



**What does
it mean to
live Behind
a Levee?**

Ask Yourself This:

Are My Home and Loved Ones Safe from Floods?

Most people know that levees are structures built near rivers and lakes to reduce the risk of flooding. And most property owners and residents in Fife know that **the Puyallup River is contained in a levee**. But what does it mean to live behind a levee? How much protection does a levee really provide? What do you need to know to remain as safe as possible?

On the best of days, the Puyallup River has nourished the Fife Valley, taking the glacial melt downstream to the Sound, bringing salmon upstream to fishermen, and providing a crucial outlet for the surrounding ground waters.



On the worst of days, the Puyallup River, and those who live near it, relies on a levee to hold back its flood waters, keeping property dry and lives safe.



It's during those worst of days, when **Flood Watches** and **Flood Warnings** (*see definitions next page*) are sounding, that you want to know that your home and your loved ones are safe!

Living in Fife, you most likely live in a FEMA-declared flood plain, and **you definitely live behind a levee.**

This booklet was created to provide the residents of Fife with history and current information on the Puyallup River Levee, with the intent to help answer your questions and encourage you to *act now* to better protect yourself against future flood threats.



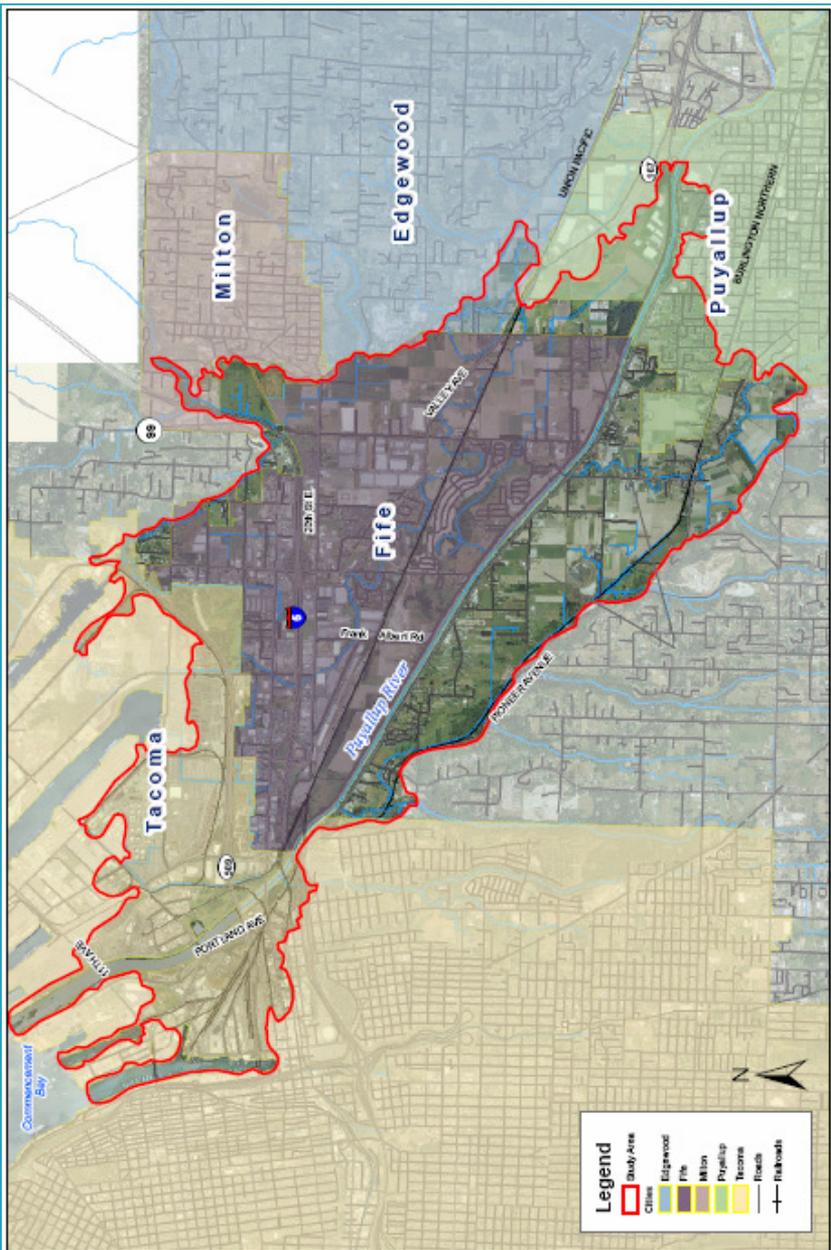
Definitions:

Flood Watch: A flood watch is issued by the National Weather Service when flooding is possible within the designated watch area. Be alert!

Flood Warning: A flood warning is issued when flooding has been reported or is imminent — take necessary precautions.

There are four essential facts about levees, explored in depth in the following pages:

1. *(page 6)* **Flooding will happen.** All rivers, streams and lakes will flood eventually. Given enough time, any levee will eventually be overtopped or damaged by a flood that exceeds the levee's capacity.
2. *(page 8)* **No levee is flood-proof.** Levees *reduce* the risk of flooding. But no levee system can *eliminate* all flood risk. A levee is generally designed to control a certain amount of floodwater.
3. *(page 15)* **Risks associated with flooding vary.** If you live behind a levee, you are responsible for knowing the threat you face from flooding. Don't assume that someone else is watching out for you!
4. *(page 18)* **Actions taken now will save lives and property.** There are many steps you can take, from purchasing flood insurance, to developing an evacuation plan, to flood-proofing your home, to reporting any problems that you see. The better precautions you take, the better off you'll be when the next flood occurs.

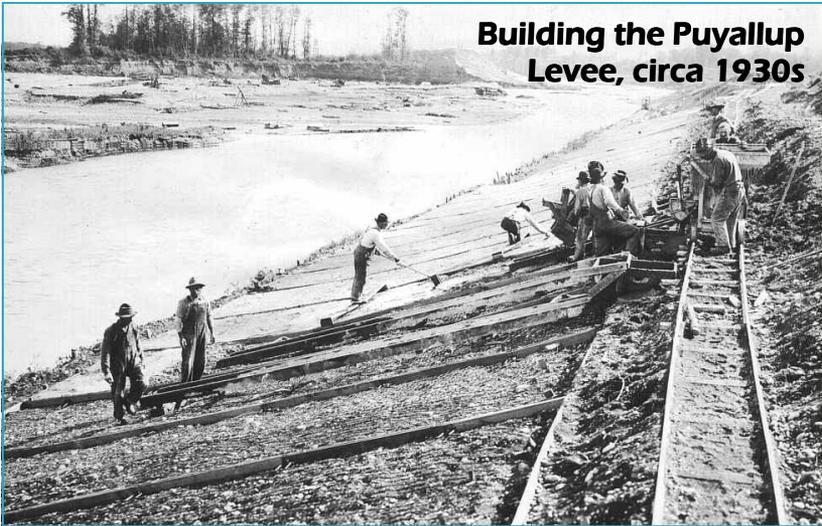


Without a levee in place, models show the expected flooding in the event of a 100-year flood. This term and others are defined in the following pages.



Flooding *will* happen.

The Puyallup River Levee construction began in the early 1900s, with the lower reach completed following a devastating flood in 1933. Although the levees were built primarily to control inundation of agricultural fields, the flood protection afforded by the levees allowed human occupation and development of the floodplain.



Building the Puyallup Levee, circa 1930s

The second most significant flood on record occurred in 1996. Thanks to the Levee and Mud Mountain Dam, constructed in 1948, widespread devastating flooding did not occur. That event triggered efforts by multiple agencies to develop a plan to address and lessen the risk of future flood damages along the river; these efforts continue to be put into practice today.

The 1933 flood occurred before floods were measured; the 1996 flood qualified as a **100-year flood**, as did the events in 2006 and 2009, proving that the term doesn't equate to a 100-year time period.

How Flood Size is Defined

A common practice to describe the size of a flood is by the “percent chance” that a flood will occur in a given year. Experts estimate the percent chance by charting the size of all known past floods at a location and recording how often floods of a particular size occur. Experts then estimate the probability (or percent chance) that the floodwaters will reach or exceed a certain level at that location.

Smaller floods occur more often than larger floods. Therefore, smaller floods have a higher percent chance of reaching or exceeding a particular floodwater level in any given year.



**100-year flood?
100-year levee?**

A flood that has a 1-in-10 chance of occurring in a single year is also known as a 10%-annual-chance flood, or a 10-year flood. A 1%-annual-chance flood (often referred to as a **100-year flood**) is likely to happen less often, but can happen more than once in 100 years. A 1%-annual-chance flood will have a higher floodwater level than a 10%-annual-chance flood. A “500-year flood” has only a 0.2 percent chance of occurring in a given year.

A levee designed to control a 1%-annual-chance flood, often referred to as a **100-year levee**, requires 3' or more of space, or “**freeboard**”, between the estimated top of the waters in flood conditions and the top of the levee.





No levee is flood-proof.

Levees reduce the risk of flooding, but no levee system can eliminate all flood risk. Levees do not always perform as intended, and can be damaged and decertified. This has happened with the Puyallup River Levee.

What Does Flood Size have to do with the Puyallup River Levee?

Taking the historical flood information of the Puyallup River into account, in 1987 the Army Corps of Engineers (ACE) determined that the Levee could withstand a **100-year flood event**. FEMA (the Federal Emergency Management Agency) then created and adopted **flood plain maps** based on the protection of the Levee. Over the years, sediment has been deposited on the floor of the river, to the point that, in 2004, the ACE decertified the Puyallup Levee based on lack of adequate **freeboard**.



**Freeboard?
New flood maps?**

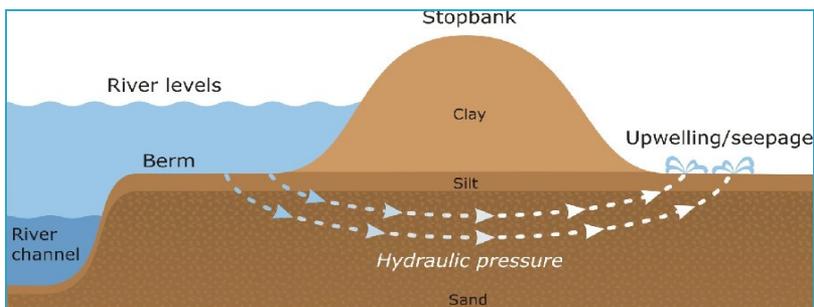
Therefore, FEMA has drawn up **new flood maps** that do NOT account for the existence of a levee; these maps are designed to estimate where and how much flooding might occur in the event of a 100-year flood if the levee should fail (see map page 5). Any location which falls within this potential flood area is said to be in a **flood-plain**. These new FEMA flood maps are scheduled to be adopted by FEMA in September of 2010 and will subsequently affect flood insurance rates.

What Measures are Underway to Reduce the Risks and/or the Impacts of Potential Flood Events?

Pierce County is conducting the Lower Puyallup River Flood Protection Investigation study to address significant flood and flood plain mapping related issues. The Puyallup River Emergency Task Force, a coalition of local jurisdictions and government agencies, is also studying the issue and reporting to elected officials at the local, state and federal levels. Additionally, the City of Fife has entered into the **Community Rating System**, sponsored by the National Flood Insurance Program. Further information, as well as some of the early findings of these studies, is detailed on the following pages.

What is the State of the Puyallup River Levee?

While the Levee no longer meets the certification requirements of a 100-year-flood event, it remains in good general condition. There is only one area of visible erosion on the Fife side, and that was reinforced last summer (see page 14). It is armored with concrete siding, which does have some visible cracking; while this can lead to “sand boils,” or seepage (see diagram below), which could further undermine the stability of the levee, at present, the probability of failure due to seepage is considered low. The greatest threat is overtopping.



Management Measures

Identifying viable means of **mitigating*** flood-related risks for residents is a primary goal of jurisdictions and agencies alike. After evaluating the condition of the Levee, alternatives most feasible to the Fife side of the

**** Mitigating:
Any sustained
action taken to
reduce or
eliminate long-
term risk to
people, property
and the
environment from
the effects of
natural and man-
made hazards.***

Levee include setting the existing Levee back, improving or constructing new sections of the Levee, and continued flood-proofing and implementation of warning systems.

These measures are either already in effect or are being studied for the best way to move forward. Moves to repair the Levee, with the ultimate purpose to obtain recertification, have begun (*detailed on page 14*). Evaluation and plans for improvements continue now, as does the ongoing work to secure funding.

Measures Specific to Fife

In the meantime, the City of Fife started working to protect its residents years ago. In 2005, Fife City Council adopted the 2004 FEMA flood maps as Best Available Science, and all development since that time has been done with flood proofing measures. In particular, new residents of Fife will be glad to know that, since 2005, all new housing has been built with the lowest finished floor level at least 1' above the estimated water level of a 100-year flood event were the levee to fail. New development is required to include an all-hazard radio for up-to-the-minute bulletins of impending disasters. And Fife boasts a state-of-the-art LaHar warning system, with 10 stations throughout the City.



Homes in Fife have been built above the estimated flood plain since 2005.



With these measures in place, Fife has obtained a **Rating of 5** from the Community Rating System (CRS) through NFIP (the National Flood Insurance Program). This equates to a **25% discount** on insurance premiums for property owners in Fife. CRS recognizes community efforts that go beyond the minimum standards for floodplain management by reducing flood insurance premiums for the community's property owners. The City continues to pursue measures to improve on this very-good rating, working to further reduce flood-related risks to our community.



LaHar Siren - one of 10 in Fife

New Best Management Practices Can Help Protect Fife



You are probably familiar with the “bench,” or “silt shelf,” of the Puyallup Levee, which sits between the water and the top of the Levee. That bench, begun by natural processes, is now believed to help protect the Levee,

as can be seen by the diagrams below and on page 13.

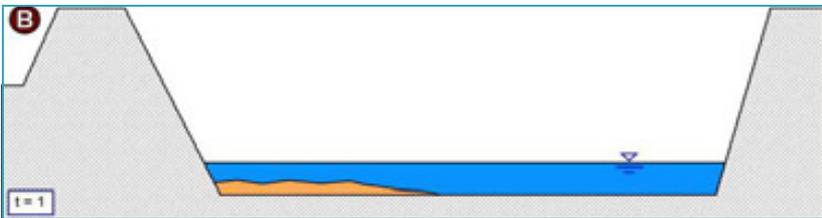
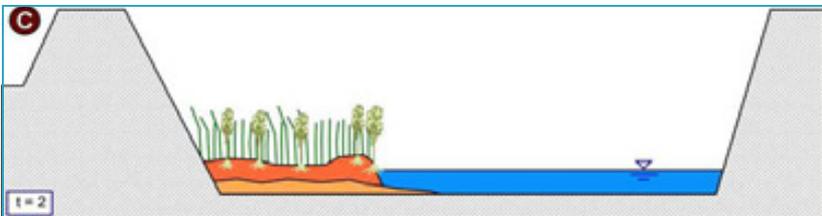
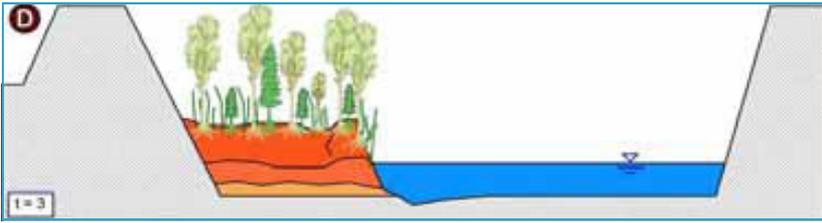
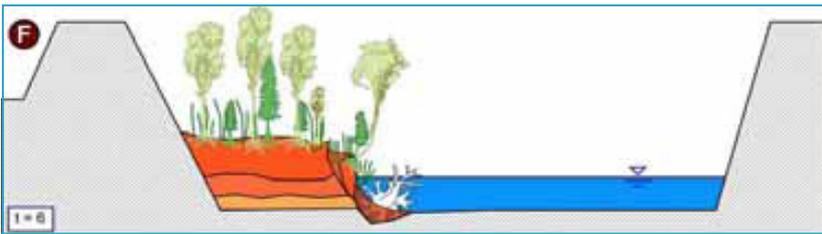


Diagram A shows a simple levee; B and C show the addition of a silt shelf with plantings growing.





With the right plantings, as erosion occurs at the toe of the levee (diagram D), there's a breakage of the bench, which fills in the toe, forming snags and roughness.



This has been shown to reverse erosion and accelerate bank re-construction (diagrams F and G).



In the absence of the best plantings, repair work simulated by the above can be done with **dolos**. This was done along the Levee in Fife, at about 62nd Ave, during the summer of 2009 (see photos next page).



Dolos



Levee Road / 62nd Ave: Dolos and log matrix used to simulate natural snags and ballast wood for bank stabilization.





Risks associated with flooding vary.

How do you Assess your Level of Safety Living Behind a Levee?

Unfortunately, there's no simple answer. Many factors must be considered. However, a better understanding of your risk will give you a better idea of what steps to take to reduce your risk. An overtopped or breached levee could allow an inch of water on a nearby street, or it could result in houses under water. The potential loss caused by a flood may vary tremendously depending on the size of the flood, levee performance, and a home's location and elevation relative to the levee. Just because water overtops a levee - or just because a levee is breached - does not necessarily mean that damage will occur.

A better understanding of your risk will give you a better idea of what steps to take to reduce your risk.

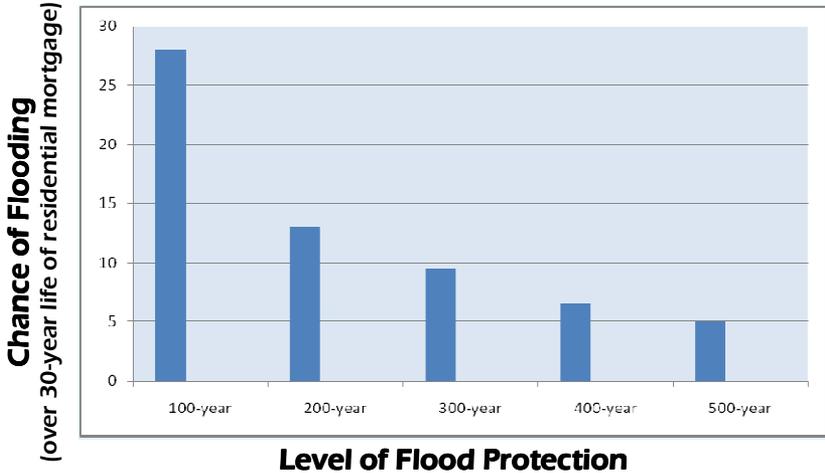
Flood Risk Will Change Over Time

Also, hazards associated with flooding may change over time. Climate change is expected to increase the intensity of storm events. Conditions within a watershed can also change due to increases in population and development. As there is less and less ground available to absorb storm water runoff, surrounding waterways become more flood-prone.

Levees and the Probability of Flooding

If you live behind a levee, you are responsible for knowing the threat you face from flooding. The chart below puts into perspective the risk associated with various flood levels.

Flood Exposure Behind Levees for Various Levels of Flood Protection



Based on "Draft Recommendations for a National Levee Safety Program" as prepared by the National Committee on Levee Safety.

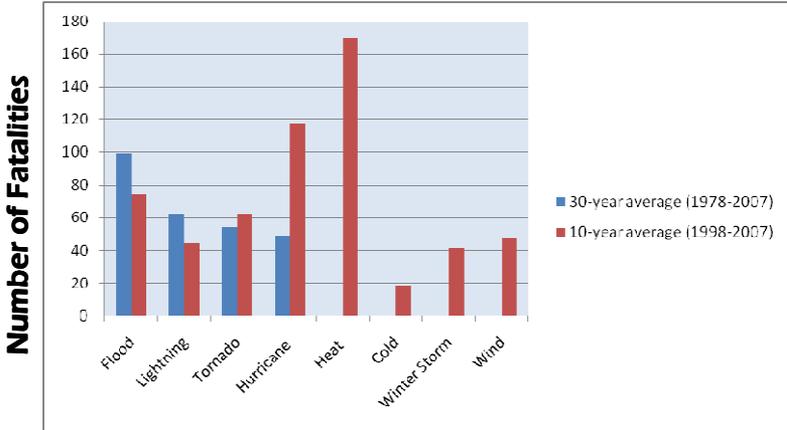
Probability modeling reveals that a levee that is designed to withstand a 1%-annual-chance flood (100-year) has a 26% chance of being overtopped by a flood during 30 years, the span of a typical home mortgage.

Flood Risk Compared to Other Natural Disasters

It's important to put the dangers of flooding into perspective. Over the past 30 years, on average, flooding has resulted in more fatalities in the United States than any other weather-related cause.

(See diagram next page.)

Weather Fatalities (30- and 10-year averages)

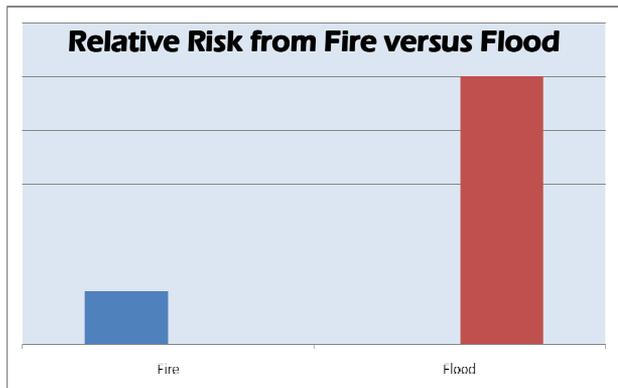


Type of Weather

Statistics compiled by the Office of Services and the National Climatic Data Center from information contained in "Storm Data," a report comprising data from the National Weather Service forecast offices in the 50 states, Puerto Rico, Guam, and the Virgin Islands. NOAA

How does the risk of flooding compare to the risk of fire? Certainly, fire poses a genuine threat. But a home located in a floodplain is five times more likely to suffer damage from flooding than from fire over the course of 30 years. Yet many homeowners do not insure themselves against flood damage unless they are required to do so.

If you live in a floodplain, the risk of damage to your home from flooding is five times greater than from fire.





Actions taken now will save lives and property.

Everyone can help promote levee and flood safety, and there are many actions you can take ahead of time!

How Communities Can Reduce Flood Risk

Flood risk can never be eliminated entirely. But just as you can take steps to reduce the risk of flooding to your home, Fife has taken actions to reduce risk to the community as a whole; the levee may be the main line of defense for Fife, but it is part of a more comprehensive approach to reducing flood risk. Other strategies employed in Fife, and detailed in the next few pages, include:

- Low Impact Development Regulations
- Develop/refine Flood Warning Systems, Emergency Evacuation Plans, and Flood Preparedness
- Creating a 200' Floodway Behind the Levee
- Regular Public Outreach
- Urge Homeowners to Purchase Flood Insurance
- Require and Maintain Elevation Certificates on Properties Located within a Flood Plain
- Maintain Base Flood Elevation Benchmarks
- Maintain a Flood Hazard Mitigation Plan
- Require Compensatory Storage
- Drainage System Maintenance

Low Impact Development Regulations

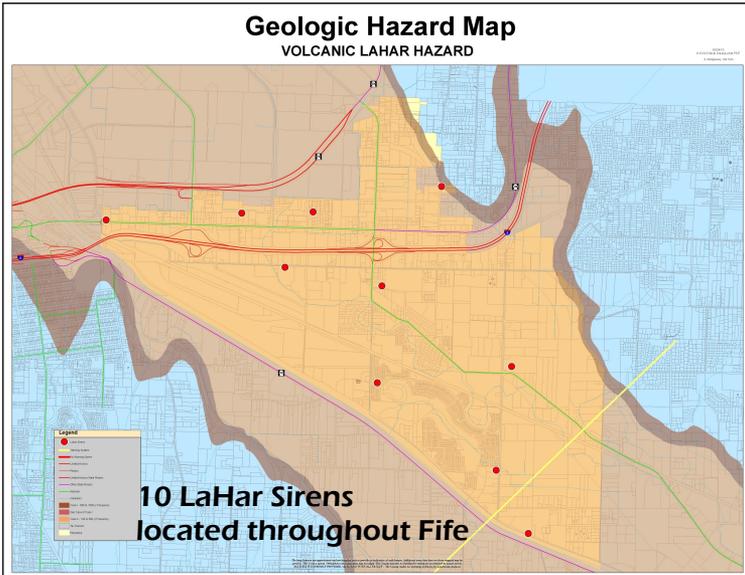
Adopted in early 2008, these strategies emphasize the conservation of natural conditions and the use of on site natural features with the goal of reducing the volume and travel rate of storm water. Examples include pervious paving, more compact development to maximize vegetated areas, rain harvesting, green roofs, and more.



Pervious Concrete

Flood Warning Systems, Evacuation Plans

The City of Fife boasts 10 LaHar Warning Sirens (see map, below), strategically placed within earshot of the entire City. Posted evacuation routes direct people out of harm's way, and are available for planning purposes (see page 20).



Floodway

Designated by FEMA and adopted by the City of Fife (FMC15.40.230), there is a 200' floodway running along the top of the levee within which there can be no new development.

Public Outreach

Publications such as this one, website information and updates, newspaper ads, public meetings, and the availability of large-size flood maps for viewing are all ways that the City strives to get the word out to its citizens and property owners about risks associated with flooding.

Flood Insurance



All of these measures together have helped our community obtain a 25% discount for Fife's residents on flood insurance. By obtaining this discount and encouraging property owners to purchase flood insurance, we are doing what we can to lower the financial risks associated with flooding.

Elevation Certificates

An Elevation Certificate is a detailed survey of a structure's elevation to see if it is above or below the base flood elevation (see next paragraph). These certificates are being required more and more by mortgage companies for homes located in a flood plain. The City of Fife maintains a data base on these certificates for most structures built since 2005 as part of its comprehensive approach to reducing flood risks.

Base Flood Elevation Benchmarks

There are 64 benchmarks throughout the City; these are used by engineers to determine whether a property is in or out of the floodplain, and appears on a property's Elevation Certificate.



FS-12: Railroad spike center west parking lot Catholic church 87 feet south of power pole H-2 at 2303 54th Ave E. Elevation 17.90

Natural Hazard Mitigation Plan

The City of Fife, in agreement and consolidation with Pierce County and other jurisdictions, maintains a Plan of Action in the event of any natural disaster, including flooding. There are steps in place that emergency personnel begin immediately, including opening up the Emergency Operations Center for efficient response.

Compensatory Storage



The City requires development to provide a way for storm water to be stored and subside. Usually this takes the form of the familiar storm pond on-site, but there are some alternatives.

Drainage System Maintenance

The City's Public Works department, working alongside Drainage District 23, maintains the drainage system, including catch basins and the Oxbow flood gate. The importance of this is demonstrated below:



During the January 2009 flooding, it was discovered that a beaver dam was blocking the flood gate. This meant that the Oxbow wetland, which runs along the Radiance housing development,



was unable to drain into the river as designed, and the City's Pump Station #12, located nearby, was threatened by flood waters.



Once the gate was cleared of debris, the danger to the pump station was alleviated.

Monitoring to prevent this from reoccurring is now routine.

What YOU Can Do in Advance

Fife's citizens are encouraged not to delay in preparing for any disaster, and that certainly includes floods, the most common and widespread of all natural disasters. Remember that the sheer force of just six inches of swiftly moving water can knock people off their feet, and cars are easily swept away in just two feet of water.



Please, take these steps today:

Prepare for a Flood

- Purchase flood insurance from the National Flood Insurance Program, through your local insurance representative.
- Store insurance papers, deeds, and other important records in a safe-deposit box or other secure location.
- Keep this booklet handy and refer to it often.
- Be aware that the City of Fife and Pierce County Emergency Operations Centers will be open in emergency situations, coordinating and facilitating resources to minimize the impacts.
- Know that sandbags are available at Fife City Hall. Also, learn of other items on the market, such as HydraBarrier, a reusable sandbag alternative, pictured below.



- Prepare an emergency kit that includes at least one large flashlight, a battery-powered radio, spare batteries, candles, waterproof matches, and other items you're likely to need in the event of a power outage.

Prepare Your Home

- Elevate your furnace, water heater, and electric panel if they are susceptible to flooding.
- Install “check valves” in sewer traps to prevent floodwater from backing up into drains.
- Seal basement walls with waterproofing compounds to avoid seepage.
- Keep family heirlooms and other priceless possessions on an upper level, if possible, or in locations within your home that are least likely to flood.

Prepare for an Evacuation



- Make a list of items to take with you in case of an evacuation (for example, clothing, cash and credit cards, prescription medications, eye glasses, mobile phone, etc). Keep this list in a handy location.
- Listen to the National Oceanic and Atmospheric Administration weather radio. (NOAA)

Prepare for an Evacuation (continued)

- Familiarize yourself with Fife's predetermined evacuation routes (see page 20), mapping out which one will best serve your family in the event of an emergency.
- Keep your vehicle full of fuel.
- Learn where official shelters are located and plan your route to the nearest shelter or other safe area. Consider whether any locations along your planned route might flood. Also consider what to do with pets; most shelters can't keep animals.



Useful websites:

- <http://www.fema.gov/areyouready/flood.shtm>
- <http://www.bt.cdc.gov/disasters/floods/>
- <http://www.ready.gov/america/beinformed/floods.html>
- <http://www.co.pierce.wa.us/pc/abtus/ourorg/dem/pubed.htm>

A sampling of products available to protect your property:

- www.hydrabarrier.com (*pictured on page 25*)
- www.floodprotectionproducts.com
- www.hydrologicalsolutions.com
- www.stormtec.net
- www.aquadam.com

**What does it mean to live
behind a levee?**

**How much protection does a
levee really provide?**

**What do you need to know to
remain as safe as possible?**



City of Fife

5411 23rd St E
Fife, WA 98424
253-922-2489

