Department of Emergency Management on their web site:

http://www.islandcounty.net/commissioners/dem/preparedness.htm.

Another excellent online source of information is from the State of Washington:

http://www.emd.wa.gov/publications/documents/0001-2013EmergencyPreparednessGuide.pdf

Most of these articles were written and edited by Grant Heiken in 2010; some updates were added in 2014. Richard Davis, Heath Gunn, George Henny, and Lauren Pool also contributed original articles.

Are you prepared for these natural hazards on Whidbey Island?

How can you mitigate their possible effects?

Earthquakes	2
Landslides	20
Wildland Fires	28
Tsunamis	34
Windstorms	40
Disaster Mitigation for Your Family	48

Brief History of Pacific Northwest Earthquakes

Just a little more than a decade ago, at 10:55 am on February 28, 2001, a large earthquake struck the Puget Sound area. The magnitude 6.8 Nisqually Earthquake originated 11 miles northeast of Olympia and affected our entire region. The result was one death (resulting from a heart attack) and $2 billion in damage, mostly in cities.

How often do we experience earthquakes that are severe enough to damage the homes and our infrastructure on Whidbey Island? [For reference, a 1.0 quake is not felt by humans, a 3.0 quake will make ornaments quiver on your shelves, and a 6.5 event might cause a house to collapse.]

The Pacific Northwest Seismic Network (a team effort involving the state, the U. S. Geological Survey, and the University of Washington) monitors about 1000 earthquakes each year in Washington and Oregon. However, most of these quakes have a magnitude of less than 1.0 — small enough that they are detected only by seismographs. Usually, only about 25 of the yearly events are large enough to be felt.

Over the last 135 years there have been 20 significant, damaging earthquakes in the region. Earthquakes with magnitudes of 5.0 or more occurred in 1904, 1909, 1932, 1939, 1945, 1946, 1949, 1965, 1995, 1996, 1999, and 2001. Older events are less well documented because of

the young historical record for Washington State. For information about quakes before 1850, we depend on findings from geologists who date events by examining the remains of disrupted near-surface deposits and deposits left in near-shore lagoons by tsunamis. Geological detective work has revealed that there was a major earthquake in the region on January 26, 1700.

How can we be so precise about the date? This estimated magnitude 9.0 (!) earthquake, which originated off the Washington-Oregon coast, caused a large tsunami that devastated low-lying communities along the eastern coast of Japan. (This is the subject of "The Orphan Tsunami of 1700" [University of Washington Press, 2005], by Brian Atwater and his colleagues in the U.S. and Japan).

There is no way to predict when an earthquake will occur, but over the last hundred years there have been at least 11 significant quakes, and it has now been over 300 years since there was a devastating one. It is realistic to expect more major earthquakes in the future and also to expect that one of them may be a truly giant earthquake.

Publication:

Earthquakes in Washington (Washington Division of Geology and Earth Resources) is an excellent source of information on the damaging earthquakes that have occurred in the state during the past 135 years.

Internet Resources:

http://www.dnr.wa.gov/researchscience/topics/geologichazardsmapping/pages/earthquakes.aspx

Sources of Earthquakes That Would Affect Whidbey Island

Looking west from Whidbey Island, the Olympic Mountains dominate the horizon. These dramatic peaks are the eroded remnants of seafloor sediments and lavas that were forced eastward and buckled by the constant movement of two plates in the Earth's crust: the Juan de Fuca plate in the Pacific and the North American Plate, on which we live. These plates collide along a zone about 50 miles off the coasts of British Columbia, Washington, and Oregon. They are moving at a rate of about 1.5 inches per year, with the Juan de Fuca (the oceanic) plate sinking beneath the North American continent.

The line along which the two plates collide is called the Cascadia subduction zone. A 600-mile-long segment of that zone appears to be the source of most of the earthquakes that affect the Puget Sound area. Although the rate at which these two plates collide is more or less constant, the slippage actually is intermittent. There may be zone segments along which there is no actual movement for a thousand years, then the boundary between the plates ruptures, releasing the energy that we experience as ground motion or tsunamis at sea. Luckily, these very large earthquakes are infrequent — the last was about 1700 CE (*current era*, formerly known as AD).

Deep earthquakes (events with focuses deeper than 30 miles below the Earth's surface) originate along the subduction zone as it dives beneath the continental plate. This movement has been the source of several large historical Northwest earthquakes.

Other potential earthquake sources are the shallow faults that cut to depths of 0 to 12 miles. They are certainly linked to movement within the Earth's crust and are potentially destructive. These faults may have formed in response to the shortening of the Puget Sound lowland by about one-fifth of an inch per year. The fault zones mostly trend Southeast-Northwest; the Seattle fault crosses Elliot Bay and the South Whidbey fault crosses from Possession Ridge to Crockett lagoon. These faults are very difficult to study on Whidbey Island because they have been buried by thousands of feet of relatively young glacial sediments. Although we refer to this feature as the "South Whidbey fault," we actually are referring to a "fault zone" that may be up to 3 miles wide.

Internet Resources:

U.S. Geological Survey Earthquakes Hazard Program.
A brief description of faults in the Puget Sound area:
http://earthquake.usgs.gov/regional/pacnw/activefaults/

Devil's Mountain Fault Zone — Is This a Problem for Oak Harbor?

Occasionally people will comment, "I worry about the South Whidbey Fault; where is it, how soon could we see activity, and how bad will it be?"

On much of Whidbey Island, the evidence for faulting is buried by glacial sediments, which may be thousands of feet thick. The first really noticeable outcrops that provide testimony for faulting and folding occur south of Deception Pass and at Rocky Point. To evaluate faults that cross the island, geologists depend on geophysical studies in the adjacent Puget Sound, projections of well-mapped faults from the mainland, and data collected from drillholes. Joe Dragovich and Benjamin Stanton, of the Washington Division of Geology and Natural Resources, have done just that in their comprehensive study of the Darrington-Devils Mountain fault, which crosses the northern end of Whidbey Island from Dugualla Bay to the northern perimeter of Naval Air Station-Whidbey. The Devils Mountain fault is actually more like a 2000-foot-wide fault zone.

There are other, less evident faults, including the Strawberry Point fault zone, 2800 to 5000 feet wide, which crosses the island just north of Strawberry Point on the northeast edge of Whidbey Island. The Utsalady Point fault zone trends from Utsalady Point on northern

Camano Island, to Polnell Point, east of Oak Harbor, and exits the island at Rocky Point. Samuel Johnson and his colleagues at the U. S. Geological Survey dug deep trenches across the Utsalady Point fault zone where it crosses the NAS-Whidbey golf course near the intersection of Golf Course Road and Duffers Lane. The structure and layers exposed in these trenches supply information on the youngest activity of that fault. The geologists found evidence for intermittent movement of the fault during the last 3000 years. This work was not without hazards — geologists working in the "duffer's trench" had to wear hard hats because of errant golf balls!

By age-dating sediments that were exposed in sea cliffs, trenches, and drill holes, geologists have discovered evidence for earthquake activity along the faults on north Whidbey activity as recently as the last 10,000 years. Blocks of rock and sediment have been displaced by both strike-slip (lateral) and reverse (upward) movement.

Unfortunately, despite our knowledge of past events, it is simply impossible to predict when the next earthquake will occur near Oak Harbor.

Internet Resources:

The State of Washington Division of Geology and Earth Resources website has a great deal of useful information.

http://www.dnr.wa.gov/ResearchScience/Topics/GeologyPublicationsLibrary/Pages/pubs.aspx

(On this site look for *Open-File Report 2007-2* for a free pdf version)

What is the South Whidbey Island Fault?
Is it under your house?

Most of us on the south end have heard of the dreaded South Whidbey fault. However, if you walk along the beach or examine road cuts, you will not find any cracks that offset the deposits. You also will not find crumpled soil that provides evidence of offsets near fences and roads, as was the case during the San Francisco earthquake of over a century ago. So, where is this fault?

Geologic detective work began with staff from the US Geological Survey (USGS), the University of Washington, and Humboldt State University, who were studying sediments in Crockett and Hancock marshes along the western coast of Whidbey Island. Sediments in these marshes were originally deposited at the same elevation, relative to sea level. However, the deposits in Crockett Marsh are now 3 to 6 feet higher than those in Hancock Marsh. The best explanation for this difference is that Crockett Marsh was displaced vertically about 3000 years ago along a fault zone located between the two marshes, and this kind of slippage surely would have generated an earthquake.

Ok, then where is the rest of the fault? While geologists were wading through the marshes, USGS oceanographers were employing seismic reflection profiling techniques to study the sediments and rocks below Holmes Harbor,

Possession Sound, and Admiralty Inlet. They identified an offshore zone along which older rocks have moved upward over younger rocks, resulting in as much as 1300 feet of vertical offset along the north side of the fault. In Holmes Harbor, sediments immediately overlying the fault are bowed upwards, but the younger sediments on top are more or less flat. The South Whidbey fault zone is mostly “blind,” in that it can be seen only with geophysical techniques. However, some trenches dug across a geophysical anomaly exposed offsets of as much as 3 to 15 feet across a portion of the fault zone.

If you put all of the pieces of the geologic puzzle together, you end up with a fault zone 4 to 7 miles wide. The southern boundary of this zone begins near Possession Point, crosses Useless Bay, is just inland from Mutiny Bay, crosses the southern end of Holmes Harbor, and leaves the island near Lagoon Point. The northern boundary of the fault zone begins about halfway between Clinton and Langley, Crosses Holmes Harbor near Baby Island, and leaves the island just north of Hancock Marsh.

Don’t start packing. This “blind” fault zone is inferred and a lot more work is needed before we know exactly where it is and how frequently it moves. The work described above proposes that a major earthquake along the Whidbey Island fault occurred about 3000 years ago.

Internet Resources:

The USGS Earthquake Hazards Program website is loaded with useful information:

http://earthquake.usgs.gov/regional/pacnw/activefaults/whidbey/

Damage Caused by Ground Motion

The extent of ground motion often depends upon where you live — and not necessarily on the actual magnitude of the earthquake.

On October 17, 1989, during the third game of the World Series being played in Candlestick Park, a magnitude 6.9 earthquake struck northern California. There was damage throughout San Francisco, but none as severe as that in the Marina District, near the shoreline of San Francisco Bay. Much of San Francisco is on rock or well-consolidated sediment, but the Marina District was constructed on debris- and dredged-sand-filled wetlands.

Seismic shaking is amplified in landfill, sometimes liquefying the sediments if they are saturated with water. Structures not anchored to underlying bedrock can suffer considerable damage. Unless an earthquake is extremely large, like the 2008 Great Sichuan earthquake in China, where every building in the region was damaged or destroyed, your home's response to ground motion may depend on what underlies the foundation.

A Seattle Urban Seismic Map, developed by scientists at the University of Washington, the US Geological Survey, and the State of Washington, shows that the greatest risk from amplified seismic shaking will be on river deltas, mudflats, and artificial fill. Seattle neighborhoods at risk

from more intense shaking include the Port of Seattle, University Village, and dock areas between Magnolia and Queen Anne.

We are fortunate that on Whidbey Island most of our communities are not located on landfill or on very young sediments. With the exception of the bedrock exposed near Deception Pass, we live on a very thick sequence of glacial till and glacial outwash sediments. Although very young, most units that make up this extremely complex stack of sedimentary rocks are well consolidated. Areas with the greatest risk for damage from amplified seismic shaking are, for example, the wetlands around Cultus Bay and Mutiny Bay in the south and in Clover Valley (Dugualla Bay) on the northern end of the island. Other homes at risk would be those perched on coastal bluffs, especially those with a history of landslides, which are discussed in a later section of this booklet.

Internet Resources:

An article in the Seattle Times discusses the Seattle Urban Seismic risk:

http://blog.seattlepi.com/blaineweber/2010/03/23/truth-or-hype-is-seattle-really-at-risk-for-a-devastating-earthquake/

Protecting Your Home from Earthquakes

Look around your neighborhood. Most of the homes are single- or two-story wood frame houses. During earthquakes, wood frame houses are much safer than unreinforced masonry buildings, yet they are still at risk. If you are at home during an earthquake, you might notice more motion on the second floor than on the first. Before an earthquake the house is stationary, loaded with the weight of the construction and all the home's contents. Ground motion moves the house sideways but the upper stories and the roof are more or less stationary because of the inertia of the house. As the roof moves in the direction of the ground motion, the foundation is moving back to original position. This back-and-forth movement continues until ground motion stops. If the movement is severe enough, a poorly anchored house may be damaged. Any house on a pier or stilt base or over a garage that underlies the entire structure is at risk from collapse.

To prevent sliding or tilting, the house frame must be anchored to the footing and have enough strength and stiffness to resist horizontal loads. If you are not sure about the anchoring, you should arrange for an inspection by an engineer. If necessary, the house should be retrofitted for seismic stability. Many local contractors are qualified to retrofit your house. The costs of

retrofitting are much less expensive than the repairs that would be required to repair structures that fail during an earthquake.

If you have a freestanding masonry chimney, have it inspected to evaluate its stability and best way to secure it. After the 6.8-magnitude Nisqually earthquake of 2001, experts actually were able to make an initial evaluation of ground motion for areas around Puget Sound by looking at chimney damage.

Make an objective inspection of your home. If it has survived earthquakes in the past it is probably safe. If you aren't sure, take a look at the online sources of information listed below and a have another look around your house. If you are still unsure, contact an expert to determine if seismic retrofitting is needed.

Internet Resources:

FEMA Homebuilders' Guide to Earthquake-Resistant Design and Construction of new homes at
http://www.fema.gov/library/viewRecord.do?id=2103

A contractor's website:
http://www.johnmartin.com/earthquakes/Eqresid/index.htm

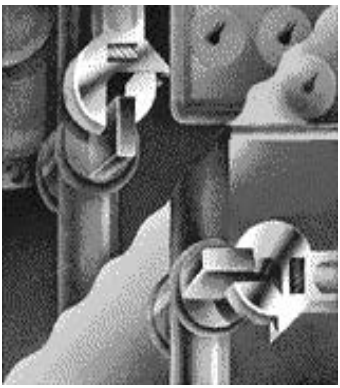
Publication:

Nisqually Earthquake 6.8. *Free* from the Washington State Emergency Management Division. 800-562-6108.

Safety Features For Natural Gas and Propane Users

After the 1994 Northridge earthquake seriously damaged parts of metropolitan Los Angeles, news coverage included films of burning homes. One in four fires initiated by earthquakes are caused by gas lines broken as houses shift from their foundations and by broken connections to gas appliances. What can you do to prevent this from happening in your home?

Plan ahead. Locate your gas connection (for both natural gas or propane) and identify the shutoff valve, which is often located at the gas meter. Some valves have a handle, but most require a wrench. Keep a wrench nearby and learn how to shut off the gas — without actually doing it. Remember, after your gas has been shut off, only your gas utility or propane supplier can turn it on again. If you have propane tanks, anchor them to the ground or to a wall.



Turn off the gas-shutoff valve

But what if there is an earthquake and you aren't at home to shut off the gas?

Your gas utility or propane supplier can arrange to install an “earthquake valve,” which automatically closes the gas line if there is ground motion. This small piece of equipment is inexpensive and is an excellent way to prevent fires that could be started by broken gas lines.

Another tip is to replace metal piping with flexible gas line connections to appliances, gas fireplaces, and hot water heaters. Following the guidelines available from the State of Washington and FEMA, strap your hot water heater to a wall, using sturdy shelving brackets and heavy-gauge metal strapping. During earthquakes, unsecured hot water heaters can tip over, breaking the gas line and flooding the room. A full hot water heater is also a good source of clean water for the days after the event.

Don’t lose your home to an earthquake-caused fire. Some fairly simple precautions can prevent this loss.

IF YOU SMELL GAS,
LEAVE YOUR HOME IMMEDIATELY!

Internet Resources:

San Francisco Bay Area Government:

http://www.abag.ca.gov/bayarea/eqmaps/fixit/gasvalves.html

Anchoring Furniture and Protecting Delicate Artwork

During an earthquake, you are more likely to be injured by falling objects or broken glass than by a collapsed building. Look around for top-heavy furniture like that new home entertainment center or display cabinet. If the room is swaying, will that ceiling-high buffet come crashing down on you? You can prevent earthquake damage and injury by taking a few simple steps to anchor your furniture and any top-heavy or delicate objects.

Here are a few suggestions to protect your possessions.

- Secure the tops of top-heavy furniture such as bookcases and file cabinets to the wall with Z-brackets or L-brackets. Be sure to anchor the bracket to the studs, not just to the plasterboard. Anything heavy enough to hurt you if it falls should be secured.
- Secure TVs, stereos, computers, lamps, and chinaware with buckles and safety straps or hook-and-loop material, such as Velcro®, attached to the tabletop, which will make it easy to move things.
- Support ceiling lights and fans with cables bolted to a ceiling joist. The cable should have enough slack to allow it to sway.

- Hang framed pictures, especially glass-covered, from closed hooks so that they can't bounce off. Only soft art such as tapestries should be placed over beds and sofas.

- Store china and heavy art objects on lower shelves in cabinets. Use childproof latches, hook and eye latches or positive catch latches, designed for boats, to secure your cabinet doors.

- Secure glass and pottery objects with nondrying putty or microcrystalline wax (also known as museum wax) to protect them from damage.

Internet Resources:

There are many sources for earthquake safety fasteners and furniture straps that can help you secure the objects in your home. One such source:

http://www.safetycentral.com/fueqfaresyfo2.html

Water Wells and Water Distribution Systems

Water Wells

The 2002 Magnitude 7.9 Denali Fault earthquake in Alaska caused a 2-foot water-level rise in a well in Wisconsin, more than a thousand miles from the epicenter. Wells close to or thousands of miles from earthquake epicenters can become turbid, dry out, or begin flowing. Water quality can degrade as a result of earthquakes. The most commonly observed type of ground-water response in a well is an instantaneous water-level offset — either an increase or decrease. Recovery to pre-earthquake water level can be so rapid that no change will be detected if it is measured infrequently; however, it may take days or even months.

Unless your well is located on a fault or unstable ground, there is normally very little damage from an earthquake. Coarse sand might be dislodged and plug a well screen or open up the well to increased flow. If, after an earthquake, your water becomes cloudy or has a different color and smell, do not use it for drinking, cooking, or tooth brushing. Until the water clears and is determined as safe, use bottled water or water treated with unscented household bleach (1 teaspoon per gallon of water).

Surface Water

If you live in Oak Harbor and NAS Whidbey, you have surface water delivered by pipeline that crosses Deception

Pass under the bridge. If the bridge is seriously damaged during an earthquake, the City of Oak Harbor has backup wells for drinking water.

Water Distribution

If there is a break in water lines within your house, turn off the supply at the main connection. If the distribution system is broken, turn off the supply at the well or contact your well manager.

Emergency Potable Water

The Island County Water Resources Advisory Committee drafted a plan for emergency potable water that was submitted to the County Commissioners. The plan covers the time of initial damage assessment (3 to 4 days) and the time of recovery (30 to 45 days). With a daily requirement of 3 gallons of water per person, about 120,000 gallons would need to be moved around the county each day. The main focus for provision of potable water are those water companies with backup power and necessary transportation to get drinking water to distribution points established by the County and the Red Cross. An important way to address this problem is for each family to store enough emergency drinking water to last them for at least 2 weeks.

Internet Resources:

Earthquakes and water wells:

http://pubs.usgs.gov/fs/fs-096-03/

Water systems and earthquakes:

http://www.verticalpulse.com/my_weblog/2005/10/water_systems_v.html

LANDSLIDES

Causes of Landslides

When I was very young I went to what was supposedly a children's movie about a kid and his dog on a farm in Southern California (yes, in the distant past there were farms in L.A.). A tall mountain composed of what appeared to be unstable rock and sediment loomed over that farm. During a violent rainstorm, the face of the mountain collapsed, wiped out the farm and severely disrupted the bucolic setting. I was terrified then — probably about 65 years ago — and today I still worry about high, unstable hills. The threat of landslides is very real and is viewed as a threat to public safety by the State of Washington, especially along the cliffs that line Puget Sound. The infamous Oso, Washington, slide of 2014, along the Stillaguamish river, caused over 40 fatalities.

Landslides, in the simplest terms, are masses of rock and sediment that have collapsed, usually along a steep slope or cliff. Shallow landslides usually involve movement of water-saturated soil and are usually a mess but not necessarily catastrophic. Deep "rotational" landslides are a more complex and catastrophic. In the Puget Sound area, many of the coastal bluffs are made up of layers of silt and clay, sand and gravel and usually collapse for two reasons:

- Wave action erodes the base of the cliffs.
- Heavy rainfall replenishes water in sand and gravel layers, increasing the pressure within aquifers and weakening the overall structure of the cliff or hill.

On March 27, 2013 a landslide cut into the bluffs along the western coastline of Whidbey Island. The Ledgewood-Bonaire landslide moved 150,000 cubic yards of poorly consolidated sediment to the west and extended the coastline about 600 feet into Admiralty Inlet. Luckily there were no casualties, although one beach house was uplifted and seriously damaged. The high headwall in that area is perilously close to homes at the top of the bluff.

Not all landslides are natural. Poor land-use practices and housing development on hillsides or coastal bluffs may destabilize the terrain through grading, road building, and residential construction. Leaky swimming pools and septic systems may speed along the collapse process.

Internet Resources:

A remarkably good Washington State website about landslides includes detailed hazard maps for the Puget Sound region (this website is very useful when looking at real estate):

http://www.ecy.wa.gov/programs/sea/landslides/index.html

A national web page about landslides:

http://landslides.usgs.gov/

LAND SLIDES

How to Recognize Unstable Land That is at Risk

State and Federal geologists have a distinct advantage because they have access to geological databases, aerial photography, and digital elevation maps to map old landslides and evaluate areas at risk from landslides.
So how can we regular folks recognize old landslides that may still be active?

Take a walk

At low tide, walk along almost any beach on Whidbey Island that is below a cliff. For those of us on the south end of the island, walks from Bush Point to South Whidbey State Park or along Double Bluff Beach provide many recent examples of landslides. High on the cliffs is a clean face where the mass broke away, usually after a period of heavy rain. Further downhill is a rumpled mass of sediment, some tilted trees and bushes, and lobes of sediment that block part of the beach. It isn't a place where you would camp during a storm. However, there is a bright side to all of this. Landslides from the bluffs ("feeder bluffs") provide the sand that maintains beaches via the process of longshore drift.

Take a drive and a walk

On the south end of the island, drive down Possession Road to the beach. There you'll see trees tilting downhill

and irregular terraces that are mostly shielded by the forest. Along the shoreline of Possession Point Park, the southernmost tip of the island, the 400-foot-high summit is broken by a headwall. Below the headwall is rumpled sediment with trees poking outward and, on the beach, there are exposures of what once were horizontal sediments but are now nearly vertical, having been tilted back by rotation of the slide as it hit the shoreline.

If your land is on a bluff or a steep slope and there has been an unusually heavy rainstorm, look for more subtle effects that indicate landslide risk, including new cracks or bulges in the ground, sidewalks, or streets, especially if they are parallel to the cliff edge. If an originally vertical tree or utility pole is now leaning downslope, you should talk to an engineering geologist. In the house, if there are growing cracks in walls and some doors don't close properly, you might have a problem.

There are many coastal bluffs along the shores of Whidbey Island where stairstep-like benches on old landslides have made convenient platforms for home construction. These homes are at risk from sliding, but the slopes or old slides might be stabilized with drainage systems or embankments to deter further movement.

Internet Resources:

A good source of information from Washington State: http://www.ecy.wa.gov/programs/sea/landslides/signs/signs.html

Worried about landslides after a heavy rain? Visit: http://landslides.usgs.gov/monitoring/signs.php

LANDSLIDES

Where are the Existing and Potential Landslides on Whidbey Island?

Most of Whidbey Island is made up of consolidated glacial and stream deposits, which consist of bedded sands, gravels, and clays. The geological framework of the island is beneficial because it contains the aquifers from which we draw most of our water. However, that same framework is responsible for sometimes unstable coastal cliffs that mark the margins of our island home.

Many of you have determined by now that a sea cliff made of sand and gravel isn't going to be the best setting for your dream home, nor for the beachside cottage located near the base of those same cliffs. An exception to this situation on Whidbey Island is along the northern tip, near Deception Pass, where sea cliffs are solid rock.

To look at areas with landslide risk, begin with the maps on the State Department of Ecology web site (address on opposite page). This site allows you to move around the island and zoom in on specific areas.

Another approach is to get into your virtual airplane and fly along the Whidbey coastline. The Washington State Department of Ecology has oblique aerial photos of all shorelines (see the web site listed opposite).

By following these oblique aerial photos, you can circumnavigate the island. Some areas of interest with visible landslides can be seen near these locations:

- Ledgewood/Bonaire (West-Central Whidbey)
- West Beach Road (south of Oak Harbor)
- Lagoon Point to Bush Point (Susanna Drive, for example)
- Double Bluff
- Scatchet Head to Indian Point
- Possession Point to Glendale
- Much of the shoreline along Saratoga Passage
- And almost any place with “Bluff” in its name

This is not an inclusive list, but provides a partial guide to places on the island with some risk from landslide activity. There might not be any sliding this year, but since surf, heavy rainstorms, and earthquakes don’t take holidays, there will continue to be landslides in the future. You might be able to lower the risk to your cliffside home with some engineering at the site, which is the subject of the next article.

Internet Resources:

Maps:
http://www.ecy.wa.gov/programs/sea/landslides/maps/maps.html

Aerial photos:
http://apps.ecy.wa.gov/shorephotos/scripts/mapsearch.asp?id=816

Engineering Solutions — Protection from Landslides

During a heavy rainstorm, put on raingear and walk around your coastal bluff property. Identify water movement across the property to evaluate the drainage — both at the surface and along any steep slopes (for visible water seepage from exposed aquifers). The goal of this damp walk is not to demonstrate your athletic prowess, but to provide an understanding of the drainage that is needed before taking the measures to decrease the possibility of landslides.

After your walkabout, go online to the Washington State Department of Ecology's website (web address opposite). Follow the link to the *Coastal Property Owner Slope Drainage Checklist*. After completing this checklist, dig deeper into this remarkably comprehensive website. It will guide you toward what you can do to manage water flows to the point where they are not contributing to accelerated erosion and landslides. There are many things that you can do before seeking professional help, including re-vegetation of slopes and understanding the effects of impermeable surfaces such as paved driveways.

When the apparent landslide risk is too great or the slope is too steep, it is time to call in the professionals. Check the Yellow Pages or do an internet search for local "civil engineers, specializing in storm drainage," "geotechnical engineers," or "geologists."

The Puget Sound coastline has provided a lot of work for these people and most are experienced. They can advise you about the best means of landslide prevention, focusing mostly on which types of drains to be used at your home site. If you are about to build a new cliff side home, give the geo types a call for a site evaluation early in the process.

If your home site is within 200 feet of a shoreline, it falls within the overview of the state's Shoreline Management Act. Any modification of drainage within this zone requires that the Island County Planning Department issue a special permit before you build.

This basic overview of landslides along the Puget Sound shorelines is intended to alert you to the issues and where to seek help. Landslides are a threat to public safety — please take this threat seriously.

Internet Resources:

The website on Puget Sound landslides managed by the Washington State Department of Ecology is comprehensive and very well written:

http://www.ecy.wa.gov/programs/sea/landslides/index.html

Wildland Fires

A Brief History of Wildland Fires on Whidbey Island

> ***Timely Rains Halt Raging Forest Fires***. "Nine fires, at as many localities on Whidbey Island, the largest covering more than 900 acres, were spreading rapidly when the rains came. Greatest damage was done to Puget Mill Company's stands of timber near Greenbank." *Island County Times, September 23, 1932.*

These fires and many others occurred on the island during the droughts that affected western Washington in the 1930s. Similar droughts raised the risk of wildfire again between October 1976 and September 1977 and yet again between January and March 2001.

Wildfires weren't always bad. The Salish used fire to maintain nettle grounds, berries, and prairies. However, serious, damaging fires began in the late 19th and early 20th century when logging was the major industry on the island. Early logging with teams of oxen and later with steam-powered donkey engines left massive amounts of slash. Fires in dry slash burned at temperatures high enough to destroy the duff layer in the forest, decreasing the moisture retention of the forest soil.

There were repeated slash fires on Whidbey and Camano Islands between 1900 and 1920. In August 1902, several fires on Whidbey Island burned for weeks in the woods and cutover land north of Oak Harbor. In the worst years

accidental fires burned between 1000 to 3500 acres of land in Island County. In 1903 the Washington legislature made the state land commissioners ex-officio fire wardens, and in 1908 the timber companies formed the Washington Forest Fire Association. After that, the number of wildfires declined. Today Washington State law requires that any burning of slash be done in rainier months during the spring and fall.

Wildfires on Whidbey in the last 70 years have mostly burned grassy areas, brush, or piles of driftwood. These fires have consumed areas of less than an acre to 100 acres; most are quickly extinguished by fire departments. However, we can not ignore the risk of wildfires, especially near homes. Continued development has pushed the urban/wildland interface further into the woods, increasing the risk posed by even small wildfires. Pay attention to the "Fire Level" signs along the highway.

Internet Resources:

Washington fire history:
http://historylink.org/index.cfm?DisplayPage=output.cfm&file_id=5496

Publication:

White, Richard, 1980. *Land Use, Environment, and Social Change—The Shaping of Island County, Washington.* University of Washington Press, Seattle, 234 pages. (A well-written history, reprinted in 1999)

Thanks: Help from Richard Castellano of the Island County Historical Society is greatly appreciated.

Wildland Fires

Homes at Risk

Most of us know that to start a campfire, you first gather kindling — small twigs, dry grass and leaves, and dry branches, especially if they are oozing pine pitch. You carefully place the kindling below the stacked wood and, with a match or a spark, you soon have a roaring fire.

Then to protect your home from wildfires, you must do exactly the opposite. Eliminate the kindling that will burn your dream house. During the normal Island County dry season, from mid-May through October, there is ample kindling, both natural and unnatural, awaiting ignition by lighted cigarettes, fireworks, and outdoor burning. The number of wildfires usually peaks during the Fourth of July weekend with the careless use of fireworks by people with poor judgment. For example, on July 4, 2014, the illegal use of fireworks started a brushfire on the bluff below the Admiralty Inlet Forest near Camp Casey.

How can you protect your home from wildfires? As summarized in the nation-wide *Firewise* program, which is supported by various state and federal agencies and private organizations, you begin by looking at a 30-foot zone around your house. Remove all dead plant material, including leaves, stacked firewood, and dry vegetation. Plants close to the house should include deciduous plants such as rhododendron, serviceberry, and vine maple. Large evergreen trees should be pruned, with the lowest

branches being 6 to 10 feet above the ground. Flammable plants with resins, such as ornamental junipers and young pines should not be within a radius of 30 feet.

Porches, fences and decks made of flammable materials are at risk, especially if dry plant debris has built up underneath or next to them. I once lived in a New Mexico town that lost 20% of its homes in a wildfire. Many people had allowed thick mats of pine needles to accumulate near their houses, claiming that they made good mulch. Those houses burned very quickly. Many of us can also remember survival classes in which we learned that pine needles were the best kindling for quickly starting a fire in any weather.

Fire-resistant roofing is also important. Wind-whipped wildfires send off clouds of hot cinders that can easily ignite roof fires. Appropriate roofing materials include Class-A asphalt shingles, metal, tile, and concrete. Split cedar shingles were very popular in the 1960s and 1970s; however, consider this: what is a great wood to burn in your fireplace? — Split cedar.

Internet Resources:

Firewise Communities USA sponsors a useful website:
www.firewise.org/usa

The Island County Firewise sponsor is the Whidbey Island Conservation District:
www.whidbeycd.org

FEMA has a great site called “At Home in the Woods:”
http://www.fema.gov/hazard/fire/pubs/athome_woods.shtm

Wildland Fires

Checklists and Community Action Can Help Minimize Home Losses

As you walk around your property, it is easy to spot problem areas where the risk of an approaching wildfire to your home would be increased. If you haven't had quite enough coffee to raise your awareness during your walkabout, here is a brief checklist that has been condensed from *FEMA* and *Firewise* handouts:

- ***Landscaping.*** *Zone 1.* Maintain a well-irrigated area with fire-resistant plants for at least 30 feet around your house. *Zone 2.* Plant mostly low-growing fire-resistant plants. *Zone 3.* Keep the volume of vegetation (fuel) low with well-spaced trees. *Zone 4.* Thin the most flammable plants selectively in the forest.

- ***Landscape maintenance.*** Water and maintain your lawn. Mow dry grass and weeds. Dispose of cuttings and debris properly. Take out "ladder fuels" — meaning the vegetation that links grass and tree tops. Remove leaves and needles from roof and gutters.

- ***Storage.*** Stack firewood at least 100 feet away and uphill from the house. Store gasoline and other flammable materials in safety cans and place the cans away from buildings.

- ***Preparation if a wildfire is threatening your neighborhood.*** Close windows, vents, and doors. Shut off the gas at your meter and turn off the propane tanks. Move small propane tanks to the perimeter of your lot where they can explode away from the house. Open the fireplace damper and close the screens; this helps clear smoke from the house. Confine pets to one room; if you must evacuate, you don't have time to chase the dog and cat around the neighborhood. Plan an escape route and park your unlocked car in an open space with the keys in the ignition.

A more complete checklist is available online at the Firewise site, which also contains information on how to better organize your neighborhood for the purpose of reducing wildfire risk. If your community takes on this challenge it will receive national recognition as a "Firewise Community." Locally, the Whidbey Island Conservation District will help you organize a Firewise Community (see website below or contact them at 360-678-4708).

Internet Resources:

Whidbey Island Conservation District:
www.whidbeycd.org

and the Firewise site:
www.firewise.org

Tsunamis

Cause and Effect

Along the shoreline roads of Whidbey Island, blue and white signs designate “Tsunami Evacuation Route.” Tsunamis are infrequent but damaging events that must be taken seriously, as was shown when the 2004 tsunami affected all landmasses bordering the Indian Ocean, killing about 188,000 people and causing untold damage to coastal cities. And in March of 2011, the Tohoku, Japan, earthquake and tsunami devastated eastern Honshu, causing 16,000 deaths. Washington’s Pacific coast is definitely at risk from tsunamis caused by earthquakes originating offshore or as far away as Alaska. Once tsunamis enter the Straits of Juan de Fuca, the effects are far more complex but usually less damaging.

“Tsunami” is a Japanese word meaning “harbor wave.” It is not a “tidal wave” and has nothing to do with the tides. Tsunamis are seismic sea waves formed after the seafloor is offset by several meters and displaces an enormous amount of water. The series of earthquake-generated waves race across the ocean at speeds of up to 500 miles per hour and can travel several thousand miles before reaching land. At sea, these waves are usually less than several feet high and are rarely noticed by ships’ crews. As the waves approach shallow water near a coastline, they are slower but wave heights may increase to many yards. Tsunamis can continue for hours in a series of waves; it is definitely not safe to run down to the beach to examine shoreline damage.

There is also the possibility of tsunamis following earthquakes or landslides within Puget Sound. Snohomish Indian stories indicate that in the early 1800s, possibly in 1820, a large landslide from Camano Head created a tsunami that swept across Saratoga Strait and hit Hat (Gedney) Island, causing damage and drowning an Indian village (outlined in "The Fall of Camano Head…" by Hugh Shipman of the University of Washington Geology Department). During the 20th Century, several other tsunami events have affected Puget Sound.

On April 13, 1949, "An eleven million cubic yard landslide occurred on Point Defiance, at the Tacoma Narrows when a 400 foot high cliff gave way and slid into the water. The water receded 20-25 feet from its normal tide line with an ominous sucking sound. Then an eight foot tidal wave rushed back against the beach, smashing small boats, dock areas, a wooden boardwalk, and other waterfront installations" (as reported by the *Tacoma News-Tribune* of April 18, 1949).

Internet Resources:

State of Washington Division of Natural Resources:
http://www.dnr.wa.gov/geology/hazards/tsunami.htm

NOAA Center for Tsunami Research:
http://nctr.pmel.noaa.gov/

Publication:

Atwater, Brian, and others, 2005. *The Orphan Tsunami of 1700 — Japanese clues to a parent earthquake in North America.* University of Washington Press, Seattle (this is a well-written, beautifully illustrated book on tsunamis).

Tsunamis

How Often Do Tsunamis Occur and What Areas on Whidbey Island Would be Affected?

Tsunamis are one of those natural phenomena that are infrequent but leave a lasting impression when they do occur. Native American oral traditions include a description of a large earthquake and tsunami that hit shorelines along the Straits of Juan de Fuca. When? We don't know, but there is geologic evidence for tsunamis that affected the region and Whidbey Island both 1100 years and 309 years ago. The earlier tsunami surged across what was then a marsh in Cultus Bay, flooding the full length of the shallow bay. The 1100 year tsunami may have been caused by an earthquake within the Puget Sound. Tsunamis usually leave a distinctive calling card in the form of a thick sand deposit that is sandwiched within the layers of mud in a lagoon. For tsunamis generated along the Cascadia Subduction Zone, the recurrence interval for a significant event (that is, an earthquake with a magnitude of 8.0 or greater) is between 500 and 540 years. The risk from subduction zone earthquakes is much greater for the Washington and Oregon coastlines than for islands within Puget Sound.

Modelers from the NOAA (National Oceanographic and Atmospheric Administration) Tsunami Research Center in Seattle, working with the State Division of Natural Resources, University of Washington, and US Geological

Survey geologists, looked into the past and modeled the effects of a future tsunami for Whidbey Island. The map, which is available online at the website listed below, shows areas that would be affected. In that model, the waves that would hit Whidbey Island have a height of 5 to 6.5 feet. The area most affected in this model is Swantown Lake, actually a lagoon, which would be flooded to a depth of about 6 feet (more than the height of the average Whidbey coastal resident). Cranberry Lake, Crockett Lake, and the wetland nearest Dugualla Bay would be flooded at depths of 1.5 to 6 feet. Velocities of the waves sweeping onshore would be between 3 and 11 miles per hour (you would be knocked off your feet). The event would flood State Parks in the lower areas of Deception Pass, Joseph Whidbey, and the Coupeville ferry terminal near Fort Casey. Flooding also would be expected in the immediate vicinity of *all* of Whidbey Island's shorelines. The degree of devastation would also depend upon the tides.

Nowhere in scientific publications about Whidbey Island's recent geological history and tsunami models is there any evidence of a catastrophic tsunami that swept across the entire island — an intriguing myth generated by too much dramatic license and not enough facts!

Internet Resources:

Tsunami Hazard Map for Anacortes and Whidbey Island (Washington State Department of Natural Resources and National Oceanic and Atmospheric Administration:
http://www.dnr.wa.gov/Publications/ger_ofr2005-1_tsunami_hazard_anacortes_whidbey.pdf

Tsunamis

Emergency Response After a Tsunami Warning

For any tsunamis generated by large earthquakes around the Pacific, there is a warning system managed by NOAA's centers in Alaska and Hawaii. If the scientists determine that a tsunami is threatening, warnings will be transmitted to emergency responders, police, and the Coast Guard along the Pacific coast. On Whidbey Island, the information will go to the Island County Department of Emergency Management, the Sheriff's Department, and the US Navy. We don't have warning sirens here and will need to depend on first responders to clear the beaches and shorelines. If the source of the tsunami is in Puget Sound itself, there will not be much warning because the waves would arrive within a few minutes.

If you are responding to such a warning, follow the blue and white "Tsunami Evacuation Route" signs to higher ground (these signs show a large wave and a person running uphill). Stay on high ground. Don't go back to the beach, even if you are curious, until the "All Clear" has been given. Information should be on NOAA weather radio and local radio stations.

If you are near a shoreline and there is a tsunami warning, quickly move to high ground. Even a tsunami of 6 feet can flood low-lying areas, damage buildings by wave impact, scour soils, and breach protective barriers,

as well as float heavy objects, turning them into projectiles. After the first wave crosses the beach, stay on high ground — a tsunami is a series of waves that can last for several hours after the time of the initial wave. Before each tsunami individual wave, the sea retreats, tempting the curious to examine rarely exposed beach areas. This is not the best behavior; do not stop to examine the sub-tidal sea life but turn and quickly run in the opposite direction.

Wait for an “All Clear” signal before returning to the shore.

Internet Resource:

FEMA on tsunamis:
http://www.fema.gov/hazard/tsunami/index.shtm

Windstorms on Whidbey Island

> **"Windstorm Slams, Swamps South End**
> A monster windstorm slammed South Whidbey Island early Saturday morning with 70 mph hurricane-strength winds, leaving thousands without power, stranding residents in their neighborhoods because of fallen power lines, and leaving home owners along the coast with severely damaged and flood-soaked homes."
> *South Whidbey Record, February 6, 2006.*

Do you remember that week (and, in some places, even longer) without power? How can you prepare for the next major windstorm? The next pages provide advice on how you can be better prepared.

Windstorms can happen any time, but in the Puget Sound area we are hit each winter by Pacific storms with winds strong enough to bring down trees and power poles (sustained winds of over 40 mph and gusts over 58 mph). In addition to the storm of February of 2006, recent severe storms occurred in January 1993, December 1995, February 2002, December 2006, and December 2007.

According to meteorologist Cliff Mass of the University of Washington, the most energetic storms (with central barometric pressures ranging from 28 to 29 inches)

approach this region from the southwest. Winds move counterclockwise around the low-pressure center but some changes in direction may occur as winds interact with the terrain. These wind directions are important, especially if you are living along the shoreline or have tall trees near your house, so follow the storm's progress online, on local TV news, or NOAA's weather radio.

Windstorms usually pass over Puget Sound between October and March. The most powerful windstorms usually occur sometime between November and February. Are you ready for the next big storm?

Internet Resources:

The State of Washington's site has additional useful information: http://mil.wa.gov/emergency-management-division/hazards/severe-storm

Cliff Mass's weather blog is useful on a day-to-day basis: http://cliffmass.blogspot.com/

Publication:

Mass, Cliff, 2008. *The Weather of the Pacific Northwest.* University of Washington Press, Seattle, 280 pages. This is a very well written and attractive book.

Windstorms

Effects of High Winds on Homes and Community Infrastructures

Long-time residents of Whidbey Island are well aware that the most obvious windstorm hazard resides in the beautiful tall trees that encircle many of our homes. After fall rainstorms loosen the soils, a windstorm can topple some of the more shallowly rooted trees onto power lines or houses. That is why Puget Sound Energy employs so many contractors to keep power lines clear of the nearby forest. You should conduct a survey of how many of your trees are tall and/or close enough to fall onto the house should they succumb to high winds. What are the odds that your favorite Doug Fir might end up in your bedroom?

Even if you live in the open, away from the forest, you should assess the potential threats to your home from high winds. Any poorly constructed home or unanchored mobile home is at risk. In the Gulf Coast of the United States, mobile home parks are frequently damaged by the high winds associated with hurricanes. Mobile homes must be anchored to the ground with cables. Loose items like lawn furniture, roofing material, or small outbuildings may lofted into windows or injure people outside the home. Carports, pergolas, and verandahs are also at risk from being detached by high winds.

You can protect your home from wind damage with some planning. If you have gable-end framing, the most common type of roof on the island, you should be aware that it presents a large, flat obstacle to the wind — thus receiving its full force — and it should be reinforced. Hipped roofs are more stable in high winds. Composition shingle roofing should be secured to the roof with at least six nails per shingle. Garage doors are weak points especially when there are multiple side-by-side doors. The doors can bend, break, and open the house to damaging winds. These doors should be reinforced with horizontal boards across the back of each door section.

Your location is important. Buildings in elevated positions like hilltops will be exposed to higher wind speeds. Do you own a mobile home located on a hilltop? Make certain that it is securely anchored to the ground.

You may encounter a downed power line, frequently with a tree on top of it. Stay away! Do not approach the line, but call 911. If you are in a car hit by a downed power line, stay in the car and wait for help.

Admire the green majesty of the forest around you on this beautiful island. However, spend a little time to evaluate the threat from that forest during windstorms.

Internet Resources:

FEMA has many excellent pamphlets and fliers about mitigating damage from windstorms:
http::://www.fema.gov/library/viewRecord.do?id=3263

Windstorms

Is Your Family Prepared for a Major Windstorm?

The results of a FEMA survey conducted in 2007 showed that at least one third of Americans openly admitted that they had done nothing to prepare for an emergency in their community or even their own home: nearly one half of those surveyed simply didn't think about preparedness and one third did not believe that an emergency could happen to them or to their family. We hope the residents of Whidbey Island are not part of this shortsighted nationwide majority!

Be prepared for a windstorm. The simple checklist below is provided by the Washington State Department of Health.

- Purchase a weather radio. Most are small and inexpensive and can be found at your local hardware or sporting goods stores. The NOAA weather radio in Puget Sound is at 162.425 MHz and broadcasts 24 hours a day.
- Assemble a disaster supply kit containing what you will need for a week, including food, water, prescription drugs, warm clothing, and flashlights.
- Don't forget a cache of emergency food and water for your pets. For advance advice about large animal care during an emergency, contact your veterinarian.

- Keep an old-fashioned phone that doesn't require an electrical plug (these models are inexpensive and worth the small price to buy). Keep your cell phone charged. Have handy references for your children's schools and daycare centers.
- Find out which residents in your immediate neighborhood will need your help, especially the disabled and elderly.
- Live along the coast? Know your evacuation routes.
- If you have a home generator, practice how to use it safely. Do not use it indoors because there is risk of carbon monoxide poisoning.
- Walk around your house and identify the nearby trees that could fall during a windstorm.

These precautions don't require much time or money and will place you in the elite minority of citizens who are prepared for windstorms.

Internet Resources:

NOAA Weather Internet:
http://www.spc.noaa.gov/products

National Weather Service:
http://www.weather.gov

Publication:

Emergency Resource Guide (Washington State Department of Health). This clear, easy to follow guide is free from the State and can be found at the Island County Department of Emergency Management in Coupeville or by calling 800-562-6108 or 253-512-7000.

Windstorms

Safety During and Recovery After the Storm

While it Rages

The wind is howling, trees are bending, and the patio furniture has been blown off the veranda. Your dog refuses to go outside to water the lawn. As the sun sets on this dramatic display of weather, the lights go out. Will your house be dark and cold for a few minutes, several hours, or a week? You are responsible for the family's comfort and safety, and your stress level has peaked out. What can you do now?

With branches breaking and debris flying, the first, mandatory rule is that you stay inside out of harm's way. Take an eye's-on roll call to be sure that all children, pets, and other household members are accounted for. Then assign tasks to each family member to find emergency kit(s), flashlights, candles, a backup supply of toilet paper, and bottled water. If your water is still running, fill the bathtubs to be used for washing, watering pets, and flushing toilets if the power outage shuts down your well. If it is cold, dig out sweaters and coats. The television doesn't work, so get out the board games.

To stay warm, use a fireplace if you have it and have a dry place to store the firewood. DO NOT USE A GAS HEATER OR GRILL OR A GENERATOR INSIDE

THE HOUSE. Every year in the Puget Sound area, people are sickened or die from carbon monoxide poisoning because they used a charcoal burner or unvented gas heater inside their homes.

After it Calms

After the storm has passed, check for damage to buildings and power lines. Evacuate any damaged buildings. If a power line is down, call Puget Sound Energy and the County Sheriff. Stay away from the line. If the power is still off, keep the refrigerator and freezer doors closed; an unopened freezer can keep food frozen for up to two days.

Contact friends and family by cell phone or with a conventional plug-in phone to allay their concerns about your situation (and to see how they weathered the storm). Check your neighbors, especially the elderly and disabled. Arrange to have any downed trees removed from your driveway or from any damaged buildings.

After you have taken care of the damage, take time to evaluate what you did in preparation for this windstorm. Were you ready? Or were you completely unprepared? What would you do differently? Don’t wait, write down immediately what you have used from your emergency supply kits so you can replenish them. Planning ahead for a storm ensures your safety and comfort and might even save you some money!

Disaster Mitigation

Protecting Those Who Are Handicapped or Infirm

For individuals with special needs, home preparations are especially important, as are the usual disaster emergency kits, but additional materials and forethought are very necessary. Anyone living with any of the challenges discussed below, as well as their caregivers, should discuss and plan carefully.

Personal Support Network: If you or a family member has a disability, you must assess capabilities and needs. At least three friends or neighbors should know about your special needs. Exchange important keys and share copies of emergency health information.

Those with Visual Disabilities: Keep a spare cane with your emergency kit. Plan on on the fact that you will lose the usual auditory clues (such as the sound of a refrigerator), on which you normally rely for navigation in your home. Keep service animals confined or securely leashed because they may become panicked or disoriented during a disaster. Those people with partial vision should keep an extra pair of glasses within easy reach.

The Hearing Impaired: Hearing aids and extra batteries should be in a small bag that you can quickly locate. Carry a card indicting if you speak American Sign

Language. For communication, include an emergency health card, along with a pad of paper and pen.

Mobility Disabilities: Arrange and secure furniture in your house to maintain a secure path to the door in anticipation of an earthquake. If possible, keep an extra cane, lightweight walker, and/or wheelchair in an easily reached space. Keep a pair of heavy gloves with the wheelchair, in case of broken glass or debris on floors.

Medication: Your pharmacy may not be open, so *always* have a 7-day supply of your prescribed medications in a bag, along with a list of the drugs and their prescribed frequency and dosage. The same paper should have the name and phone number of your family doctor and pharmacist. If you require oxygen, keep a 7-day supply at all times. Oxygen tanks should be secured to the wall to prevent falling and breaking the regulator.

Psychiatric Disabilities: Disasters may result in confusion and disorientation; individuals should carry a laminated card that explains their needs.

Internet Resources:

American Red Cross Preparedness Information for Senior Citizens :
http://www.redcross.org/museum/prepare_org/seniors/srsforsrs.htm

Publication:

Emergency Resource Guide (Washington State Department of Health). This clear, free guide is free from the State and is available at the Island County Department of Emergency Management in Coupeville or by calling 800-562-6108 or 253-512-7000.

Disaster Mitigation

Protecting Children

We all witnessed catastrophic loss for the children of Haiti. Homes, schools, even parents were lost and recovery is taking a very long time. It is unlikely that an event of the magnitude of the Haitian earthquake will occur on Whidbey Island, but any disaster such as a fire or earthquake can cause real problems for children of our own island. You can help them cope.

Disasters will upset the comfort of a child's daily routine. Behavior may change and intense fears can develop, ranging from being afraid of the dark, to not wanting to sleep alone, to fear that they may be separated from family and will be lost. There is a loss of trust in adults, who couldn't prevent the disaster from happening. They may be affected by sudden loud noises, wind, or rain.

Adults can help by providing strength and reassurance during and after a disaster. You should clearly and simply explain to children what has happened. Encourage communication and learning, but avoid the repeated and sometimes exaggerated media coverage about an event. Ensure that children understand that the disaster and its aftermath were not in any way their fault. Spend more time with them at bedtime. Listen carefully to their

concerns. As soon as is possible, re-establish their former routines.

Before the effects of a disaster are forgotten, involve the family in preparing or updating your disaster plan. Each member should have the responsibility for parts of the plan. Recognize and praise the child's responsible behavior during preparation and execution of the disaster plan. On the anniversary of the disaster or relaxed time when everyone is at home, practice the actions included in your disaster plan. Make certain that children know how to call for help; post appropriate phone numbers for fire, police, close friends, and relatives. Parents and children should memorize key contacts or carry a small card with phone numbers of schools and caregivers as well as information about vital prescriptions.

In August, 2009, FEMA (Federal Emergency Management Administration) director Craig Fugate told a Senate committee that most of the country is poorly prepared to help children if a disaster strikes. "We've historically looked at special populations as an afterthought," Fugate said. "Children are not small adults." Let's do a better job on Whidbey Island. Prepare your children and yourself for any disasters and for the months of care and even counseling needed afterwards.

Internet Resources:

FEMA — Helping Children Cope With Disaster:
http://www.fema.gov/rebuild/recover/cope_child.shtm

This bilingual guide for parents and teachers helps children after a natural disaster, using the Haitian

earthquake as an introduction to educational materials. Also see the extremely useful material at this site:
http://www.colorincolorado.org/article/35420

Protecting Your Pets

Our pets enrich our lives in more ways than we can count and become treasured members of our families. In turn, they depend on us for their safety and wellbeing. The best way to protect your family from the effects of a disaster is to have a disaster plan, which must include your pets. Being prepared can save their lives. If you must evacuate, the most important thing you can do to protect your pets is to take them with you. Leaving pets behind, even if you try to create a safe place for them, is likely to result in their being injured, lost, or worse.

Be Well Prepared

Just as you do with your family's emergency supply kit, think first about the pet's basics for survival. Consider two kits. In one, put everything your pets will need if you are able to stay where you are. The other should be a lightweight, smaller version that you can take with you if you need to get away. Kits should include medications and medical records (stored in a waterproof container), a first aid kit, leashes, harnesses, carriers, food, potable water, bowls, cat litter/pan, and a can opener. Make sure all pets are wearing collars with up-to-date identification tags. You might want to consider implanted ID tags.

Have a Definite Plan

Be prepared to ensure your pet's safety during an emergency.

- Create a getaway plan ahead of time.

- Develop a buddy system. Talk to your neighbors and work out a plan to safeguard your pets if you are not at home when a disaster strikes.

- Talk to your veterinarian about emergency planning. Have extra medications on hand at all times. Gather contact information for 24-hour emergency animal treatment.

- Have a safe place to take your pet, such as a friend's or relative's home if you will not be able to keep them with you.

- Maintain an up-to-date list of "pet-friendly" hotels and motels in your area. Prepare a list of boarding facilities or veterinarians who could shelter animals in an emergency; include their 24-hour phone numbers.

Protecting Your Livestock

On this semi-rural island, another very important asset to protect is livestock — the big pets. Individuals who have many animals obviously face substantial difficulties during a crisis. In addition to emotional and humanitarian concerns, these creatures can represent a substantial economic investment.

Disaster preparedness for livestock must deal with two possible scenarios. In the first situation, you are on the spot and are able to continue to care for your livestock. In the second scenario, you are separated, either short- or long-term from your livestock, whether you are merely stranded elsewhere or are injured and cannot take responsibility for their welfare. Developing a good plan for the first scenario forms the basis for dealing with the second scenario.

Before the Disaster

It is critically important for you to put the disaster plan for your livestock in writing, on paper. During a crisis you will need a written, printed plan to help you deal with confusion, fright or discomfort; remember, the computer may not be functioning. In addition, if you are away, the

document becomes a vital resource for others. The plan should contain feeding instructions, emergency contacts, and emergency water locations. You should list your veterinarian's contact information and location; your usual source of feed and other supplies, and any regularly employed helpers who know your stock.

The document should also be a "to-do" list of actions to take immediately after disaster strikes.

After the Disaster

First, examine your livestock for injuries. Your animals may be traumatized as well, but focus first on actual physical injury. Treat the problems that you can and contact veterinarians to deal with more serious issues; you can expect that they will be busy with many local animals, so be prepared to stay with your livestock until help arrives. Next, examine animal housing structures; if any are damaged, block animal access. Look for cracked support beams or other timbers and jagged pieces of metal or wood. Third, inspect your fence lines. Roaming livestock are at risk and may be a danger to others.

Internet Resources

For more information, visit

www.ready.gov

also contact T.J. Harmon, Executive Director for the American Red Cross, Oak Harbor Chapter (360) 675-2912.

Disaster Mitigation

Emergency Food and Water Could Save Your Life

Have you ever wondered how long you could survive on the food in your cupboards or pantry? If a “major event” occurs (earthquake, extended power outage, major blizzard, windstorm, etc.) you might get the chance to find out!

Try to imagine this — you cannot get any food from stores, food banks, or other sources other than your own cupboards and vegetable gardens or those of your neighbors……..and you estimate it will be at least three days until help can get to you. Keep in mind that this scenario is actually possible. We have all watched dramatic news coverage of communities world wide that have had to cope with the effects of natural or manmade catastrophes, but we seldom consider how such events would affect us on our safe Whidbey Island.

Having even three days worth of potable water and food that does not need to be cooked could save your life or that of your child! Dehydration is a serious health threat, and for small children, the elderly, or anyone whose health is fragile, regular nutrition is vital. An emergency stash of food and water should be easily accessible; some amount of these supplies might even be stored in your

“grab-and-go” kit in case you cannot remain in your home. So what do you stash? Think in terms of three days of food for each person in your house, and then add a little extra:

- Water (see the next section for guidelines)
- Ready-to-eat canned food
- Canned or boxed juices or milk
- High-energy protein bars or peanut butter
- Any specific foods for children, the elderly, or family members with special needs
- *And* don’t forget your dogs or cats!

Such a food kit could easily fit into a pack or small duffel bag and be easily accessible even if there is severe damage to your house. Everyone in the house should be aware of its location. This three-day kit of food and water is an excellent way to get your emergency planning started. There are many excellent resources on the Internet — enter “emergency food planning” using your favorite search engine

The most important thing is to just do it.

Today would be a good day to find an old athletic bag or backpack and put some canned goods and bottled water in it (don’t forget the can opener!). You can improve on this original version as time goes on, but tomorrow you will be better prepared for any “major event.”

Protection and Storage of Potable Water

The need for safe drinking water is even greater than the need for food. Disaster specialists recommend that we keep on hand 1 to 3 gallons per day per person. And that doesn't include water for flushing toilets. On Whidbey Island, 75% of our water comes from wells that tap into myriad aquifers underling the surface. Many residents have their own wells, but others depend on community water systems. We have very good water on the island, but typically we take it for granted until the power network has failed and our wells stand silent. When that happens, it is usually too late to run to the grocery for enough bottled water to last through the power outage, which may be from a few hours to more than a week. What if, following a natural disaster, we find ourselves without water for two or three weeks? This is where your careful planning will pay off.

Island County already has a plan to provide emergency potable water to its residents. The main focus of the county's plan is to work with water companies that have backup power and necessary transportation to get drinking water to distribution points. However, until this plan could be implemented after a natural disaster, each family might need to rely for as long as two weeks on the emergency drinking water that they have stored.

If, for example, the Deception pass bridge were to be unsafe to use and the docks in Clinton were damaged by tsunamis, it would be extremely difficult to provide sufficient supplies for the island's population.

The easiest way to store drinking water is to purchase large containers of bottled water. If you store water in this way, try to replace the supply every 6 months.
If you use tap water, store it in clean containers after boiling or treating it with unscented liquid household bleach. (Use 1/8th of a teaspoon of bleach per gallon of water.) If the water is turbid, filter it with coffee filters or paper towels before treatment. Tightly close the cap, not touching the inside with your fingers. Once it is purified, the water should be stored in a cool, dark place.

Other immediate sources of water in your home include the hot water tank and in the pipes. Outside of the house, water is available in streams, lakes, and natural springs, but must be treated with household bleach before using.

We are fortunate because we have daily access to clean, pure water, something that is not available in most of the world. It is also inexpensive. There is no excuse for not maintaining an emergency supply.

Internet Resources:

The FEMA web site has basic information on water purification:

http://www.fema.gov/plan/prepare/water.shtm

Disaster Mitigation

Carrying On — Shelter, Heating, and Cooking

Shelter

By following the general recommendations in earlier articles, you can be certain that your home will likely survive earthquakes, windstorms, or wildfires. In our relatively mild climate, if your home is not habitable immediately after a disaster, you can temporarily "camp out" in a tent or travel trailer. Our island is well known for its generous and helpful population: neighbors and friends typically are anxious to help each other. If all else fails, you and your family can go to a community emergency shelter (usually established in a school gymnasium or church).

Heating

Stay in your shelter and dress warmly if the weather is cold and rainy. If you have a well-vented fireplace, use it for both heating and cooking. NEVER USE GRILLS OR ELECTRICAL GENERATORS INDOORS because they generate dangerous carbon monoxide gas (CO). During the December 2006 windstorm, carbon monoxide poisoning affected 100 people in western Washington — nine of them died. Five members of one family in Burien died after using a gas generator

to stay warm in their home. Unlike typical gas leaks, which can be detected in sufficient time to leave an area, the CO cannot be seen or smelled and can kill in just minutes. The CO is produced when any fuel (gas, oil, kerosene, wood, or charcoal) is burned. Never sleep in a home with an unvented gas or kerosene heater, including camp heaters.

Cooking

Be cause of the CO threat, camp stoves, gas grills, or charcoal grills may be used *only outside*. The simplest way to keep your stomach full is to have a large supply of nutritious trail mix or snack bars. If you must cook inside, canned Sterno or canned candles may be used with small saucepans or chafing dishes. Be sure you have a good supply of kitchen matches where you can easily find them. Remember to store boxes of matches in a closed metal container to ensure they are not near flammable material and they remain dry enough to use.

You can also follow the military example of keeping a stock of Meals-Ready-To-Eat (MREs), which have an extended shelf life and are self-heating. A dozen MREs may be purchased for about $70 (there are many online sources for these emergency meals).

Internet Resources:

The FEMA web site provides more about shelter, heating, and cooking during emergencies:

www.fema.gov/areyouready/index/shtm

Maintaining Normal —
Light, Tools, Sanitation, and Documents

After the worst of the crisis has passed, you'll want to count noses, establish shelter, and locate your emergency food, water, and clothing. You now have the "luxury" of establishing some sort of daily routine. This routine may include cleanup and evaluating the stability of your home. Here are some approaches that can help:

Shed Some Light

Stumbling around in the dark is irritating and downright dangerous. Many of you have discovered this on camping trips when your flashlight batteries have failed. A vast array of high tech lanterns and flashlights are available, but all require that you refresh the batteries annually. How many of us remember to do that? Usually we wait until we need the flashlight only to discover it has died. There are solar and hand-cranked flashlights (many of the hand-cranked lights may also be used to charge a cell phone). Alternatives to flashlights include kerosene or white gas lanterns (these are effective but involve flammable fluids and are smelly), ordinary candles placed in candle lanterns, and Nuwick® or other commercially available emergency candles.

Home Tool Kit

The least expensive and easiest to assemble tool kit consists of a pair of pliers, a screwdriver, a sturdy knife, and a hammer. For cleaning up debris or chopping firewood, an axe, hatchet, and spade are essential; be sure you know where these items are kept. Add a pair of work gloves for cleanup chores. Duct tape and plastic sheeting are always useful. Even the Apollo lunar landing modules had a roll of duct tape in the tool kit!

Sanitation

One of the first questions you'll hear from your family after a disaster is, "where do we go to the bathroom?" If you have the answer, you are on the way to recovery, even though it may be a split trench in the back yard. Being clean is not only a health issue but gives everyone a better attitude. Keep an adequate supply of toilet paper, feminine and infant supplies, bar soap, liquid detergent, toothpaste, and toothbrushes. Large plastic bags may be needed for trash or to protect cooking equipment and food. Containers of pre-moistened towelettes and rolls of paper towels are always useful. Camp showers (solar-heated bags with a shower head) and even old towels provide a welcome relief from feeling grubby while coping with the disaster.

Documents

We may be fairly laid back on Whidbey Island, but we all rely on information — whether on paper or stored on our electronic devices. In your emergency supplies you should have *printed*, current copies of your critical information in a waterproof bag or container. The most

important items in this cache are copies of personal identification and credit/debit cards. The second tier of documents should include birth certificates, social security cards, passports, deeds, wills, and insurance papers. A list of emergency contacts and their phone numbers will be useful, especially if your cell phone is functioning. For very secure information, maintain a compact disc or a thumb drive with data on bank accounts, cloud accounts, stocks and bonds, and credit card numbers; these data should be protected with passwords and the media should function on any computer.

Don’t forget to include extra sets of house and car keys.

We lead busy, complex lives. The lists above include some of the most basic items you’ll need as you recover after a natural disaster.

Internet Resources:

The FEMA web site includes more basic suggestions about tool kits, sanitation necessities, and documents:

www.fema.gov/areyouready/index/shtm

Protecting Valuables and Dealing With Guns

Protection of valuables is a challenge, even in normal times. During and after a disaster, it may be difficult to protect valuables, but there are steps that can be taken to prevent their loss and damage.

- Make a digital photographic catalog of your possessions, focusing on those items that are financially and emotionally important to you. Photos are critical when you are filing insurance claims. Insurance against earthquakes and floods can be prohibitively expensive, but many of the side effects of those disasters may be covered by policies, such as fire, incidental water damages, and theft. Remembering details about your possessions might be difficult without the catalog as a reminder. Store the catalog away from your home; for example, in a secure outbuilding or in a fireproof safe. Of course, the catalog might be kept in a bank safety deposit box, which is also a great repository for computer drive back-ups and copies of key documents.

- Develop secure primary locations for valuables such as jewelry, precious metals, coins, small art objects, etc. A heavy fireproof safe or a wall safe may be the best choice; however, these are costly.

A lighter safe is more easily removed by thieves but may be secured to a wall or floor with chains or bolts. Few safes are water tight, so when firehoses are used or in the event of flooding they may not offer the best protection for your valuable items.

- When there is a risk of flooding, put your photos and paper financial records in waterproof containers as high as possible within your home. Assume that water levels will be much higher than what you initially anticipate. High shelves or attics with well-constructed roofs might provide a more protected location.

- If guns are among your valuables, they need the same protection as other items; you might need photographs, serial numbers, and purchase receipts to document your losses. Gun safes are readily available and, because they may be very heavy, will usually prevent random visitors from removing them from your home.

Internet Resources:

Comprehensive insurance tips are available:
http://www.ldi.state.la.us/consumers/misc_pubs/DisasterPreparednessInsuranceTips.pdf

Information from NOAA:
http://www.srh.noaa.gov/jetstream//tropics/tc_safety.htm

Whidbey Island Communications

When disaster occurs, and the family is in danger, one of the immediate urges is to pick up the phone and check on loved ones to make sure they are safe. We want to know. We live in an age of instant communication through technology — landlines, broadband Internet, cell phones, text messaging, Skype… But which of these will work in a disaster? Which won't? And how can you be best prepared to communicate with others?

For communications systems on Whidbey Island, service may depend on the specific area where you live. In a disaster, reliability is critical. South Whidbey Island has the distinction of having its own locally owned telephone company and, in 1961, became the first community in the nation to have 100% buried phone lines. Whidbey Telecom serves the island south of Greenbank Farm and because all the communications lines are underground, they are reliable, regardless of the wind, weather, or earthquake.

For Central and North Whidbey Island, most of the telecom providers' communications lines are overhead. Also, be aware that almost all cable company lines on

the island are overhead, attached to power poles.

In such areas, you can assume that if power lines are down in your vicinity. your phone, Internet, and cable connections may be affected.

But back to your call… In a disaster, most people try to phone family and friends, potentially overloading the capacity of any communications system. This is especially true of satellite/cellular systems. If the power is out (which is fairly likely), but your telephone company's lines are still functioning, your best bet is to use a landline. It is important to keep an old, standard telephone handy; unlike the newer remote handset systems, they work without power.

What about cell phones? What is their reliability? First, they require a battery charge to run, so in an extended power outage, which would be likely after an earthquake, cell phones won't be useful for long. Second, cell phones actually communicate over only the relatively short distance to a tower before connecting to the landline network. Towers will also be vulnerable to earthquake damage. For these reasons, the reliability of the terrestrial network is critical for communications in a disaster. Finally, if the data network is also out, text and Internet will not be possible on a cell phone (many parents would love this…).

What about types of communications that use the Internet? Skype and other "Voice over IP" (VOIP) communications are only as effective as the power, Internet, and communication networks available in

your area. And, of course, your computer functionality follows suit.

It is extremely useful to establish a contact plan with someone who lives outside of the area — preferably at least one state away — so that there is little chance that the same disaster would affect both of you. This person can relay information to others. Be patient! Keep trying…and be courteous…. keep your calls brief.

Internet Resources:

The Federal Communications Commission (FCC) has an excellent site on emergency communications at:
http://www.fcc.gov/cgb/consumerfacts/emergencies.html

Create Your Own Personal Emergency Plan

This pamphlet of articles, originally published in the *Whidbey Marketplace & News*, provides basic information on the causes and effects of natural disasters, their frequencies, and the risks that accompany them. We all read about and watch in the media stories of the devastation wrought by natural phenomena elsewhere in our world. It could happen here.

Now that you have read *Natural Hazards on Whidbey Island*, please take the time to evaluate your home and how it would be affected by a natural disaster. Your family's safety is important and you can keep them much safer in an emergency by taking some fairly easy steps now. You can find ways to mitigate the risks from disasters as well as care for yourself and others for two to three weeks if our Island were cut off from outside help.

This material is intended to supplement information and training for disaster response that is available from the Island County Government, American Red Cross, and Community Emergency Response Teams.

Internet Resources:

Information on how to prepare for emergencies from the Island County Department of Emergency Management: http://www.islandcounty.net/commissioners/dem/preparedness.htm.

Pamphlet:

Another great source of information is the *Disaster Preparedness Handbook*, free from the State of Washington and distributed by Island County.

Begin Your Emergency Plans Here

COULD THERE BE DESTRUCTIVE EARTHQUAKES ON WHIDBEY ISLAND?

WHAT ABOUT THE POTENTIAL FOR A GREAT TSUNAMI?

WHAT ARE THE FACTS?

HOW DO I PROTECT MY FAMILY AND MY PETS?

IS MY PROPERTY AT RISK?

You live in one of our state's most beautiful areas…….but you worry about safety issues. In this guide, you'll find answers to the above questions and learn how to avoid or survive natural hazards on Whidbey Island.