

## Frequently Asked Questions

### Skagit River General Investigation Study

Congress specifically authorized the Corps to work with Skagit County and other local interests to study a comprehensive flood damage reduction project for the Skagit Basin from Sedro Wooley to Puget Sound. Skagit County and the Federal government co-fund the study, which has an estimated cost of \$8 million total. It is scheduled to be completed in 2009.

#### **What will the study do for flood control?**

The Corps and County are evaluating a number of flood damage reduction plans, including modifications of dams, levees, floodwalls, overflow channels, and floodproofing. No one project will provide a full solution, but a combination of projects will be needed.

#### **Did the study get Federal funding in 2006? What will the money be used for?**

Congress provided the study with \$300,000 of federal funds in 2006. To date, the Federal government has contributed \$2 million to the study. Skagit County is matching that expenditure with needed study work. This year, the Corps will complete our evaluation of existing conditions in the basin, including flood damages, areas of flooding, depth of flooding, erosion issues, and environmental studies. The County and the Corps will also complete a preliminary evaluation of likely flood damage reduction alternatives to develop preliminary costs, designs, and benefits. Based on the results, the County and Corps will discuss in June 2006 whether to continue the feasibility study.

#### **When could we see Federal construction?**

Once the feasibility report and Environmental Impact Statement are completed, the Assistant Secretary of the Army and the Office of Management and Budget need to approve the project. The project is then forwarded to Congress for authorization under a Water Resource Development Act bill, and specific appropriation of funds. A period of detailed engineering and design is needed to complete construction specifications. For a study completed in 2009, the earliest construction would likely be in 2012.

#### **What does the sponsor need to do for a General Investigation Study project?**

A local government agency provides 50 percent of the study costs and effort. The sponsor funds 25 percent of detailed design, and 35 percent of construction. The local sponsor funds all project maintenance and operation after construction. The sponsor provides real estate requirements for the project, which can in some cases cover a portion of the sponsor construction costs. The sponsor obtains permits for construction. The projects are constructed by contractors under contract with the Corps of Engineers.

#### **How does a flood damage reduction alternative get selected for a Federal project?**

The Corps is required to recommend flood damage reduction methods that provide the most benefits, usually at the least cost. The projects must be environmentally acceptable, economically justified, engineeringly sound, and acceptable to the public. The Corps does not necessarily provide 100-year flood protection, but optimizes projects based on costs and other factors. If a local sponsor wishes more protection, they fund the extra costs -- assuming the project still meets environmental and engineering requirements. The Corps is mandated by Presidential Executive Order to not encourage future development in the floodplain. Therefore damages are based on existing, not future development, and project areas are required to develop sound land use planning to prevent future flood prone development.

#### **What other flood control authorities does the Corps have?**

Besides the large General Investigation studies, the Corps has a Small Flood Control authority (Section 205) that allows the Corps to design and construct site specific flood damage reduction projects for under \$7 million Federal. The study requires a local government to cofund the study, provide real estate, and maintain the project. Projects under this authority can be approved at the Corps Division level. These studies require a decision document and an environmental assessment or EIS. From study initiation to construction is usually 3-4 years.

### Skagit River General Investigation Study -- Hydrology

#### **What does the Corps believe is the 100-year flood at Concrete? Some say it is 235,000 cubic feet a second (cfs); other days, it is 297,000 cfs. Can you tell me what the Corps' actual estimate of the 100-year event is?**

The peak flow for the 100-year flood at Concrete with all of the dams in place is 235,000 cfs (what we call a regulated flow). If we did not have flood control at the dams, the peak flow for the 100-year event at Concrete would be

299,000 cfs (called an unregulated flow). We calculate both of these values because we first need to see what the natural conditions are. Historic flows such as the 1897, 1906, 1917, and 1921 floods did not have flood control so they represent natural flows. We can calculate the impacts of the dams on the floods for most of the rest of the years since then, so we can determine what the natural flows are for most of the period of record. Once we determine the 100-year natural flow, we use a numerical model to route these flows through the dams using our current flood control authorities to determine the "regulated" 100-year event. This way we have utilized as much of the historic record of flows on the Skagit River as possible.

**What is the 1-percent chance exceedance flood or 100-year flood?**

A 100-year flood is calculated to be the maximum level of flood water expected to occur, on average, once every one hundred years. Hydrologists prefer to use the term 1-percent chance exceedance flood since there is a 1 percent chance that a flood equal or exceeding the stated level will occur in any year. This flood is talked about more frequently than other floods because it is often the criteria used for building permits, environmental regulations, and flood insurance.

**How are these types of flood frequencies determined?**

The historic record observed at a representative stream location is analyzed and what has been observed in the past is assumed to be what may occur in the future. This data is collected and is put through a statistical process called a frequency analysis. If the current or future condition is likely to be different than the historic data, then the flows need to be adjusted to have a representative record. The statistical process is not considered valid with less than 10 years of data. This analysis improves and can change significantly as more data is collected. The more data that is collected reduces the probability that the flood frequency will change. For a more thorough and accurate description, see: <http://www.usace.army.mil/publications/eng-manuals/em1110-2-1415/entire.pdf>

**When and where does flooding occur in terms of flow and elevation for the Skagit River?**

The following stage and flows are derived from the Skagit River near Mount Vernon gage. Looks like table got cut off on the right.

Stage (Ft.)	Discharge (cfs)	Character of Flooding
25.0	53,200	1. Beginning of backwater in Nookachamps Creek area with flooding of low-lying farmlands -- no damage
28.0	67,850	1. Zero damage
30.3	82,260	1. Beginning of flooding in town of Hamilton 2. South End of Francis Road is overtopped and closed to traffic which is the road to Sedro-Woolley via Clear Lake. Those living in this lower area on Francis Road No longer have an escape route. 3. Beginning of overland flow to levee east of Burlington on Fairhaven Street, on north side of river between Sedro-Woolley and Burlington.
32.7	100,300	1 Major damage discharge in the vicinity of Mount Vernon
33.8	110,000	1. Levee freeboard as follows: Levee east of Burlington on Fairhaven Street 3 to 4 feet 2. Levee failures may occur when river remains above this stage more than 24 hours, with flood conditions varying as levees fail or are overtopped throughout the valley 3. In view of the inadequate cross-section of practically all Skagit River dikes, the following action should be taken by the Corps at this time <u>if a 2-foot rise is indicated in the next 24 hours: Be prepared to evacuate flood fighting crews from areas below Mount Vernon.</u>
36.60	141,500	1. Flooding expected in many districts. Dikes on either right or left bank from Hwy. 99 bridge downstream to Mt. Vernon may be breached
38.1	160,000	1. Emergency raising of Burlington and Mount Vernon levees necessary to prevent flooding

**Where can I find flow and stage information for the Skagit River?**

Both the Corps and US Geological Survey (USGS) maintain websites that have information on the flows and stages seen on the Skagit River. These sites are at:

**Corps:**

<http://www.nwd-wc.usace.army.mil/nws/hh/basins/skagit.html>

**USGS:**

<http://waterdata.usgs.gov/wa/nwis/current/?type=flow>

In addition, the Northwest River Forecast Center, which is a branch of the National Weather Service, predicts future flows up to a week in advance. There is significant uncertainty in these predictions but it can be useful for planning purposes. Their website is at: <http://www.nwrfc.noaa.gov/>

**What is the 1-percent chance exceedance flood (100-year flood) expected on the Skagit River near Mount Vernon?**

The methodology that the Corps and FEMA use to calculate the 1-percent chance exceedance flood is slightly differently so there are two estimates for this flood. The Corps methodology results in 242,000 cfs reaching Sedro-Woolley and 230,000 cfs is estimated to flow past Mount Vernon. The FEMA methodology results in 235,000 cfs reaching Sedro-Woolley and 221,500 cfs is estimated to flow past Mount Vernon. If all of the water was put through the width of the current levee system past the Skagit River near Mount Vernon gage, the water would reach an elevation of 45.9 feet with the Corps methodology and 45.1 feet for the FEMA methodology. The current levee system is only 41 feet right at the gage.

**What are the chances of a flood on the Skagit River exceeding the levee capacity near Mount Vernon in any year?**

In the past, there have been serious concerns when the stage at the Mount Vernon gage approaches 38 feet. In both 1990 and 1995, the stage reached 37.3 feet and the system was close to its capacity. The estimated flows for these stages are roughly 150,000 to 160,000 cfs. These flows have a 3 to 4 percent chance of occurring in a given year (also called a 25- to 33-year Flood).

**How do I find out if my residence is vulnerable to flooding?**

FEMA produces Flood Insurance Rate Maps (FIRMs), Flood Insurance Study (FIS) texts, and other flood-map-related products. These maps delineate the 1-percent chance exceedance floodplain as a minimum. One of the easiest ways to view the flood maps is to view scanned versions of the materials at the [FEMA Flood Map Store](http://www.fema.gov/floodmaps). (<http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1>) . If you would like to examine the maps and speak with someone knowledgeable about your local circumstances, you may also contact your local map repository, an office that keeps the FEMA maps for public reference and use. This office is usually in your local (county or city) planning, engineering, or public works department.

**Where is the best information on flooding if I live in Skagit County?**

Skagit County Public Works has very detailed information about what to do in case of a flood at: <http://www.skagitcounty.net/Common/Asp/Default.asp?d=Flood&c=General&p=floodmain.htm>

**Skagit River General Investigation Study -- Dams****What is the Corps' role in helping to reduce flooding?**

During predicted floods, the Corps manages flows from the dams in ways to reduce flooding, and assists with emergency management operations. If there is a willing local sponsor, the Corps will collaborate on planning studies that look at flood damage reduction and will also cost-share the construction of the project that this type of study would recommend.

**How can dams be used to reduce flooding?**

The objective of dams used to reduce flooding is to capture enough runoff in the reservoir to keep streamflows from reaching damaging levels. The filling of storage reservoirs must be timed so flows are reduced the most when runoff is highest. If the flows are reduced too early in a flood and the reservoir fills up too quickly, then there is no empty space left to store the streamflow entering the dam and high flows must be passed on downstream.

**What dams are in the Skagit River Basin?**

There are five dams in the Skagit River Basin: Ross, Diablo, and Gorge Dams on the mainstem Skagit River upstream of Newhalem, and Upper and Lower Baker Dams on the Baker River that enters the Skagit River just upstream of Concrete.

**Who owns these dams?**

Seattle City Light owns the mainstem Skagit River dams (Ross, Diablo, and Gorge) and Puget Sound Energy owns the two dams on the Baker River (Upper and Lower Baker).

**What flood storage space is available for the dams in the Skagit River Basin?**

Ross and Upper Baker Dams are required to set aside a specific volume of flood storage during the winter months to

reduce flooding downstream. Diablo, Gorge and Lower Baker Dams are restricted to not allowing the drafting of their reservoirs by releasing more water than is entering the reservoir during flood conditions.

#### **How is the Corps of Engineers involved with these dams?**

The Corps of Engineers was tasked with the justification of necessary flood storage space as part of the dam authorization process through the Federal Energy Regulatory Commission (FERC). In 1954, the Corps justified 120,000 acre-feet of flood storage in Ross Dam. In 1956, FERC required Upper Baker Dam to provide 16,000 acre-feet of flood storage to make up for lost valley storage caused by the building of the dam. The Corps justified an additional 58,000 acre-feet of flood storage in 1977. Congress authorized to Corps to use this space. In each of these cases, the Corps was given the control to fill the flood control space and to manage flows from these dams when flooding occurs.

#### **How does the Corps utilize this flood storage space in Ross and Upper Baker Dams?**

The Corps of Engineers takes over control of flows from Ross and Upper Baker Dams 8 hours before the unregulated (natural) flows for the Skagit River at Concrete are expected to exceed 90,000 cfs. The 90,000 cfs flow at Concrete is the flow at which major damage is expected to occur on the Skagit River. The reason that control is taken 8 hours ahead of time is because this is the anticipated time that it takes for water released from Ross Dam to get to Concrete. When the 90,000 cfs is expected to be reached, the outflows from the dams are reduced to the minimum required flow releases.

#### **Is water ever released from a dam with flood storage space during a flood?**

Yes. There are limits to the amount of space there is available in any reservoir. It is not possible to design flood storage reservoirs to store all the flow that enters it. The size of flood storage reservoirs are usually optimized by weighing cost versus the benefit of reducing flooding downstream. When the predicted volume of water is expected to exceed the volume that is available, the smallest amount of water is released that reduces the volume of water to be stored to the reservoir's flood storage capacity. There are also occasions where water will start to be released from the dam before all of the flooding downstream has stopped. If a dam is quite a ways upstream, the flow releases from the dam can take some time to get to the downstream location where the flooding is occurring. In these circumstances, releases can sometimes be made that will not affect the flooding downstream because the water will arrive after the peak has passed.

#### **How come Diablo, Gorge and Lower Baker Dams do not have flood storage set aside for them?**

The Corps is currently working with Skagit County to evaluate the feasibility of adding additional flood storage. The Corps has several requirements that must be fulfilled before taking on additional flood storage at these dams. These requirements may represent significant obstacles to achieving this, however. One of these requirements is that the dam must meet the Probable Maximum Flood (PMF) Standards. These standards are based on the idea that the Corps does not want to take responsibility for a dam that could potentially fail under an extreme event and induce more severe flooding due to its operation. Another requirement is that the additional storage must produce a positive benefit to cost ratio. As an example, if the dam needs to be completely retrofitted to meet the PMF standards, there must be enough benefits from flood storage to overcome the costs. In addition, there are limitations to the operation of these three dams that make the additional storage a challenge to obtain. These limitations are as follows:

**Diablo Dam** controls the tailwater elevation for Ross Dam and Ross Dam needs the tailwater elevation controlled in fairly narrow elevation bands. This limits the storage that can be available.

**Gorge Dam** does not have the ability to hold a significant amount of water. Its full pool only contains 8,100 acre-feet of storage which would not be even able to hold back 5,000 cubic feet per second (cfs) for a day. It also has pool restrictions as it controls the tailwater elevation for Diablo Dam.

**Lower Baker Dam's** ability to keep storage available below its spillway crest is limited due to the fact that their outlets below this elevation can only release a maximum of 4000 cfs. To make sure that Upper Baker Dam does not fill in when floods move in, flows significantly greater than 4000 cfs are released and cause Lower Baker Dam to fill.

#### **Can all floods be prevented by these dams?**

No. Dams can only control the flows that enter the reservoir behind them. Ross Dam has 999 square miles of area that runs off into its' reservoir. The area that runs off into Upper Baker Dam is 215 square miles. The total area that drains down to the Skagit River at Concrete is 2,737 square miles, which means there are 1,523 square miles of drainage area that is not controlled by Ross and Upper Baker dams. From Concrete to Mount Vernon, there are an additional 356 square miles that drain into the Skagit River. Therefore, 60 percent of the flow in the Skagit River Basin can not be controlled by Ross and Upper Baker Dams. The clearest example of uncontrolled runoff comes from the Sauk River. The Sauk River is completely uncontrolled and has 732 square miles that drain to it. In October of 2003, it contributed 106,000 cfs by itself to the Skagit River.

**How much of this flow is being released by the dams during the 1-percent chance exceedance flood (100-year flood)?**

Upper Baker Dam would release about 5,000 cfs (the minimum flow) and Ross Dam would release roughly 12,000 cfs. If the dams did not exist or were not operated to reduce floods, the 1-percent chance exceedance flood (100-year flood) would be 298,500 cfs at Sedro-Woolley and 274,000 cfs at Mount Vernon (49.6 feet). These flows were calculated in the Corps' Skagit River General Investigation Study.

**Why is water released from Lower Baker and Gorge Dams when the Skagit River is flooding?**

The Corps regulates flow from Upper Baker and Ross reservoirs. There is no storage in the other reservoirs, so they are unable to hold back the water and inflows are passed downstream. The Corps does coordinate with PSE and Seattle City Light to ensure that they do not exacerbate the flood situation by evacuating water prematurely from these reservoirs. Upper Baker and Ross Dams control about 1/3 of the Skagit River watershed and releases are closely coordinated to effectively cut off their flow when Skagit River floods.

**Why doesn't the Corps use Lower Baker to control flooding?**

The design of Lower Baker Dam does not allow it to be used for flood control. The outlets can not be opened fast enough to keep up with inflows, so the reservoir fills prematurely. During flood conditions, Lower Baker generally is full and must release the water that enters the reservoir to protect the dam.

**Skagit River General Investigation Study -- Corps Emergency Response and Levee Rehabilitation**

**Why are the levees important and what is their function?**

The Skagit Valley levees have greatly reduced flood damages since they were constructed. Without the levees, the Skagit Valley communities would be flooded practically every year. The levees prevented major damage to the cities of Burlington and Mount Vernon in the floods of 1990, 1995, and 2003. Levees protect homes, businesses and infrastructure such as freeways, highways, sewage treatment plants, water treatment plants.

**When and how does the U. S. Army Corps of Engineers respond to Skagit River flood events?**

The U.S. Army Corps of Engineers is authorized to assist local governments with flood response. Diking Districts or Skagit County can request assistance for situations which are an imminent threat to life or property. Typical Corps emergency measures include shoring or raising levees, repairing levee breaches, and bank armoring to prevent river migration and to lessen flood damage.

**How do we prioritize flood response?**

Flood response efforts for the Skagit River are managed by the Skagit County's Incident Command System. The Corps of Engineers provides technical assistance to both the Diking Districts and Skagit County; however the decisions regarding flood response activities are made by the County.

**Are the Skagit levees certified and who do they belong to?**

The Skagit River levees are owned and maintained by the Diking Districts or the County. Many of the levees meet the requirements of the Corps levee rehabilitation program but the levees are not certified to withstand a given event.

**Why is levee maintenance important?**

Annual levee maintenance is critical to the reliability of the levee. All of a levee's components need to be operating correctly in order for the levee to function properly. Vegetation maintenance is needed to assure structural stability of the riverward slope; reduce seepage paths through the levee, and to make the levee accessible during inspections and emergency response. Riprap armoring also needs to be maintained to assure scour protection during flood events.

**Why do levee repairs need to be expedited?**

Damaged levees pose a serious threat to lives and property during floods. The Corps recommends that flood damage repairs are completed prior to the next flood season. This entails an expedited design and construction process. A levee in a damaged state could possibly suffer catastrophic failure as a result of a small or moderate flood.

**Does the Corps mitigate for emergency flood response and levee repairs?**

Yes, the Corps designs levee repair projects to incorporate habitat features. The intent is to make the post repair condition to the same level of protection than the pre-flood condition. The Corps tries to include as many environmental features as possible without risking the level of protection afforded by the levee. Emergency response alternatives are also evaluated to minimize impacts to the environment. Most actions are replacing damaged structures and do not have significant impacts.

## **Regulatory permits during emergency events**

### **Does the Corps have a process for applications in an emergency?**

Seattle District is able to expedite the application review process for emergencies. According to 33 CFR 325.2(e)(4), an emergency is a situation which would result in an unacceptable hazard to life, significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard procedures. Except in extreme and rare circumstances, we will not classify situations created by poor planning or late submittal of a permit application as emergencies. For emergency situations that comply with 33 CFR 235.2(e)(4), our review process can take from one day to one week to complete. We will make reasonable efforts to receive comments from interested Federal, State, and local agencies and the affected public. Also, the Corps will publish through notice any special procedures authorized and the rationale. If the work is authorized, the Seattle District will make the final decision and after-the-fact coordination and additional requirements will be unlikely. For emergency work subject to an individual permit, the Seattle District will perform coordination and recommend a decision; however the Northwestern Division office, one level above the Seattle District office, is responsible for final approval. After the emergency work authorized via an individual permit is completed, the Corps must finalize their evaluation of the project and may add requirements concerning restoration, mitigation, or the operation and maintenance of the completed work.

### **Do the NMFS and USFWS have any emergency consultation processes?**

The two agencies have an emergency consultation process (50 CFR 402.05) for unpredictable events with potential to cause imminent loss of human life or property. Property is defined as significant infrastructure such as key transportation corridors, dwellings, and office buildings. Emergency consultation can take from one day to about two weeks. In an emergency, the Corps notifies NMFS and/or USFWS that emergency procedures are being invoked and employs measures to minimize the impacts of the emergency work. Where possible, the Services may provide advice to reduce the potential for adverse effects on listed species. After-the-fact consultation is required and may require significant modification, or total removal of temporary solutions employed in the emergency once the emergency has subsided. Additional mitigation actions may be required to account for "take" of listed species and/or loss of habitat for listed species.

For more information, contact the Seattle District Public Affairs Office at (206) 764-3750.