TOWN OF LA CONNER

Flood Emergency Response Plan

Prepared by:

nhc northwest hydraulic consultants

Leaders in water resource technology

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Town of La Conner
Flood Emergency Response Plan

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Town of La Conner

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1.0 Introduction

A significant portion of the Town of La Conner lies within the 100-year floodplain of the Skagit River, making it susceptible to periodic flooding to a depth of two to six feet (see Figure 1). The primary cause of flooding in La Conner is due to dike breaks occurring along the Skagit River – dikes that are operated and maintained by several different agencies. Due to La Conner's physical location at the lowest corner of the floodplain, floodwaters from dike breaks up to 15 miles away can eventually inundate the Town. Such flooding would close all roads into and out of La Conner, impact key public facilities and services, and necessitate evacuations of areas around and within La Conner.

In response to this threat to public safety and infrastructure, the Washington State Department of Ecology and the Town of La Conner have provided funding to develop this Town of La Conner Flood Emergency Response Plan.

This report includes an overview of the Skagit River and its recent flood history; describes the flood threat to La Conner; and summarizes the flood warning system in place and the flood response plans of other agencies. This report also describes La Conner's vulnerability and details La Conner's roles, responsibilities, and required actions during flood emergencies. Potential capital projects and actions are listed which can reduce future flood damages.

2.0 Overview of Skagit River Basin

The Skagit River basin is 3,277 square miles in area, covering an area in Canada and the United States between the Cascade Mountains and the Puget Sound. Elevations in the basin range from sea level near La Conner to 10,778 feet at the summit of Mount Baker. Significant Skagit River tributaries include the Sauk River, the Cascade River, and the Baker River. Major dams include Ross, Diablo, and Gorge dams on the Skagit River, and Upper and Lower Baker dams on the Baker River. Ross Lake provides some flood control for 978 square miles of the Skagit Basin, and the Baker River reservoirs provide some flood control on an additional 485 square miles.

The lower main stem of the Skagit River flows westerly through Skagit County, creating the boundary between the Cities of Burlington and Mount Vernon. Downstream of Mount Vernon, the river flows through its delta in two main channels: the North Fork and the South Fork, each about ten miles long. The Skagit River floodplain includes approximately 90,000 acres of lowland outwash plain and reclaimed tidelands. Below Burlington and Mount Vernon, the floodplain widens to nearly 20 miles. The floodplain, cities, agricultural lands, and reclaimed tidelands are protected by a system of 93 miles of dikes, owned and operated by a variety of agencies and entities.

3.0 Historical Floods

Throughout the years, major flooding has occurred in the Skagit River Basin. Because of its geographic location, the Skagit River Basin is subject to floods generated by winter rains and accompanying snowmelt, with the largest floods usually occurring between November and March. The winter floods have a considerably higher magnitude than the average annual spring high water that occurs due to seasonal snowmelt.

La Conner has been flooded in the past due to dike breaks on the Skagit River; the last time this occurred was in 1951. Dike breaks also occurred during floods in 1990 and 1995, but these did not impact La Conner. Continuous flow records for the Skagit River have been kept since approximately the late 1800's. In addition, flow estimates have been made for extremely large flood events occurring in 1815 and 1856.

A detailed description of significant historical floods, provided by USGS Water Supply Paper #1527 and Skagit County Public Works, is included in Appendix B.

4.0 Existing Conditions Flood Potential

This section provides brief summaries of recent flood studies with a focus on the existing flood potential in La Conner.

4.1 Skagit County Flood Insurance Study

A flood insurance study (FEMA, 1989) for unincorporated Skagit County identified the regulatory 100-year flood elevations for the La Conner area at 8.0 feet, National Geodetic Vertical Datum (NGVD). Figure 2 shows the existing conditions 100-year flood inundation limits for the area including the town of La Conner. Floodplain mapping is based on the assumption that a 100-year flood on the Skagit would cause levee breaks along Burlington or the Avon bend area, and the coastal levees (levees along the Swinomish Channel) would contain the floodwaters until they were overtopped (Figure 3). It is expected that floodwaters from dike breaks on the Skagit would flow across the valley until they hit the coastal levees and then "pond up". Once the floodwaters reached the elevation of the top of the coastal levees, they would pour over them into Swinomish Channel or Skagit Bay. Therefore, an average levee crest elevation, 8 feet NGVD, was used as the water-surface elevation of the 100-year flood.

4.2 Skagit County/Corps of Engineers Flood Feasibility Study

4.2.1 Overview

Skagit County and the Army Corps of Engineers (Corps) are conducting a Skagit River Feasibility Study to evaluate flood damage reduction alternatives for the Skagit River. The study includes topographic mapping of the floodplain, development of hydraulic and economic models for predicting potential flood damage, extensive public involvement, and development of alternatives for feasibility analyses. A key study finding is that the current dike protection system is inadequate to withstand large floods. Extensive capital improvements are required to create a level of protection commensurate with the infrastructure and the number of people that the dike system protects (including La Conner). Two alternatives have been proposed and environmental and economic studies are underway to determine the preferred alternative. Either alternative would increase La Conner's level of protection against future floods and reduce damages.

4.2.2 Dike Break/Floodplain Inundation Scenario

As part of this feasibility study, the Corps developed dike break and floodplain inundation scenarios to evaluate the economic impacts of floods under existing conditions. To develop inundation scenarios, the Corps first developed a "probable failure point" analysis of the existing levee system, which determined the flood level at which the levee would "probably fail". A hydraulic model of the river channel and floodplain was developed; this was used to give rough predictions of possible levee failures and the corresponding flood flows onto and through the floodplain.

Of particular interest to La Conner are computer simulations of the 50-year and 100-year floods. These simulations show the potential for catastrophic levee failures on the

right bank of the Skagit River in both the Burlington and the river bend areas. Flood waters from these levee breaks all flow westward, ponding up behind the coastal dikes and causing flooding in La Conner up to several feet deep. Figures 4 through 7 show "probable failure points" and maps of the corresponding maximum flow depths for the modeled 50-year and 100-year scenarios.

5.0 Flood Warning System

A flood warning system has been developed for the Skagit River, which includes river monitoring gages and a sophisticated weather and river modeling system, used to track, forecast, and issue warnings if potential flood situations arise. Each is described below.

5.1 USGS, Corps, and Skagit County River Gage System

The United States Geological Service (USGS), Corps, and Skagit County have built and maintain an extensive flood warning system, which includes several river monitoring instruments, called "gaging stations." These gaging stations continuously monitor river levels and provide valuable information for forecasters and emergency response agencies during floods. There are four significant gaging stations on the Skagit River, at Newhalem, Concrete, Sedro-Woolley, and Mount Vernon. There are also gaging stations on major tributaries, including the Sauk and Baker Rivers.

Important Skagit River gage information is provided in Appendix A, including tables showing gage information (Table A1), peak river levels reached from 1975 – 2002 (Table A2), historical flood flows at each gage (Table A3), and flood frequency statistics at some key gages (Table A4).

5.2 National Weather Service Flood Warning System

5.2.1 National Weather Service

The National Weather Service Forecast Office in Seattle, Washington tracks a variety of weather and river related data and also issues warnings to emergency response agencies and the general public. For river flood forecasting in the Pacific Northwest, including the Skagit River, the NWS relies on predictions of the Northwest River Forecast Center in Portland, Oregon.

The Northwest River Forecast Center uses the National Weather Service River Forecast System (NWSRFS) and the Streamflow Simulation and Reservoir Regulation (SSARR) to simulate soil, snow, stream channel, and reservoir conditions. Daily forecasts are made using observations of temperature and precipitation. Forecasts of meteorological parameters are included in the river forecast models.

Flood forecasts and warnings for the Skagit River are disseminated to the public through the Seattle NWS Forecast Office. Forecast distribution is made using the NOAA (National Oceanic and Atmospheric Administration) Weather Radio, commercial radio, television, and local emergency agencies.

During periods of flooding, the NWS issues forecasts for the height of the flood crest, the time a river is expected to overflow its banks (flood stage), and the time when the river is expected to recede to within its banks.

The NWS flood forecast website is: http://www.wrh.noaa.gov/Seattle/

5.2.2 Flood Advisory Definitions

The National Weather Service uses specific terms when issuing advisories or warnings regarding floods. Their definitions are listed here:

FLOOD STAGE: A site-specific river level at which flood damage may start to occur, usually at or above the top of the riverbank. Flood heights are often measured relative to the flood stage defined for that gage. At the Concrete and Mount Vernon gages, flood stage is 28 feet.

FLOOD WATCH: The first of two basic advisories issued by the National Weather Service. A flood watch is issued when conditions are favorable for flooding. A watch does not mean that flooding will definitely occur, but it does give a community an early notice of potential flooding and allows the community to review flood safety steps.

FLOOD WARNING: The second basic advisory issued by the National Weather Service. A flood warning is issued when flooding conditions are expected to develop. In some cases, the food warning will be river stage or height reading. The National Weather Service tries to issue flood forecasts with an accuracy of plus or minus one foot, but there are many variables that can enter into this forecast. Some of the variables are difficult to predict, yet have great impacts on flood forecasts.

5.2.3 Skagit River Gage Heights and Phases

When issuing flood warning information specific to the Skagit River, the National Weather Service (and other local agencies) will refer to two river gage locations: the gage near Concrete, and the gage near Mount Vernon. River heights and corresponding flood alert phases are shown below:

Skagit River Gage near Concrete

This USGS gage is located near the community of Concrete at river mile 54.1 on the Skagit River

Phase 1	Phase 2	Phase 3
28.0 to 32.0	32.0 to 37.0	37.0 to 48.8+

Skagit River Gage near Mount Vernon

This USGS gage is located at the Riverside Bridge on the main stem at river mile 17.0.

Phase 1	Phase 2	Phase 3
28.0 to 32.0	32.0 to 35.6	35.6 to 40+

Gage heights are listed in feet.

6.0 Plans in Place to Respond to Flood Emergencies

A variety of agencies have responsibilities during flood emergencies, therefore, several plans have been developed to respond to flood emergencies in the Skagit River basin. Several of these plans are described very briefly here, along with key points for La Conner.

6.1 Federal Government

The Federal Government, primarily through the Federal Emergency Management Agency (FEMA), collects, evaluates, and disseminates flood disaster information to the state government and appropriate federal agencies working in Washington State. FEMA can assist local governments in using available resources to maintain government services during disasters. FEMA also assists with funding a significant portion of disaster recovery and hazard mitigation efforts after a flood.

Key points for La Conner: FEMA activities would generally include planning assistance prior to a flood and recovery efforts following a flood.

6.2 Washington State Government

The Governor is legally responsible for directing and controlling all state activities to protect lives and property from the effects of disasters. The Governor may initiate coordination of emergency preparedness measures, and is responsible for coordinating support and resources from adjacent states and the Federal Government.

The State of Washington Department of Community Development, Division of Emergency Management, is responsible for coordinating operational support and implementing essential services not normally provided by state and local governments. In widespread flood events, the State Department of Emergency Management will activate an Emergency Operations Center.

Key points for La Conner: Upon activation of the state's EOC, agencies such as the Washington State National Guard and Washington State Patrol could be available to assist the Town of La Conner.

6.3 Skagit County Emergency Management Plan

Skagit County and member cities/towns (including La Conner) have formed the Skagit Emergency Management Council, made up of the County Commissioners and Mayors. Under their direction and control, the Skagit County Department of Emergency Management has the responsibility for coordinating disaster preparedness, response, recovery, and mitigation efforts for Skagit County and member cities and towns.

The Skagit Emergency Management Council has prepared the Skagit County Emergency Management Plan. This Plan establishes the appropriate governmental response and recovery actions to emergencies and disasters within unincorporated

Skagit County and the incorporated cities/towns of Anacortes, Burlington, Concrete, Hamilton, La Conner, Lyman, Mount Vernon, and Sedro-Woolley. This Plan also details Emergency Support Functions, which include, among other functions, Evacuation and Transportation responsibilities and procedures.

The Skagit County Emergency Operations Center (EOC) is the focal point for emergency management operations within Skagit County, including member cities and towns. It is located at *2911 East College Way, Mount Vernon*. During emergency or disaster events, the Skagit County EOC staff will include representatives from various county departments and offices (as needed) and selected representatives from other support agencies within the county. During large events, liaison personnel from a variety of agencies and organizations, such as selected counties, cities, and towns, the Washington State Military Department, and other federal agencies, may be on location in the Skagit County EOC. Support agencies may include law enforcement, fire department, emergency medical, public works, dike and drainage districts, utilities, and volunteer organizations such as the American Red Cross.

Key points for La Conner: As a member organization of the Skagit Emergency Management Council, La Conner will receive periodic situation reports from the Skagit County EOC during flood emergencies. These will include crucial information such as flood levels, forecasts, dike breaks, evacuation areas, road closures, etc.

6.4 Skagit County Flood Fight Operations Plan

During flood events, the Skagit County Public Works Department has responsibility for directing and controlling all flood-fighting resources provided by the county. They can assist cities, towns, and dike, drainage, and fire districts (if resources are available). They will formally request assistance from the Army Corps of Engineers if local resources are overwhelmed. A Flood Fight Coordinator, operating from the Skagit EOC, will coordinate and prioritize equipment, personnel, and materials for countywide flood fight activities.

In large floods, Skagit County Public Works deploys personnel throughout the Skagit River system to ascertain risk, provide situation reports, and request materials, equipment, and personnel for flood fight purposes through the Flood Fight Coordinator. The area is divided into six sectors. La Conner is in Sector C, which includes West Mount Vernon, and Dike District #1.

In October of each year, Skagit County Public Works schedules sector planning meetings for flood fight personnel to exchange contact information and to discuss logistics, inventory, and needs.

Key points for La Conner: During flood emergencies, La Conner can request assistance, materials, personnel, and/or equipment needs through the Public Works Sector C personnel.

6.5 Corps of Engineers Flood Fight Support

During large floods when local resources are overwhelmed, the Flood Fight Coordinator will request assistance from the Army Corps of Engineers (Corps). The Corps will send a team of flood engineers and administrative personnel to assist in the County's flood fight operations. The Corps flood team provides engineering and geotechnical expertise to assist County sector personnel in evaluating problem areas. They are also prepared and authorized to mobilize equipment, personnel, and materials (through pre-arranged agreements with area contractors).

Key points for La Conner: Corps engineers can be available, by request through County Sector C personnel or Skagit EOC, to evaluate risks such as a potential levee break, or to mobilize heavy equipment and materials if emergency construction operations are necessary.

6.6 Dike District #12 Standard Operating Procedures

Dike District #12 owns, operates, and monitors a section of dike along the north and west banks of the Skagit River, and along Padilla Bay. Dike District #12 Standard Operating Procedures include an agency meeting 24 hours in advance of anticipated flooding. They initiate limited dike patrolling and reporting when the Riverside (Mount Vernon) gage reads 28 feet or above, and 24-hour patrolling and reporting when the gage reads 32 feet or above. Dike District #12 considers any gage reading over 35 feet extremely dangerous.

Key points for La Conner: A dike break in Dike District #12 can eventually flood La Conner; but, according to Corps modeling scenarios (See Section 4.2.2), it can take as long as 48 hours for floodwaters from a dike break in this area to reach the Town. The section of dike that affects flooding in La Conner extends along the Skagit River, from Highway 20, between Sedro-Woolley and Burlington, downstream to Pulver Road, near Avon. Dike District #12 will be monitoring their dike and providing situation reports to the Skagit EOC during large flood events. A dike break in this district will necessitate a massive evacuation of Burlington, Avon, and several thousand acres of farmland. In order to reach high ground on Fidalgo Island, many will need to use the La Conner Whitney Road, which runs through La Conner. If Highway 20 is closed due to floodwaters, this route through La Conner becomes the primary evacuation route for people, equipment, and livestock south of Highway 20.

6.7 Dike District #1 Standard Operation Procedures

Dike District #1 owns, operates, and monitors a section of dike along the west bank of the Skagit River, from Pulver Road (near Avon) downstream to the North Fork Skagit River. Dike District #1 Standard Operating Procedures include an agency meeting 24 hours prior to anticipated flooding, limited dike patrolling/reporting when the Riverside gage reads 28 feet or above, and 24-hour patrolling/reporting when the gage reads 32 feet or above. Dike District #1 considers any gage reading over 35 feet extremely dangerous.

Dike District #1 also closes the State Route 536 Bridge as necessary. Current procedures for bridge closure include a one-lane closure when the Riverside gage reads 29 feet or above, and complete closure when the gage reads 30 feet or above.

Key points for La Conner: A dike break in Dike District #1 would likely flood La Conner. The District will be monitoring their dike and providing situation reports to the Skagit EOC during large flood events. Also, a dike break in this district will necessitate a massive evacuation of Avon, West Mount Vernon, and several thousand acres of farmland. La Conner lies along the primary evacuation route for this area. And since closure of the S.R. 536 (Memorial) Bridge occurs relatively early in a flood event, there will likely be an increase in evacuation traffic through La Conner, via the La Conner Whitney Road.

6.8 Dike District #8 and Private Dikes

Dike District #8, on the north bank of the North Fork Skagit River, along with several privately-owned dikes in the La Conner area, have procedures to patrol and inspect their dikes during flood events, request assistance, and report dike breaks through the Skagit County Sector C personnel, or the Skagit County EOC.

Key points for La Conner: A dike break in any section of Dike District #8 can flood La Conner, as can breaks in private dikes along the (north side of) North Fork Skagit River and along the east side of Swinomish Channel. Dike owners will be monitoring their dikes and providing situation reports to the Skagit EOC during large flood events.

6.9 Sandbagging Operations

Dike District #12, Dike District #1, the U.S. Army Corps of Engineers, and Skagit County Public Works all have significant stockpiles of sandbags. During floods these agencies, upon request, can arrange for the delivery of sand, pallets, personnel, and volunteers at key locations for filling, delivery and placement of sandbags. Each of these entities can assist neighboring jurisdictions, if they are not overwhelmed with their own flood fight activities.

If La Conner anticipates the need for sandbagging operations, requests for sandbags and materials can be made through the Sector C personnel or Skagit County EOC. La Conner requests should specify the number of sandbags, volume of sand, and delivery location (La Conner Public Works shops are likely locations). Sandbags do not come filled. Therefore, volunteers will be needed to fill, deliver and place the sandbags. La Conner can request expert assistance from the Army Corps or County staff, again via Sector C personnel or Skagit County EOC, for logistical and sandbag placement support. Sandbagging operations require shovels, gloves, raincoats, food, water and generator-powered light banks for work at night. Often, due to logistics and safety requirements, it's beneficial to fill and stack sandbags on wooden pallets at remote locations and, using forklifts and trucks, deliver the full pallets to the flood fight site.

7.0 La Conner Vulnerability

This section lists public infrastructure, services, and populations that are vulnerable to flooding in La Conner.

7.1 Transportation Routes

In the event of dike breaks at any point along the north and west banks of the Skagit River, transportation routes in and out of La Conner will be closed as floodwaters expand westward toward La Conner. Roads likely affected are Avon-Allen Road, Bennett Road, State Route 536 (Memorial Highway), Bradshaw Road, McClean Road, Chilberg Road, and La Conner Whitney Road. As each road is closed, the ingress/egress options in and out of town become more limited. With the closure of Chilberg and La Conner Whitney Roads, the only route out of La Conner will be the Maple Road-Rainbow Bridge-Reservation Road. (See Figure 8: La Conner flood Evacuation Routes). Eventually, flooding could close Maple Road, resulting in no land-based access in or out of La Conner.

7.2 Evacuations

Depending upon location, timing, and duration of dike breaks along the Skagit River, La Conner (via Rainbow Bridge) could serve as the only evacuation route for several thousand residents from Burlington, Avon, West Mount Vernon, the Skagit Flats, and Fir Island. Due to the nature of the surrounding land use, evacuations will include residential areas as well as large blocks of agricultural land. Agricultural evacuations typically include the mobilization of livestock, heavy equipment, agricultural products, and farm implements.

If the flooding is imminent, a large portion of La Conner will need to be evacuated. When this situation occurs, it is highly likely that most roads in and out of town will already be closed, leaving the Maple Street-Rainbow Bridge-Reservation Road as the only option until it, too, is closed due to flooding.

7.3 Schools

All La Conner schools are in the floodplain. The Boys & Girls Club, Old Cafeteria, and gymnasium are at-grade on concrete slabs and could be flooded. The High School, Junior High, and Elementary schools are elevated, but would be islands in a large flood, and therefore not suitable for sheltering evacuees. In the event of a dike break, and if time allows, La Conner schools will be closed and the students transported home in their normal manner. If time is short, students will be transported to the Social Services Building and its gymnasium on the Swinomish Reservation, and released to their parents from there. Once the students are all in safe locations, the school district buses could be available, upon request, for evacuation assistance. The school district also has some food supply on-hand, which could be available to area shelters upon appropriate request.

7.4 Sewer Treatment Plant

The La Conner sewer treatment plant, maintained and operated by La Conner Water and Wastewater Services, is located above the 100-year flood elevation, and should not be subjected to flooding. The pumping and drainage collection system may be impacted in some locations due to inundation by floodwaters.

7.5 Anacortes Water Treatment Plant

The city of Anacortes operates a regional water treatment plant on the Skagit River, on the east bank of the Riverbend area, near Mount Vernon. The water system serves Anacortes, La Conner, the Swinomish Reservation, Oak Harbor, Whidbey Island Naval Air Station (NAS) and the March Point refineries. The city also sells water to the Public Utility District. The water treatment plant has a flood fight operations plan (sandbagging), and utilizes personnel from Whidbey NAS in flood fights. Personnel provide updates to the Skagit EOC during flood fights.

Levee breaks in Dike District #17, especially on the east bank of the Riverbend area, could damage or destroy the treatment plant and distribution system for La Conner's water supply. La Conner operates a water storage tank that can provide up to two or three days supply of potable water for the Town. Water treatment plants can take up to six months to recover from flood damages.

7.6 Stormwater system

La Conner area stormwater is collected, treated, and pumped into Swinomish Channel. During flood events, the pump system capacity will be overwhelmed and ineffective until floodwaters dissipate. La Conner public works field personnel will be monitoring and maintaining the stormwater system during floods.

7.7 At-Risk Populations

The La Conner Retirement Inn, 204 North First Street, La Conner, is home to between 50 and 60 full-time residents. Retirement Inn staff routinely practice evacuations as part of their safety program. If needed, evacuation assistance will be requested through the Skagit County EOC. Elderly populations typically require coordination and delivery of prescription medications in addition to food, water, and shelter.

There are no day care facilities listed in the phone directory for La Conner, nor are there any registered with the La Conner Chamber of Commerce.

8.0 La Conner Emergency Flood Response

This section describes the roles, responsibilities, and actions that can be taken by La Conner officials in preparing for, responding to, and recovering from flood emergencies.

8.1 La Conner Legislative Responsibilities

The Town Council is the legislative body of La Conner. They are responsible for passing ordinances (including emergency ordinances), resolutions, and laws regarding the Town. They also counsel Executive and Operations personnel on matters of policy as needed during floods.

8.2 La Conner Executive Responsibilities

The Mayor's tasks during a flood event include:

- Declares a state of emergency in the Town, when necessary;
- Appoints an Emergency Management Coordinator;
- Takes appropriate steps to seek state and federal assistance;
- Responds to requests for information from the media (or refers requests to the Skagit County EOC, which has a designated Public Information Officer).

The Town Administrator's responsibilities during a flood event include:

- Directs and controls the emergency disaster activities of the Town during each Phase of a flood;
- Notifies and updates Town Council and Mayor of the situation;
- Authorizes emergency response activities;
- Creates and maintains an effective recording, documentation, and financial tracking system.

8.3 La Conner Operations: Emergency Management Coordinator

The Emergency Management Coordinator's (appointed by Mayor) responsibilities during flood events include:

- Coordinates all emergency services activities of the Town during flood events;
- Activates La Conner Emergency Operations Center (See Section 8.7);
- Notifies and updates Town Administrator and Mayor of disaster status;
- Requests personnel to report to and staff the La Conner EOC, if required;
- Coordinates planning, response, and recovery from floods;
- Assists Mayor in requesting state and federal funds for mitigation and recovery;
- Attends flood planning meetings;
- Provides flood fight training to Town personnel.

8.4 La Conner Public Works

The Public Works Director's responsibilities include the following:

- Coordinates field personnel and equipment to respond to flood fight activities;

- Identifies needs and requests materials, equipment, personnel, sandbags;
- Patrols and maintains stormwater system;
- Monitors the sewer treatment plant and water storage tank;
- Moves Town vehicles and other equipment to a safe location if required;
- Provides signage for closed streets and evacuation routes;
- Monitor the water system to prevent contamination and conserve water.

8.5 Skagit County Sheriff

Skagit County sheriff's responsibilities during flood events include the following:

- Law enforcement;
- Search and rescue operations;
- Evacuations;
- Protection of evacuated areas (security and patrol).

8.6 La Conner Volunteer Fire Dept. and Fire District #13

La Conner fire Chief would be the responsible individual. Fire District #13 responsibilities during flood events include the following:

- Fire protection;
- Assistance in flood fight operations;
- Can assume incident command at specific sites.

Since the fire station is subject to flooding, care must be taken to move personnel, materials and equipment to high ground before flooding occurs. Fire engine and pump trucks may need to be placed upon special flatbed trucks with extra clearance to access potential structure fires in flooded areas.

8.7 Phased Operations Plan

Skagit County agencies initiate flood fight operations using a Phased Operations Plan, which specifies emergency responses based upon certain river levels, or phases, of flood threat. The following sections define each Skagit River flood phase and likely La Conner tasks for each phase.

8.7.1 Phase 1 Skagit Riverside (Mount Vernon) Gage 28 ft. – 32 ft.

Phase 1 is an "increased readiness" stage. Under Phase 1 Flood, Skagit County will open the Skagit EOC with limited staff to monitor up-river gages and NWS bulletins, set up computers and communications equipment, send out observers to up-river areas and update the river hotline on an hourly basis. The river information hotline number is (360) 419-3425. During a Phase 1 flood response, the La Conner Emergency Services Coordinator tasks include:

- Checks/updates resource and material inventories;
- Checks contact numbers and coordination links;
- Tests equipment;
- Reviews evacuation routes.

Most Phase 1 floods will not require additional action for La Conner personnel.

8.7.2 Phase 2 Skagit Riverside (Mount Vernon) Gage 32 ft. – 35.6 ft.

Phase 2 floods inundate a wider area and may cause significant damage. A large Phase 2 is approximately what occurred in December 1975, which was estimated to be a 10-year flood event (the magnitude of a flood that would have a 10% chance of occurring on any given year).

During a Phase 2 flood, Skagit County's Emergency Operations Center (EOC) will be activated, county sector personnel will be deployed, the Corps of Engineers will arrive to assist flood fight efforts, and all Dike Districts will be conducting round-the-clock dike patrols. Flood Fight activities will likely be underway in various locations.

La Conner (Town Hall) will be receiving periodic situation reports from Skagit County EOC, including current river levels, warnings, forecasts, road closures and other pertinent information.

During Phase 2 floods, the La Conner Emergency Services Coordinator should contact the Skagit County EOC and Skagit County Sector C personnel to provide them with round-the-clock contact information for La Conner. The Coordinator should request immediate contact in the event of a dike break. The Coordinator should also monitor situation reports, and update the Administrator, Mayor, and Town Council as appropriate. Dike breaks become a possibility at river levels experienced in Phase 2 floods, although most dike breaks will automatically trigger a Phase 3 flood response.

8.7.3 Phase 3 Skagit Riverside (Mount Vernon) Gage above 35.6 feet

Phase 3 floods can cause catastrophic damage in the valley. A very large Phase 3 flood would be considered a 100-year flood, which means the probability of a flood of this magnitude would have approximately a 1% chance of occurring in any given year.

In the event that Skagit County EOC initiates a Phase 3 level of activation, or dike breaks are reported, La Conner Emergency Services Coordinator should activate its local Emergency Operations Center (EOC) at Town Hall. (See Section 8.7, La Conner EOC.)

As discussed in Section 6, of particular concern to La Conner are dike breaks reported in Dike District #12, Dike District #1, and Dike District #8 as dike breaks in these jurisdictions can flood La Conner. However, dike break reports during floods often reference the area that the dike protects rather than a particular Dike District. Dike breaks in Burlington, Avon, River Bend, West Mount Vernon, or any "right bank" or "west bank" dike break could impact La Conner, thus reports of these situations need to be monitored.

A dike break in Dike District #17 will not flood La Conner, but could damage or destroy

the Anacortes Water Treatment plant, La Conner's water supply. A dike break on Fir Island (Dike District #22) or in Mount Vernon (Dike District #3) will not flood La Conner, but will increase evacuation traffic through La Conner.

8.8 La Conner Emergency Operations Center

8.8.1 Activation

The La Conner Emergency Services Coordinator should activate a La Conner Emergency Operations Center (EOC) whenever he or she deems it appropriate to oversee and control flood emergency activities in or around La Conner. In general, any Phase 3 flood, or the report of a dike break that could flood La Conner, should automatically trigger the activation of the La Conner EOC.

8.8.2 EOC Purpose

A key function of the La Conner EOC during large floods with dike breaks will be not only to evacuate La Conner, but also to assist the Skagit County EOC in the evacuation and provision of shelter for several thousand people moving westerly toward and through La Conner. This could include providing signs designating evacuation routes, and requesting equipment from the National Guard or State Patrol to keep roadways and intersections open. A critical service will be communicating the latest flood information to evacuees, potential evacuees, and incident command personnel in the field.

8.8.3 La Conner Emergency Operations Center (EOC) Operations

The La Conner EOC, housed in the Town Hall, provides a facility in which Town and other agency officials and representatives can coordinate local response and recovery activities during major floods. The purpose of the EOC is to provide warnings, a centralized point for information, and direction and control of local response. Agencies that could place representatives at the La Conner EOC include Skagit County Sheriff, La Conner Schools, La Conner Volunteer Fire District, Fire District #13, Washington State National Guard, Corps of Engineers, and Skagit County Public Works.

Upon activation of the La Conner EOC, the Coordinator or their designee should perform the following tasks:

- Notify Skagit County EOC of the activation, and provide an unpublished, "back-door" phone number for direct contact.

- Notify the Town Administrator and Mayor, and any support personnel that will be expected to staff the EOC. (Staffing schedules should be prepared in advance. Shifts should be 13 hours in length to allow a 30-minute overlap on each side of a 12-hour shift to brief the next shift. Longer shifts are not advised, and staff schedules should include at least one full day off per week.)

- Provide supervision and management of EOC staff and delegate tasks to

appropriate staff for action.

- Obtain information, primarily through situation reports from Skagit EOC, the Emergency Broadcast System, news reports, field reports, evacuee interviews, and other sources.

- Receive and/or prepare situation reports, identify and request needed resources, assist in requests from Skagit County EOC or other agencies.

Upon deactivation of the La Conner EOC, the Coordinator or their designee should perform the following tasks:

- Notify Skagit County EOC of the deactivation;

- Notify Town Administrator and Mayor of deactivation;

- Provide documentation and permanent records, including individual and telephone logs, situation reports, action plans, maps, contacts, and time sheets.

8.9 Damage Assessment and Recovery Phase

Immediately after a large flood event, FEMA requests that formal damage assessments be made for the purposes of declaring a federal disaster and authorizing federal aid. In events large enough to trigger La Conner flooding, it is likely that federal teams will be activated to assess damages, with state and local officials accompanying and assisting these survey teams. It is recommended that damage survey team members not consist of the same individuals who have participated in round-the-clock flood fight operations, due to fatigue and their need for rest.

These assessment teams will generate Damage Survey Reports, which catalogue and estimate costs to repair damages to public infrastructure. These reports will be used to initiate the funding, design, and reconstruction of damages. La Conner will be responsible for administering the contracts for those projects within La Conner.

9.0 Recommended Actions to Reduce Flood Damages

9.1 Additional Hydraulic Modeling

An essential but difficult issue in any evacuation is determining how much time is available. The existing Corps floodplain hydraulic model could be used to evaluate the arrival time of flooding from a variety of potential dike break locations. Charts could be developed that show the estimated arrival time of floodwaters, depending on the dike break location. This would help La Conner prioritize flood fight efforts and provide more effective evacuation procedures. La Conner could request that the Corps conduct this work.

9.2 Establish and equip shelter locations

La Conner, Skagit Department of Emergency Management Department, the American Red Cross, and La Conner Schools should coordinate on developing specific shelter locations and identifying which agency will supply food, blankets, and other supplies. Maple Hall, in La Conner, should be considered since it has kitchen facilities. Some shelter locations require installation of a generator transfer switch, which allows the power circuits to be powered by a portable generator in times of power outages. Other potential shelter locations include:

La Conner Civic Garden Club (has a kitchen and small generator transfer switch);
La Conner Neighborhood Church (17444 Snee-Oosh Road, La Conner);
Sacred Heart Church (410 Douglas, La Conner);
St. Paul's Catholic Church (17456 Pioneer Parkway, La Conner);
Swinomish Spiritual Center (17456 Pioneer Parkway, La Conner);
La Conner United Methodist Church (601 South Second Street, La Conner).

When evacuations are required, La Conner EOC will recommend evacuation areas to the Skagit County Department of Emergency management via the Skagit County EOC. Skagit County DEM will contact the American Red Cross to coordinate shelter locations, and to deliver food, blankets, and other supplies.

9.3 Public Information

Flood warning information, contact numbers, and evacuation procedures could be mailed to La Conner residents annually in the form of brochures or other printed media. Skagit County produces brochures for mailing to county residents. La Conner could consider providing their brochure to Town residents. A useful method other municipalities use is to include a flood brochure in the October water billing (or other utility) envelopes.

10.0 Potential Capital Projects to Reduce Flood Damages

10.1 Evaluate Emergency Construction of a Temporary Cross Dike

Cursory field observations indicate that two potential alignments are viable for constructing a temporary cross dike (see Figure 9). Both originate on high ground at the intersection of La Conner-Whitney Road and Chilberg road. They continue north to the drainage ditch, then west to the Swinomish Channel dike. A temporary dike in this location would be difficult to construct quickly, especially in rainy conditions. However, with proper preparatory work, planning, and the right equipment, a temporary dike could significantly reduce damages in La Conner. Ramps would be required to keep traffic moving while building up the section over the La Conner-Whitney Road. The Army Corps of Engineers would be a likely agency to assist La Conner in this effort.

Floodwaters against a temporary dike would pond to an elevation equal to the coastal levees (along Swinomish Channel and the lower North Fork Skagit River). When this occurs, one option to consider (carefully, due to potential liability) is to notch, lower, or excavate an intentional breach at a location in the coastal levee. This could relieve pressure on the La Conner ring dike.

10.2 Evaluate Construction of a Permanent Cross Dike

A permanent cross dike will permanently provide a much higher (and more reliable) level of protection to La Conner from Skagit River floods. A permanent dike would follow the same dike alignment as the temporary cross dike (Section 10.1), but would be designed, funded, permitted and constructed as a permanent structure to protect La Conner from future flooding.

One option would be to construct a cross dike with a top elevation of 9.0 feet (NGVD), or approximately one foot higher than the coastal dikes along Swinomish Channel, such that ponded floodwaters would spill into the Swinomish Channel rather than La Conner. La Conner – Whitney Road would be raised about 2.5 feet, with permanent ramps constructed on each side of the raised section. Estimated costs for Alignment #1 and #2 (Figure 9) are $900,000 and $1,000,000, respectively.

Another option would be to build the permanent cross dike to a top elevation three feet higher than the 100-year regulatory flood elevation (8.0 feet NGVD) of 11.0 feet NGVD. The Federal Emergency Management Agency (FEMA) criteria requires this three feet of extra freeboard to consider eliminating the flood insurance requirements for property owners behind new levees. (There are other requirements, including approval by the Army Corps of the structural integrity of the new dike.) Typical homeowner flood insurance premiums run $350 to $500 or more annually. Estimated costs for this option are $1.5 to $1.75 million.

11.0 References

Army Corps of Engineers. 1989. *Skagit County Flood Insurance Study*. Federal Emergency Management Agency (FEMA)

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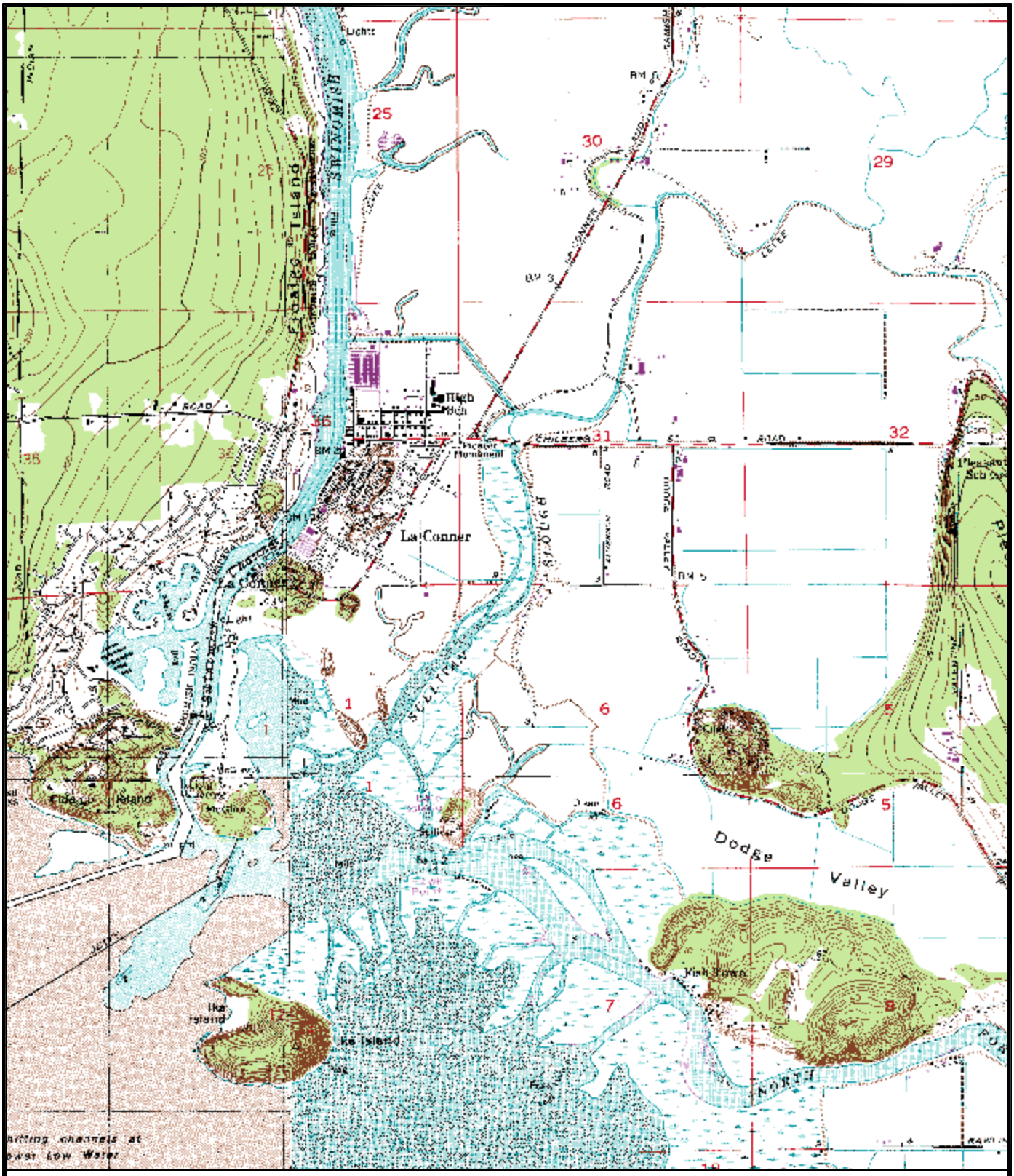
Figures



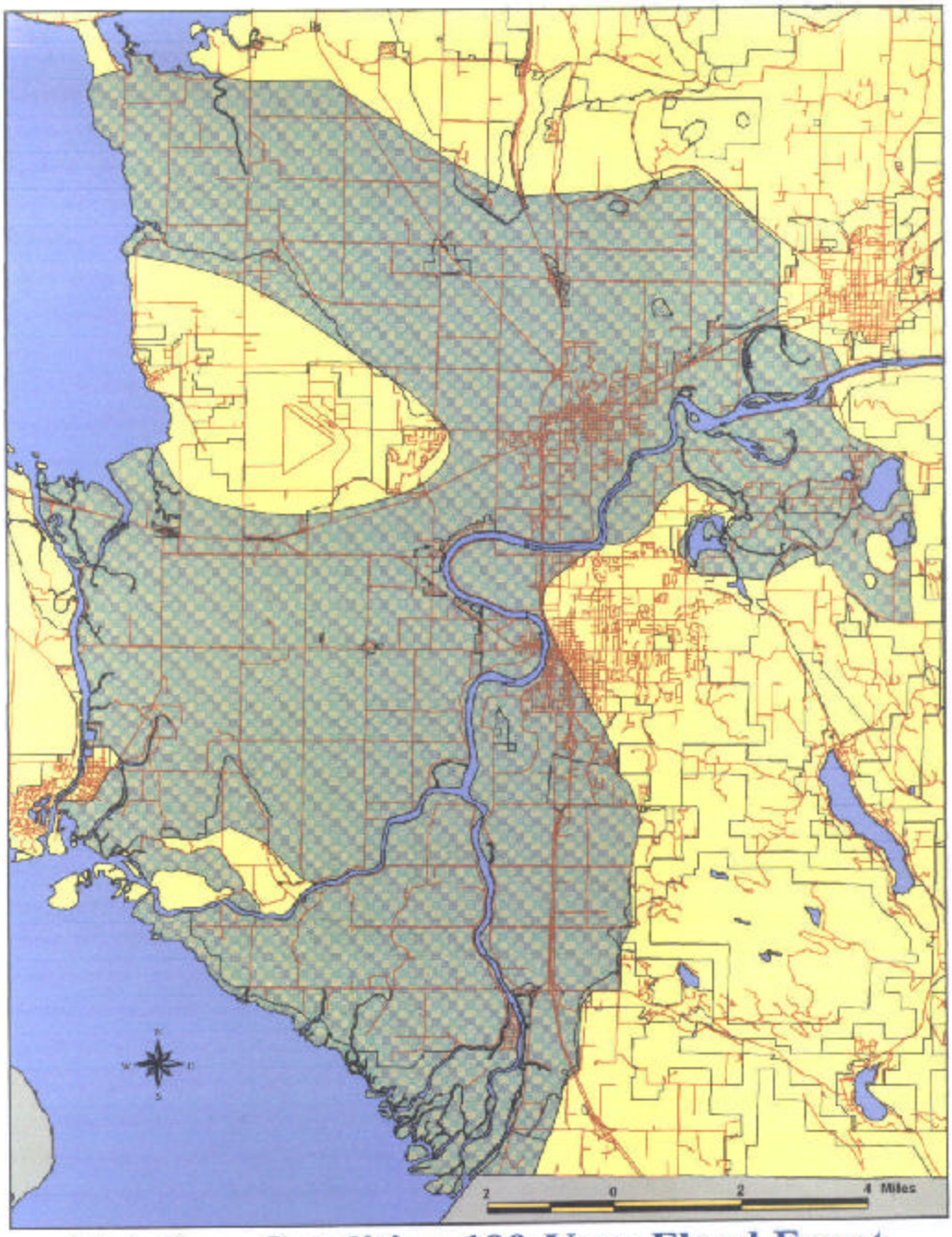
La Conner Emergency Flood Response Plan

Vicinity Map

northwest hydraulic consultants inc.

Date:	1/20/2003	Figure	1

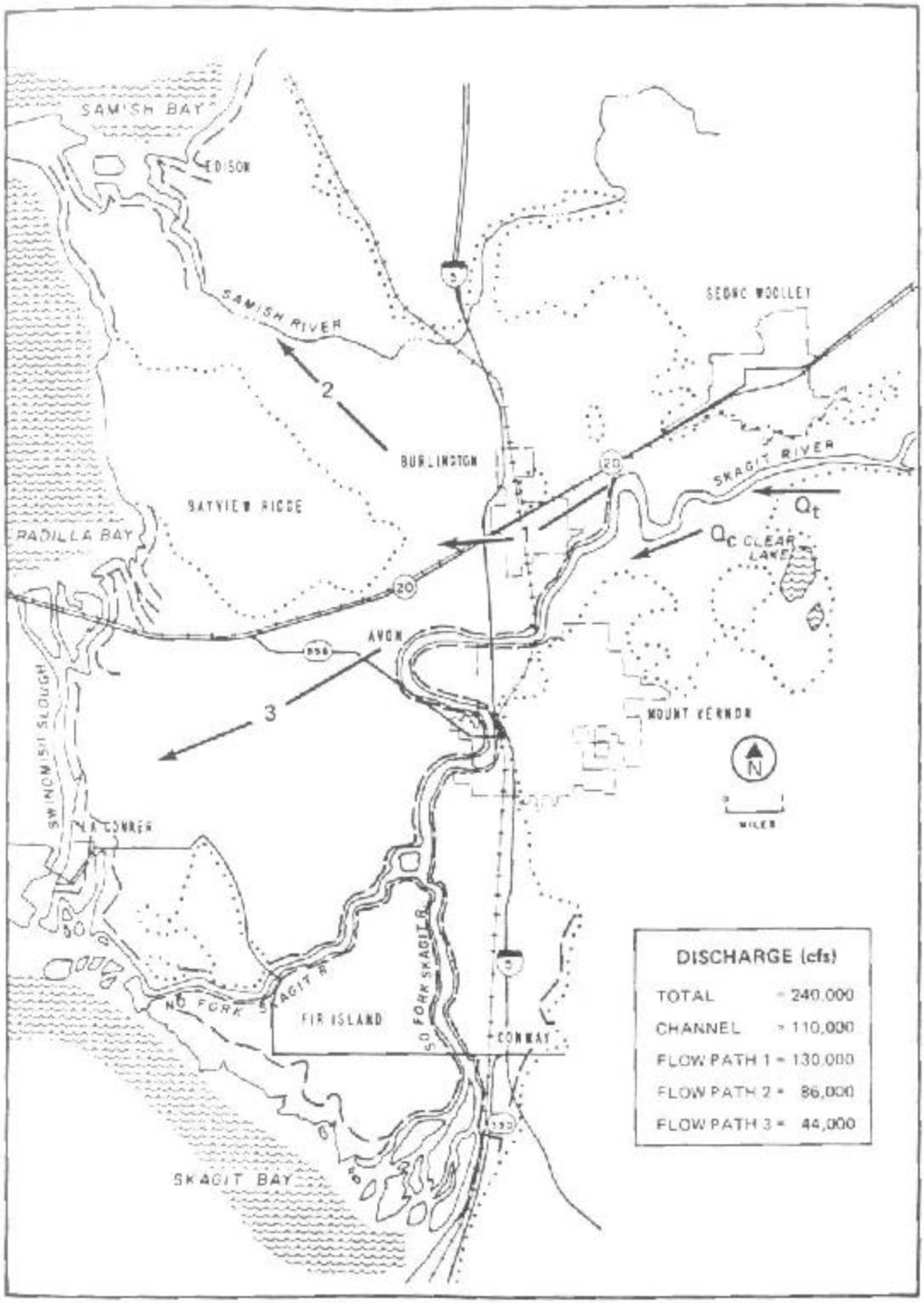
US Army Corps of Engineers
Seattle District



Existing Condition 100-Year Flood Event Inundation Limits

La Conner Emergency Flood Response Plan		
Existing Conditions 100-year Flood Event Inundation Limits		
northwest hydraulic consultants inc.		
Date: 1/20/2003	Figure	2

21126



DISCHARGE DISTRIBUTION IN DELTA AREA

FIGURE 13

La Conner Emergency Flood Response Plan			
Discharge Distribution in Delta Area (From Flood Insurance Study)			
northwest hydraulic consultants inc.			
Date:	1/20/2003	Figure	3

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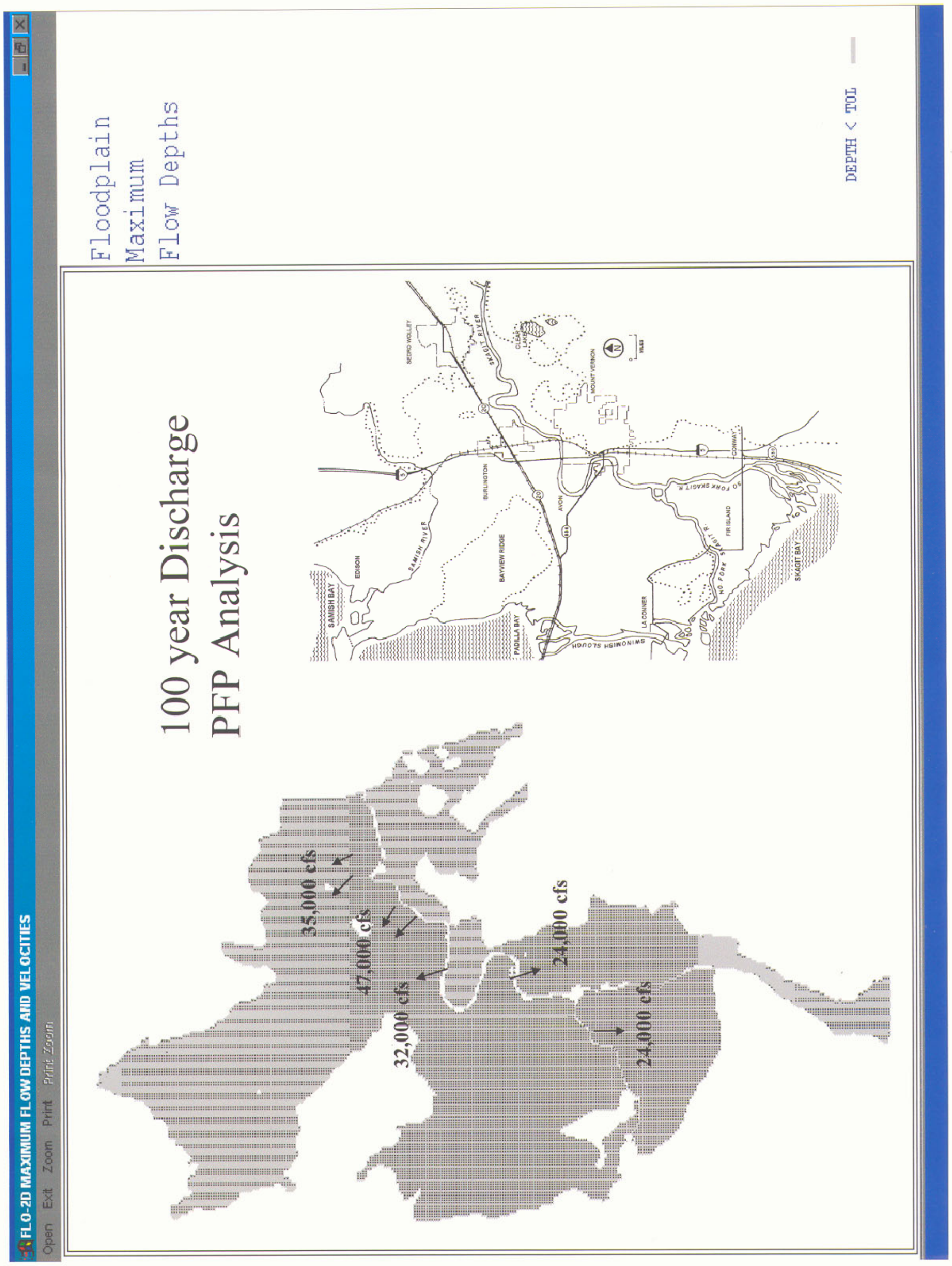
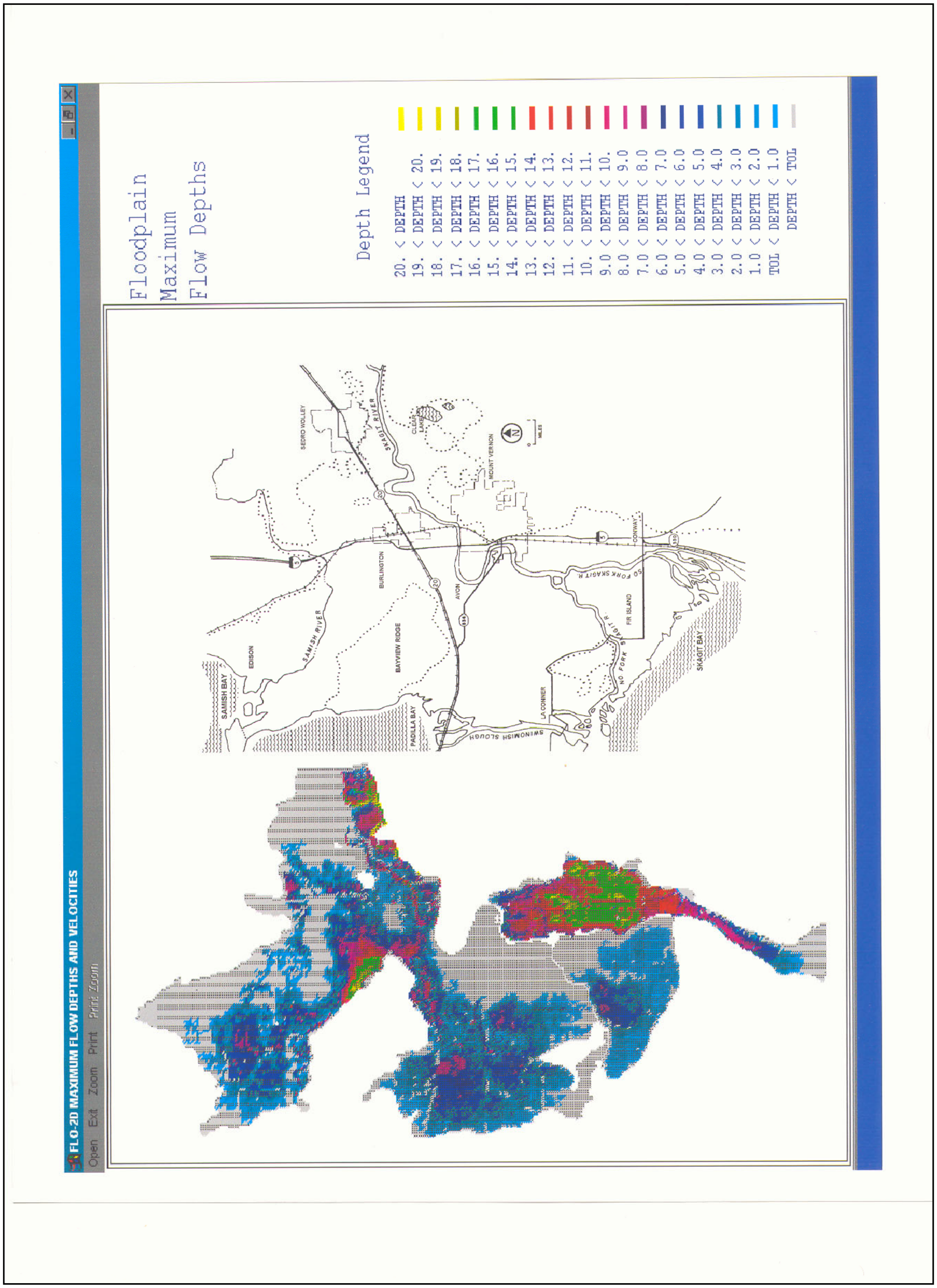


La Conner Emergency Flood Response Plan

100-year Discharge
Probable Failure
Point (PFP) Analysis

northwest hydraulic consultants inc.

Date:	1/20/2003	Figure	4



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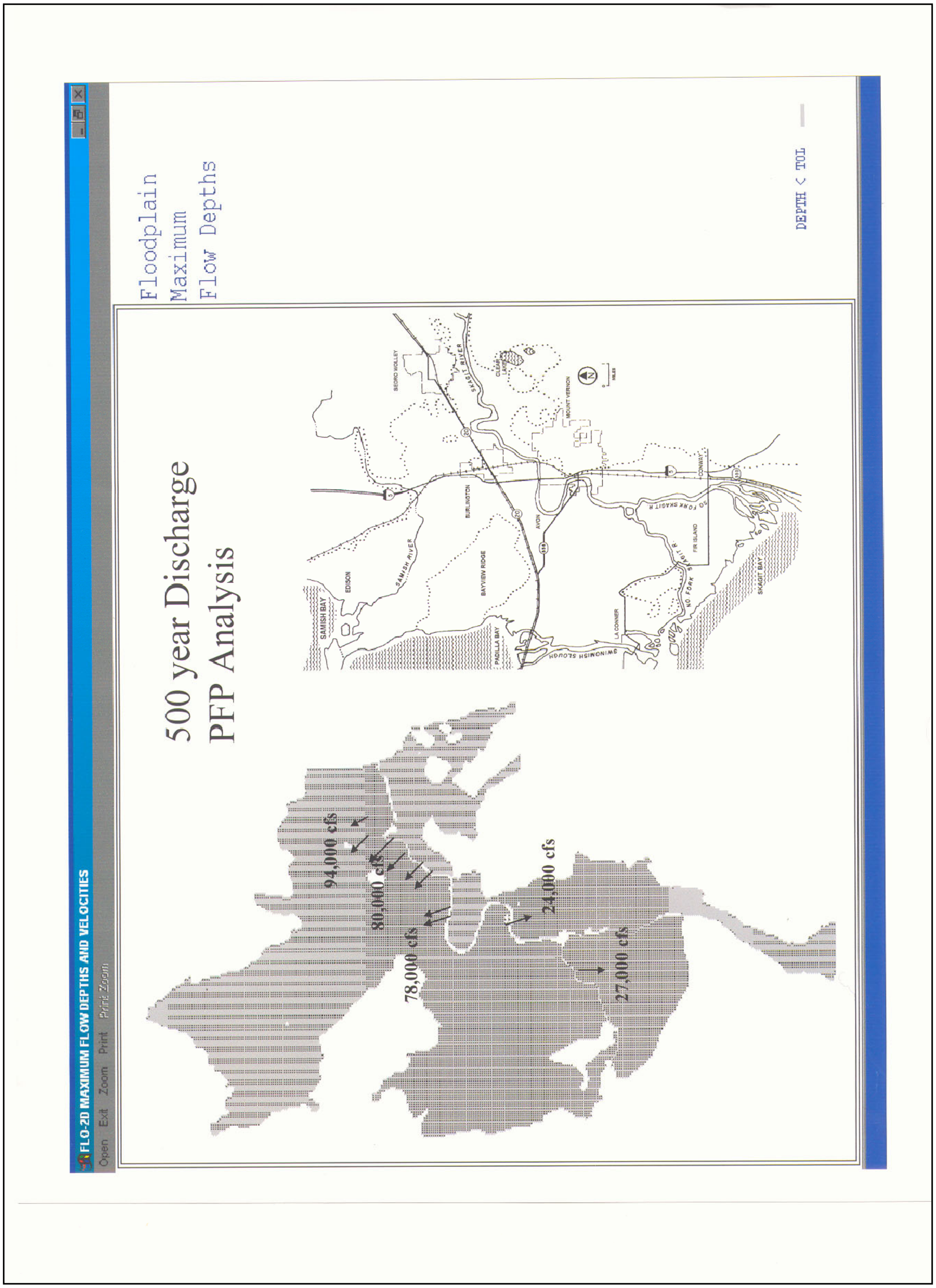
La Conner Emergency Flood Response Plan			
100-year Discharge Floodplain Maximum Flow Depths			
northwest hydraulic consultants inc.			
Date:	2/11/2003	Figure	5

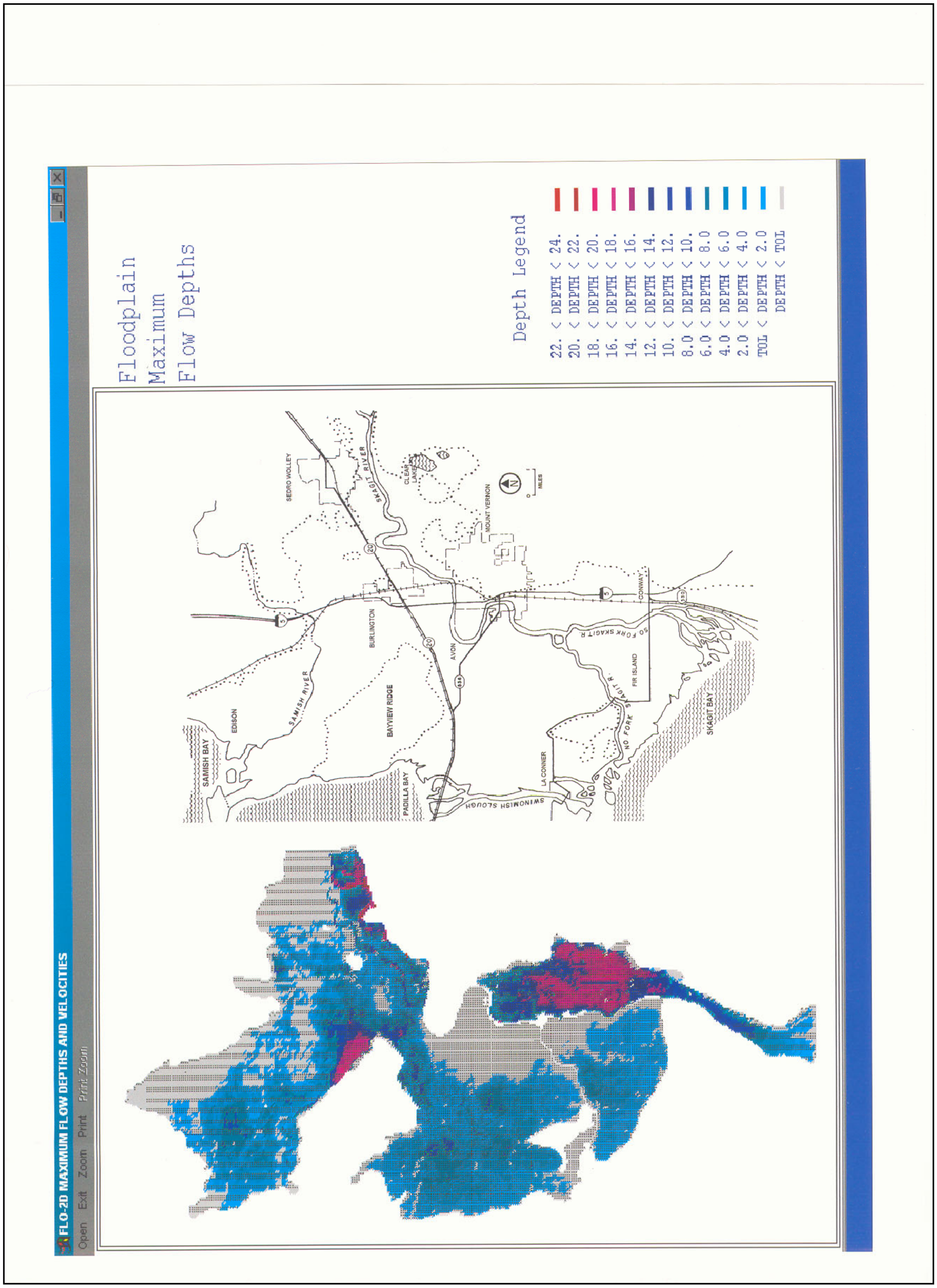


La Conner Emergency Flood Response Plan

500-year Discharge
Probable Failure Point
(PFP) Analysis

northwest hydraulic consultants inc.

Date:	2/11/2003	Figure	6



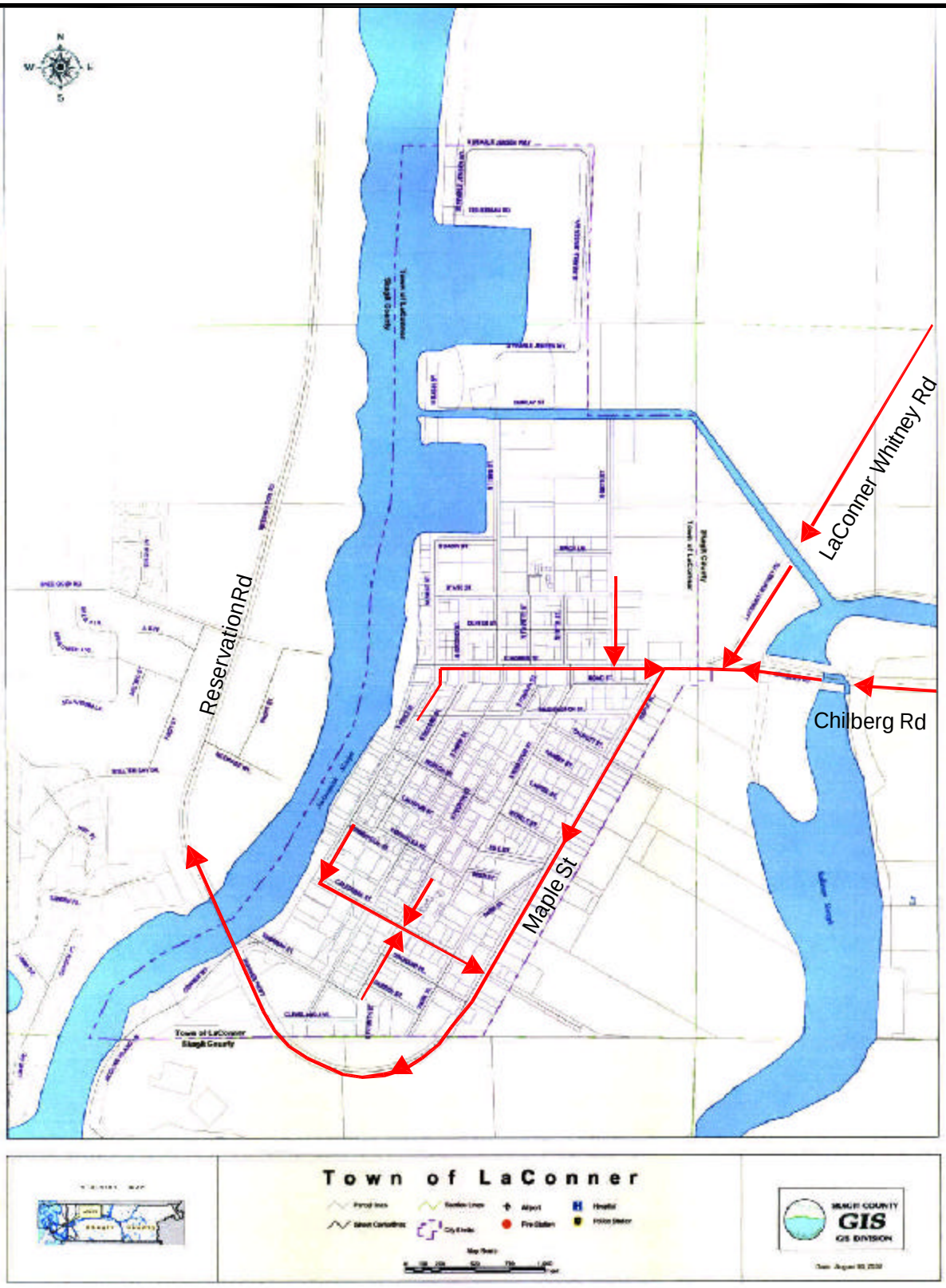
La Conner Emergency Flood Response Plan

500-year Discharge
Floodpalin Maximum
Flow Depths

northwest hydraulic consultants inc.

Date:	2/11/2003	Figure	7

21126



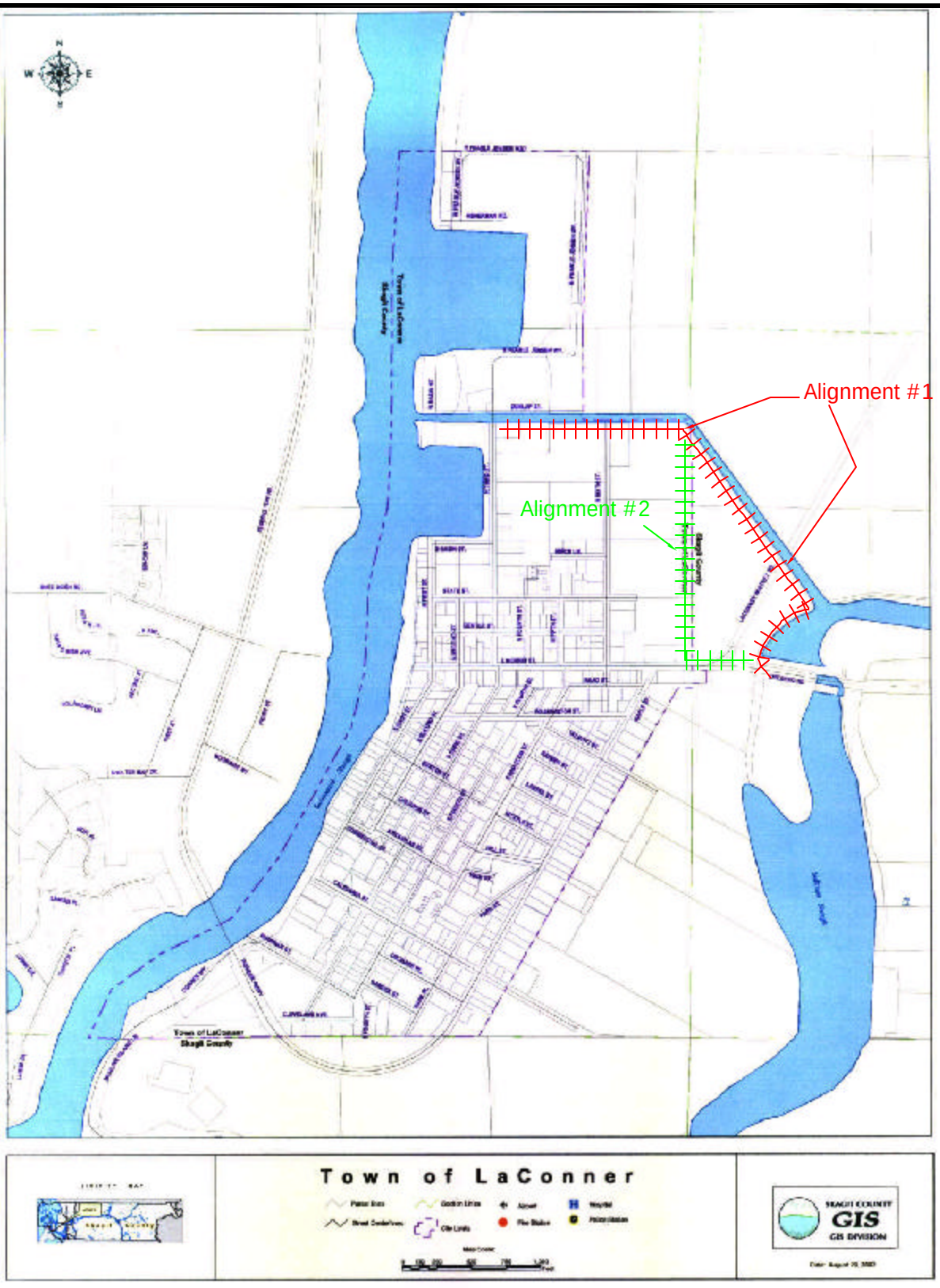
La Conner Emergency Flood Response Plan

LaConner Flood Evacuation Routes

northwest hydraulic consultants inc.

Date:	2/11/2003	Figure	8

21126



La Conner Emergency Flood Response Plan

Potential Ring Dike Alignments

northwest hydraulic consultants inc.

Date:	2/11/2003	Figure	9

21126

Appendices

Appendix A: Skagit River Gage Information

The following tables and gage information was obtained from Skagit County Public Works.

TABLE A1. Streamflow Data – Skagit River Basin*

Stream Gage Location	Drainage area, square miles	Number of years of record	Average	Discharge cfs Maximum	Minimum
Skagit River					
At Newhalem	1,175	86	4,387	63,500	136
Near Concrete	2,737	70	14,980	154,000	2,160
Near Sedro-Woolley[1]	3,015	19	16,230	220,000	2,830
Near Mt. Vernon	3,093	54	16,520	152,000	2,740
Sauk River					
Near Sauk	714	66	4,320	98,600	572
Baker River					
At Concrete	297	55	2,640	36,600	30

*Based on records of the U.S. Geological Survey through September 1994.

[1] Incomplete information due to gage damage.

Table A2: Skagit River Gages

Recorded High Levels
1975 - 2002

Date	Lower Sauk	Upper Sauk	Concrete	Mt. Vernon	Rockport
DEC. 75	**15.05**	-	**36.8**	**35.6**	-
DEC. 79	**14.27**	-	**38.57**	**34**	-
DEC. 80	**18.24**	-	**41.12**	**34.2**	-
DEC. 82	**13.84**	-	**33.74**	**28.6**	-
NOV. 89	**11.6**	**7.8**	**33.8**	**31.2**	**13.4**
DEC. 89	**14.6**	**10.2**	**36.4**	**32.1**	**12.4**
NOV. 10. 90	**15.43**	**11.84**	**40.2**	**36.6**	**14.45**
NOV. 24. 90	-	**12.56**	**39.89**	**37.37**	**13.71**
NOV. 8. 95	-	**12.4**	**39.34**	**31.6**	-
NOV. 29. 95	-	**12.32**	**41.57**	**37.32**	-
FEB. 96	-	**10.24**	**32.11**	**29.27**	-
MAR. 97	-	-	**30.1**	**29.5**	-
JUN. 97	-	-	**29.78**	**27.4**	-
JUL. 97	-	-	**32.46**	**29.2**	-
NOV. 12 '99	**13.0**	**9.3**	**34.2**	**29.9**	**-**
NOV 15 '01	**-**	**8.1**	**30.8**	**28.0**	**-**
JAN 8 '02	**13.3**	**9.3**	**33.0**	**29.9**	**-**

Table A3:
HISTORICAL FLOOD FLOWS OF THE SKAGIT RIVER[1]

DATE	C.F.S. CONCRETE	RIVER LEVEL	C.F.S. S-W	C.F.S. M.V.	RIVER LEVEL M.V.[2]
1815	500,000	69.3	400,000	54.56 (Sedro Woolley ("S-W") Gage)	
1856	350,000	57.3	300,000	51.06 (S-W Gage)	
11/16/1896			185,000	45.86 (S-W Gage)	
11/18/1897	275,000	51.1	190,000	45.96 (S-W Gage)	
11/16/06			180,000	180,000[3]	37.00
11/18/08			97,000	N/A	N/A
11/30/09	260,000	49.1	220,000	47.56 (S-W Gage)	
11/21/10			114,000	N/A[4]	N/A
12/30/17	220,000	45.7	195,000	N/A	N/A
12/12/21	240,000	47.6	210,000	140,000[5]	N/A
12/12/24	92,500	32.44	N\A	N/A	N/A
10/16/26	88,900	32.03			
1/12/28	95,500	32.90			
10/9/28	74,300	29.94			
02/27/32	147,000	39.99	157,000	N/A	N/A
11/13/32	116,000		125,000	N/A	N/A
12/22/33	101,000	33.60	110,000	N/A	N/A
01/25/35	131,000	37.90		N/A	N/A
06/19/37	68,300	28.97			
10/28/37	89,600	32.16			
5/29/39	79,600	30.70			
12/2/41	76,300	30.17		65,300	25.99
12/3/43	65,200	28.49			
02/8/45	70,800			59,800	25.77
10/25/46	82,200	31.14		64,900	27.80
10/26/45	102,000	34.00	N/A	94,300	30.25
10/19/47	95,200	32.99	N/A	69,400	28.68
11/28/49	154,000	40.8	149,000	114,000	34.21
11/26/50			N/A	68,400	28.19

[1] Pool levels are supposed to be at 1592.1 ft at Ross and 707.9 ft at Upper Baker Reservoir before the simulation begins.
[2] Authors Note: Flood stage is at 28.0 feet.
[3] This figure is incorrect. The levees in 1906 could not have held 180,000 cfs. The figure is a typo contained in the 1965 COE report.
[4] N/A = Not Available.
[5] Extreme difference between Sedro Woolley and Mt. Vernon was due to break in dikes upriver on Burlington side of river. Source: COE report 1/31/25.

DATE	C.F.S. CONCRETE	RIVER LEVEL	C.F.S. S-W	C.F.S. M.V.	RIVER LEVEL M.V.[2]
12/25/50			N/A	74,000	29.08
02/11/51	139,000	38.99	150,000	144,000	36.85
02/1/53	66,000	28.61		65,700	27.76
10/26/55			N/A	84,900	30.69
11/04/55	106,000	34.48	113,000	107,000	33.52
04/30/59	90,700	32.36	92,000	92,300	31.68
11/24/59	89,300	32.17	91,000	91,600	31.58
11/21/60			N/A	70,200	28.51
12/16/60			N/A	70,200	28.51
01/16/61	79,000	30.61	N/A	76,000	29.40
11/20/62	114,000	35.73	N/A	83,200	30.44
10/22/63	73,800	29.80	N/A	N/A	N/A
11/27/63	84,200	31.41	N/A	72,100	28.80
06/22/67	72,300	29.59	N/A	72,000	28.78
10/28/67			N/A	72,700	28.89
01/21/68			N/A	70,900	28.43
06/03/68			N/A	68,800	28.09
01/31/71			N/A	70,300	28.52
07/13/72	91,900	32.54	N/A	80,600	30.07
01/16/74	79,900	30.75	N/A	77,600	29.64
12/4/75	122,000	36.88	N/A	130,000	35.66
12/2/77	70,300	29.27		65,600	27.59
12/19/79	135,000	38.57	N/A	112,000	33.99
12/27/80	148,700	40.19	N/A	114,000	34.16
12/04/82	100,000	33.82	N/A	71,600	28.65
01/05/84	109,000	34.94	N/A	88,200	31.14
01/19/86	93,400	32.75	N/A	72,800	28.84
11/24/86	83,500	31.30	N/A	70,700	28.49
10/16/88	74,100	29.86	N/A	56,700	25.77
11/11/89	119,000	36.39	N/A	88,220	31.14
12/05/89			N/A	95,480	32.39
11/11/90	142,000	40.20	N/A	142,000	36.60
11/24/90			196,000[6]	152,000	37.37
11/08/95	143,000	39.45	N/A	89,900	31.62[7]
11/11/95	72,900	29.67	N/A	59,200	26.60
11/14/95	67,700	28.86	N/A	57,100	26.18

[6] Info obtained from COE 1993 reconnaissance study fax dated 3/29/93.
[7] Info obtained from USGS

DATE	C.F.S. CONCRETE	RIVER LEVEL	C.F.S. S-W	C.F.S. M.V.	RIVER LEVEL M.V.[2]
11/25/95	63,200	28.11	N/A	61,500	27.03
11/29/95	160,000	41.57	N/A	133,000[8] 141,000[9]	37.32
02/09/96	88,900	32.11	N/A	81,800	29.27
03/20/97	74,740	29.96	N/A	74,980	29.52[10]
11/13/99	101,000	33.80	39.20	78,600	29.88[11]
11/15/01	65,100	28.4	N/A	67,400	28.0[12]
01/08/02	95,600	33.06	38.5	78,700	29.9[13]
06/29/02	63,900	28.23	35.02	58,100	26.25

Table A4: Flood Frequency, Skagit River [14]

FLOOD	GAGE AT CONCRETE	GAGE AT SEDRO WOOLLEY	GAGE AT MT. VERNON
10 year flood	120,000 cfs.	137,000	114,000
20 year flood	147,000	165,000	139,000
30 year flood	162,000	187,000	150,000
40 year flood	173,000	196,000	152,000
50 year flood	185,000	205,000	158,000
60 year flood	191,000	213,000	163,000
70 year flood	200,000	221,000	168,000
80 year flood	208,000	227,000	171,000
90 year flood	214,000	234,000	175,000
100 year flood	220,000	236,000	180,000

[8] First reported by the COE.
[9] Currently being reported by USGS (10/27/02)
[10] Info obtained from COE Internet Web Site
[11] Info obtained from USGS Internet Web Site
[12] Ibid
[13] Ibid
[14] All figures obtained from the Corps of Engineers, Seattle District February 1995.

Appendix B: Skagit River Historical Floods

Note: The following information was obtained from Skagit County Public Works and the United States Geological Survey.

Throughout the years, major flooding has occurred in the Skagit River Basin. Because of its geographic location, the Skagit River Basin is subject to winter rain floods and an increase in discharge during spring due to snowmelt runoff. Rain-type floods occur usually in November or December, but may occur as early as October or as late as February. Antecedent precipitation serves to build up ground water reserves. Frequently, a light snow pack is then formed over most of the entire basin. A heavy rainfall accompanied by warm winds completes the sequence, which produces major floods. The heavy rainfall and accompanying snowmelt result in a high rate of runoff, as the ground is already nearly saturated from earlier precipitation. Two or more crests may be experienced within a period of a week or two as a series of storms move across the basin from the west. The winter floods have a considerably higher magnitude than the average annual spring high water.

The snowmelt peak is expected during the spring or early summer, caused by the seasonal rise in temperatures with resultant melting of the accumulated snowpack. These high discharges may have a minor contribution from warm rains, but are caused predominantly by snowmelt. Relatively slow rise and long duration characterize the spring snowmelt. While this high water occurs annually, it seldom reaches a damaging stage. During the annual spring or early summer high water, power reservoirs are filling, and as a result, the spring peak discharges are frequently reduced.

The magnitude and intensity of a storm cannot always be used as an index of the resultant river discharge. Other factors, such as temperature sequence, degree of soil saturation, and moisture content of the snowpack, largely influence the rate of and total runoff produced by a particular storm. Conditions preceding a storm may be such that even a moderate storm could set in motion the related factors that collectively result in a flood. Conversely, conditions in the drainage basin may be such that a severe storm results in only minor high water.

USGS Water Supply Paper #1527 has described historical floods experienced in the Skagit River basin through 1975. A brief description of these and others are as follows.

About 1815:

Highest flood; gage height of 20 feet at Diablo Dam; at Rockport the river was at least 15 feet above the flood mark of the 1917 flood; at Concrete a gage height of 69.3 feet; at Sedro Woolley the flood exceeded the 1909 flood by 7 feet, covered the highest ground in the town with 1.5 feet of water, about 10 feet of water in present business district, and a gage height of 63.5 feet.

1856:

Second highest flood; Reflector Bar (Diablo Dam) gage height of 18.5 feet; Concrete gage height of 57.3 feet; Sedro Woolley gage height about 60 feet.

November 19, 1897:

From Birdsview east, the highest the river has ever been due to a warm Chinook wind and heavy rain the river rose suddenly and after 36 hours the rain subsided suddenly. Cascade, Sauk, and Baker Rivers were high and caused a peak on the Skagit at the mouths of each stream. Because of the sudden stopping of the rain, channel storage greatly reduced the crest, as it was moving downstream. At Marblemount and Concrete the flood was 1.3 feet and 3.6 feet higher, respectively, than the 1909 flood.

November 30, 1909:

A series of low pressure storms moved through the area, with the last storm moving in on November 26th, and lasted through November 29th, dumping 8.3 inches of precipitation at Sedro Woolley. On the 26th and 27th the precipitation was in the form of snow above 2,500 feet. But on the 28th and 29th a warm rain melted snow up to 4,000 feet elevation.

The result was the largest flood since the initialization of flood records. At the Reflector Bar (Diablo Dam), the crest was 2.4 higher than the 1897 flood. At Newhalem the gage was 22.0 feet above the datum gage. At Concrete, the gage was 36.4 feet with water reaching the footing of a hotel near the cement plant. Down river the flood breached a dike near Burlington, pushing water over most of the land between Burlington and the Swinomish Channel. The gage height at Sedro Woolley was 56.5 feet.

December 30, 1917:

This flood was remarkable for the length of time it remained high, rather than the crest, which was comparable to the 1896 flood and was 2.5 feet below the 1909 flood crest. At Sedro Woolley, the gage was 54.1 feet.

December 12 - 13, 1921:

The weather in November of 1921 was below average temperatures and excessive precipitation. December was cold, but snowfall was less than average, much of which was melted off by excessive rain on the 10th and 12th. Between 6:00 p.m. of the 9th and midnight on the 12th, Silverton (in Snohomish County, east of Everett) received 14.2 inches of precipitation, David Ranch near Ross Dam received 10.2 inches, and 3.4 inches fell at Sedro Woolley. Twenty-four hour maximum rainfall records at these stations were 5.9, 5.0, and 2.0 inches, respectively. These conditions created the second largest flood on record and caused a dike break just above the Great Northern Railway Bridge between Mount Vernon and Burlington, dumping 60,000 cubic feet per second (cfs) of water into the Samish River Delta Area.

November 1949:

The flood of November 1949 is a good example of the flattening of a flood crest as it moves downstream. Channel storage had a marked effect on the sharpness of the peak between Concrete and Mount Vernon. The peak discharge of 154,000 cfs near Concrete was reduced to 114,000 cfs near Mount Vernon. Precipitation records in the basin at the time of this flood partly explain the reduction in crest in the lower reaches of the channel. The Sedro Woolley gage indicates that very little rain fell in the lower part of the basin.

February 10 - 11, 1951:

The 1951 flood was an example of a long duration flood. Although the peak discharge was smaller, the duration of high water was considerably longer than the 1949 flood. At Concrete, the crest reached a discharge of 129,000-cfs (10-year flood frequency) compared with 153,000 cfs (14-year flood frequency) in the 1949 flood. The difference though, can be seen when comparing the Mount Vernon discharge. For 1951, the crest reached 144,000 cfs (15-year flood frequency) compared with 114,000 cfs (5-year frequency) in 1949. This flood caused a major levee break near Conway.

December 1975:

On November 30th, a cold front moved into the Skagit area covering the area between Burlington and the Cascades with a moderate amount of snow. On December 1st, a new front moved into the area raising the freezing level higher up in the mountains and dumping rain on the valley as the temperature continued to rise. Melting snow and rainwater began swelling ditches, streams, and the Skagit River, which began flooding some time Tuesday night. The weather continued to stay warm and rainy through Wednesday with wind coming up in the afternoon causing wave action, which threatened dikes and other structures along the river. Several critical periods were met during the flood when tides were high and

winds strong. Peak high water level was reached Thursday night when the river crested at 35.6 feet at the Riverside Bridge in Mount Vernon. The Skagit County Engineers consider twenty-six feet of water in the river at this point flood stage. Clear weather and cooler temperatures beginning Thursday affected immediate receding along the river as soon as the crest passed. By Friday, December 5th, the water level was dropping and water receded at a remarkably rapid rate. The river lacked only 2,000 cfs of becoming a flood of the same magnitude as the 1951 flood, which caused a major levee break near Conway. At the time of the flood crest at Concrete (which amounted to a measured value of 122,000 cfs) the inflow into Ross Reservoir was approximately 24,000 cfs, therefore, the added inflow into Ross Reservoir that was not released, namely 19,000 cfs, would have added substantially to the Concrete crest, thereby creating a peak flow of approximately 141,000 cfs. Ross Dam had control over approximately 17 percent of the river flow at that time. It has been calculated that the control had enabled them to reduce the flood levels at Concrete by approximately 2.5 feet.

1975 - 1989:

Three major flood flows have occurred since the USGS Water Supply paper was written. Floods with magnitudes of 135,800, 148,700, and 100,000 cfs occurred in Concrete on December 18, 1979, December 26, 1980, and December 4, 1982, respectively. The Town of Hamilton was completely inundated each time. Cockerham Island levees overtopped and failed in 1979 and 1980. The levee system protected the Lower Skagit Valley and most of the damage occurred upstream of Sedro Woolley. Each of these floods was incurred by heavy, warm rains accompanied by a melting of the snow accumulation in the lower elevations.

November/December 1990:

The first event was the result of extremely heavy rain falling over western Washington State for 40 hours from late November 8th through November 10th, 1990. Skagit River reaches its 20-year event.

The second event was again the result of extremely heavy rain. The Skagit River crested at 37.37 feet in Mt. Vernon on November 25th. This was equivalent to a 25-year event and was the new maximum on record. Major dike failures caused millions of dollars of damage throughout Fir Island.

December 1995:

The Skagit River crested in Concrete at 41.57. This is the highest crest since 1921 and was approximately a 35-year event[i]. Major damage once again occurred and Skagit County was declared a disaster by the state and federal governments. Damage estimates were over 14 million dollars. County damage included 331 homes, 8 businesses, 8 apartments, utility damages, and over 15,000 acres of crop damage, etc.

February 1996:

The Skagit River exceeded flood stage cresting in Concrete at 32.1 ft. causing damage to the Cockerham Island Levee and over one million dollars in total damage countywide. Disaster assistance was again provided.

Major damage-causing floods can be expected to continue to occur in the future. If all the flood-producing conditions should take place at the same time, significant flooding would become possible. For example, if the river should be running high, with soil saturated and a deep, wet snowpack over the basin, and if a series of storms should follow each other in from the Pacific Ocean, precipitation and snowmelt could cause a flood much larger than the 1909 flood.

[i] At the time of this report, no final flood summary has been completed for this event.