# CHAPTER 2

# WATERSHED DESCRIPTION AND FLOODING PROBLEMS

Skagit County has abundant resources of water, with the Samish and Skagit Rivers within its borders. These rivers have a history of flooding, however, and have caused extensive damage to major sections of the county, affecting the county's economy, resources, and way of living. This chapter describes the watershed area of the two rivers, the flood history, the typical flooding problems experienced, and the potential damage flooding causes. The areas which have had specific flooding problems are also discussed.

## DESCRIPTION OF WATERSHED

Skagit County has within its boundary four major watersheds: Skagit, Samish, Nooksack, and Stillaguamish, as presented in Figure 2-1. The flood plains of the two latter watersheds are located outside the County's boundary and will not be included in this plan. The Skagit and Samish basins comprise an area of 3,277 square miles between the crest of the Cascade Mountains and Puget Sound.

Elevations within the Skagit and Samish drainage basins range from sea level at LaConner to 10,778 feet at the summit of Mount Baker. The northern end of the Skagit Basin extends 28 miles into British Columbia, where it borders the Frazer River Basin. The extremely rugged topography in the vicinity of Mount Baker gives way in the western part of the Skagit Basin to rolling country with a wide flat valley. Exclusive of the small area in Canada, the Skagit Basin has an area of 2,750 square miles. During major floods the Skagit River overflows a low divide between the Skagit and Samish River flood plains and the floodwaters from both streams intermingle on the Samish River flood plain. Flood problems of the two streams are, therefore, related, and both basins are generally treated as one large flood plain.

### Skagit River

The Skagit, third largest river in the western portion of the United States, flows southwesterly from its source high in the Cascade Mountains in Canada for 163 miles to tidewater in Skagit Bay, an arm of Puget Sound. It falls 1,600 feet in this distance, 1,300 feet from its source to Marblemount. The remaining 300 feet of fall are distributed over 92 miles in the lower basin. The river flows through a delta in two main channels, the North Fork and the South Fork, about 10 miles above the mouth, below Mount Vernon. These forks are nearly equal in length and during the usual range of river discharge the flow is so divided that about 60 percent is carried by the North Fork and 40 percent by the South Fork. The river is tidal to the Great Northern Railway bridge 15.4 miles above the mouth. The mean diurnal range of tide at the mouth is 11.1 feet and the extreme range is 19 feet.

Three major tributaries augment the Skagit's flow; the Cascade, which joins it near Marblemount; the Sauk near Rockport; and the Baker at Concrete. Several small watersheds are also tributary to the Skagit. These include the Illibot Creek, Finney Creek, Day Creek, and Nookachamps Creek watersheds. Many additional feeder streams also discharge directly into the Skagit River.

Ross Dam Reservoir on the Skagit River controls the drainage from 978 square miles of watershed. It provides storage and head for a hydroelectric plant at the dam and supplements low flows for run-of-the-river hydroelectric plants at Diablo and Gorge Dams. Hydroelectric developments on the Baker River, a tributary to the lower Skagit River, include Lake Shannon controlling 270 square miles of watershed and Baker Lake, controlling an additional 215 square miles of watershed. A diversion system for supplying water to the city of Anacortes is located at Avon near Mount Vernon.

## The Samish River

The Samish River drains about 139 square miles between the Skagit River Basin on the south and the Nooksack on the north. The Samish River originates on a low divide south of Acme in Whatcom County, and its tributary, Friday Creek, originates in the hills south of Bellingham. The river has a very narrow flood plain and flows much of its 20-mile length in a southwesterly direction between steep and rugged mountains. It outlets into Samish Bay, near Edison.

## The Flood Plain

The entire floor of the Skagit River Valley, the deltas of the Samish and Skagit Rivers, and reclaimed tidelands adjoining the Skagit, Samish, and Stillaguamish River Basins comprise the flood plain. The flood plain covers 90,000 acres, including 68,000 acres of fertile land downstream and west of the city of Sedro Woolley, and 22,000 acres of river bottom land east and upstream of this city. The valley upstream from Sedro Woolley is narrow and relatively undeveloped, the agricultural area extending in general only to Concrete. Even in the reach from Sedro Woolley to Concrete, about two-thirds of the bottom land is uncleared or is occupied by river channels and sloughs. The width of the flood plain varies from less than one mile along the tributaries and


Figure 2-1 Watershed Boundaries

SKAGIT COUNTY

upper reaches of the main stem to over 20 miles in the lower reaches. The upper flood plain is characterized by flat benches along the river which are heavily covered with vegetation and sharply defined by steep canyon walls. Much of this area is unsuitable for farming because of the sandy, rocky soil and the changeable nature of the river channel in the steeper sections. Below Sedro Woolley the valley drops almost to sea level and widens to a flat, fertile outwash plain adjoining the Samish Valley to the north. These fertile lands are ideal for farming. The outwash plain extends west through Mount Vernon to LaConner and south to the flood plain of the Stillaguamish River.

Potential flood damage in the Skagit River Basin is greatest in the flood plain. The flood plain is primarily agricultural, but includes a large proportion of the county's urban and rural population, many manufacturing plants, and major transportation routes.

## Climate and Hydrology

Runoff from the Skagit River basin depends on rainfall and snowmelt as provided by climatic conditions. Due to the proximity of the Pacific Ocean to the Skagit Basin, the influence of maritime air masses is pronounced in both the temperature and precipitation regimes, producing a mild but wet climate. During the winter, the Skagit Basin, lying directly in the storm path of cyclonic disturbances from the Pacific Ocean, is subject to numerous storms, which are frequently quite severe and may follow one another in quick succession. On the mountain slopes, storm precipitation is heavy and almost continuous as a result of combined frontal and orographic effects. During summer months, the weather is warm and relatively dry as the Alleutian low pressure system is displaced by a semi-permanent high pressure system. The Skagit River Basin is subject to winter rain floods and annual high water due to snowmelt runoff. Low flows occur during August and September after the snowpack has melted and the ground water flow has been partially depleted. A summary of streamflow data for the key stream gages is shown in Table 2-1.

Table 2-1. Streamflow Data--Skagit River Basin[a]

| Stream gage location | Drainage area, square miles | Number of years of record | Discharge, cfs | | |
|---|---|---|---|---|---|
| | | | Average | Maximum | Minimum |
| Skagit River | | | | | |
| At Newhalem | 1,175 | 70 | 4,484 | 63,500 | 136 |
| Near Concrete | 2,737 | 54 | 15,190 | 154,000 | 2,610 |
| Near Sedro Woolley | 3,015 | 19 | 16,230 | 220,000 | 2,830 |
| Near Mount Vernon | 3,093 | 38 | 16,810 | 144,000 | 2,740 |
| Sauk River | | | | | |
| Near Sauk | 714 | 52 | 4,402 | 82,400 | 572 |
| Baker River | | | | | |
| At Concrete | 297 | 39 | 2,677 | 36,600 | 30 |

[a]Based on records of the U.S. Geological Survey through September 1978.

## HISTORY OF FLOODING

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. The spring snowmelt is characterized by relatively slow rise and long duration. 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.

Historical floods experienced in the Skagit River basin through 1975 have been described by USGS Water Supply Paper 1527. A brief description of these is as follows.

About 1815: Highest flood; gauge 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 gauge 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 gauge height of 63.5 feet.

1856: Second highest flood; Reflector Bar (Diablo Dam) gauge height of 18.5 feet; Concrete gauge height of 57.3 feet; Sedro Woolley gauge 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 26 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 initiation of flood records. At the Reflector Bar (Diablo Dam), the crest was 2.4 higher than the 1897 flood. At Newhalem the gauge was 22.0 feet above the datum gauge. At Concrete, the gauge 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 gauge 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 gauge 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 levy 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 raise. Melting snow and rain water 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. Twenty-six feet of water in the river at this point is considered flood stage by the Skagit County Engineers. 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 they had enabled them to reduce the flood level at Concrete by approximately 2.5 feet.

Flooding since 1975: 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. Cockreham 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.

Major damage-causing floods can be expected to continue to occur at rare intervals. If all the flood-producing conditions should take place at the same time, the unlikely would become the 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.

# TYPES OF WATERSHED FLOODING PROBLEMS

Skagit County has faced flooding problems in its watersheds throughout its history. In general, inundation and standing water that causes property damage are the typical problems during high stream flow periods. The types of problems can be categorized by watershed area.

## Leveed Area

When the Skagit River reaches flood stage in the flood plain several types of problems can occur. The rapid flows tend to erode the stream bank as the river attempts to rechannel itself. The existing levy that hold the river in place suffer from erosion and deterioration also. The levees have failed in the past, causing extensive damage to agricultural land and private and public property. Heavy rains that fall on the flood plain travel toward the river but are unable to cross the levees. This water ponds up at the pumping facilities. Extensive water overburdens the stations, putting them at a risk of failure. The elevated height of the river causes high water table levels, which can result in sand boiling near the toe of the levees. Extended periods of high water cause productivity losses in the agricultural lands. Heavy stream flows carry large amounts of sediment, which deposit on surrounding property if the levees fail or overtop. Levees are at risk of overtopping and emergency vehicles are unable to access the inundated areas, and are unable to administer needed emergency service.

## Coastal Areas

Almost all of the westerly boundary of the County has been saltwater-diked. High winds and high tides cause deterioration to the dikes and breakwaters, requiring repair. Dikes are at risk of overtopping and failure when high tides are accompanied by high winds and low barometric pressure. The land becomes affected by the added salinity, reducing agricultural productivity.

## Upper Skagit/Samish Valleys and Feeder Streams

The areas upstream of Sedro Woolley are generally unprotected from flooding; the levee system generally extends only to the Burlington area. Extensive areas near Nookachamps Creek and along the upper valley flood plain are inundated for extended periods of time during high water periods.

Feeder streams, although having high gradients and no real flood plain of their own, cause flooding problems as they approach the Skagit and Samish Rivers. The high-energy flows have a tendency to leave their stream channels, and flow over nearby fields, depositing sediment and debris in the pathway.

Undersized, broken, and misaligned culverts do not allow the flows to pass, causing extensive ponding behind them. The rising water can spill over road or railway fills, creating a falls which may completely wash out the fill.

As timber is removed from the forested areas, an increase in runoff occurs. The excessive amounts of water come down the hillside, causing erosion and picking up debris and sediment that are deposited at lower stream gradients. The high flows carry logs, brush, and small structures, which tend to jam around bends or constrictions, causing a backwater behind the jam. Bridges crossing these streams are at risk of damage from the debris and from undermining of bridge foundations.

Urban and Rural Areas Away from the River

Development has encroached on the flood plain areas and has brought with it an increase in paved, impervious surfaces. This has caused increased peak flows and volumes which can overwhelm the existing storm sewers and cause local flooding problems. Agricultural areas downhill of the developed areas experience difficulty in handling the increased runoff. Poorly-maintained ditches do not carry the water off rural sites quickly, causing standing water and ponding in these areas.

## POTENTIAL FLOOD DAMAGE

The potential for loss of life and monetary damage from a flood is great. Existing flood control measures mitigate potential flood damage somewhat, but the protection level differs throughout the County. The maximum protection achieved is for floods occurring at a frequency of once every 25 years, while other areas have little or no protection. Continuing residential and commercial development in the flood plain will increase the potential for damage.

The flooding problems discussed for each of the five different geographic areas cause considerable damage. The damage done by floods can be separated into three different categories. Physical damage is caused to structures, public and private, with losses in equipment, material, and furnishings. Financial loss results from decreased production, and the situation increases living expenses and operation cost. Cleanup, emergency, and relief activities require an enormous effort and expense. Each of these types of damage apply to the businesses, residences, and public utilities in the floodplain area.

Residential

Homes in the floodplain may be inundated, furniture waterlogged, basements filled with sediment and debris, heating facilities ruined. Yards, sidewalks, fences, and septic tanks are damaged. With greater depth and the force of flowing water, buildings may be moved off their foundations or undermined.

Commercial

Properties used in commerce, business, trade, services, and entertainment are affected. Land, buildings, equipment, supplies, merchandise, and raw material all can suffer loss or damage. Overhead expenses are increased for cleanup and inventorying. Normal operations costs increase and net profit is substantially reduced for the period.

Agriculture

Loss and destruction occurs to growing crops, land, barns, equipment, feed, livestock, and fences. The removal of debris, weed, and seed from affected land is time-consuming and costly. Siltation and saltwater can cause the soil to be less productive and fertile. Specialty horticulture such as bulbs and berries can be substantially damaged. Prolonged periods of high water are especially damaging. As agriculture is the major economic entity, extensive flood damage causes economic hardship to the entire county.

Public

Schools and roads are damaged and become unfit for use. Electric, water, telephone, and sewer utilities services can be interrupted, with additional problems if these services are needed for emergency purposes. Water rushing over roadways can potentially wash them out. Bridge foundations can be undermined when debris is trapped on piles and girders, causing an additional rise in the water surface.

Emergency Aid

The preservation of life and property are priority concerns during a pending flood. Flood emergency preparations are made. Evacuations are assisted. Additional police protection is needed. Rescue operations are performed. Mobilization of sandbagging teams of residents and military is needed. After the flood has passed, debris and wreckage is removed, and channels cleared. Private and public facilities are repaired or replaced. Damaged flood control works need restoration or repair.

## Costs

The costs associated with the potential damages are difficult to determine. Historic estimated costs do not have a similar basis of comparison, nor have they taken into account all of the factors that have been damaged. In general, damages increase exponentially with respect to the size and duration of the flood. Table 2-1 contains available flood damage estimates of some of the major flood events. Flood damage has been reduced in recent years with the storage of water behind Ross and Upper Baker dams, and with an extensive, well-maintained levee and dike system on the Lower Skagit River, and a well organized and effective flood fighting effort.

Table 2-2. Summary of Discharge Data and Flood Damage Estimates[a]

| Date | Station | | | | | Damages in flood plain west of Sedro-Woolley (million dollars)[f] |
|---|---|---|---|---|---|---|
| | Skagit River near Concrete (2,737 sq mi) | | Skagit River near Sedro-Woolley (3,015 sq mi) | Skagit River near Mount Vernon (3,093 sq mi) | | |
| | Peak discharge, cfs | Recurrence interval, years[b] | Peak discharge, cfs | Peak discharge, cfs | Recurrence interval, years[b] | |
| 1815 | 500,000 | | 400,000 | -- | | -- |
| 1856 | 350,000 | | 300,000 | -- | | -- |
| November 16, 1896 | -- | | 185,000 | -- | | 71.4 |
| November 18-19, 1897 | 275,000 | | 190,000 | -- | | 71.9 |
| November 16, 1906 | -- | | 180,000 | 180,000 | | 70.9 |
| November 18, 1908 | -- | | 97,000 | -- | | -- |
| November 29-30, 1909[g] | 260,000 | 70 | 220,000 | -- | | 84.4 |
| November 21, 1910 | -- | | 114,000 | -- | | -- |
| December 29-30, 1917 | 220,000 | 33 | 195,000 | -- | | 72.4 |
| December 12-13, 1921 | 240,000 | 50 | 210,000 | -- | | 79.6 |
| February 27, 1932 | 147,000 | 8 | -- | -- | | 63.7 |
| November 13, 1932 | 116,000 | 5 | -- | -- | | 39.6 |
| December 22, 1933 | 101,000 | 3 | -- | -- | | 14.1 |
| January 25, 1935 | 131,000 | 7 | -- | -- | | 54.3 |
| November 27, 1949[c] | 154,000 | 14 | 149,000[b] | 114,000 | 8 | 41.2 |
| February 10, 1951[c] | 139,000 | 10 | 150,000[b] | 144,000 | 18 | 68.2 |
| November 3, 1955[d] | 106,000 | 6 | 113,000[b] | 107,000 | 6 | NA |
| November 23, 1959[e] | 89,300 | 4 | -- | 91,600 | 4 | 2.3 |
| November 20, 1962 | 114,000 | 7 | -- | 83,200 | 3 | NA |
| July 13, 1972 | 91,900 | 4 | -- | 80,600 | 3 | NA |
| December 4, 1975 | 122,000 | 10 | 121,000 | 130,000 | 12 | 7.3 |
| December 18, 1979 | 135,800 | 14 | -- | 111,900 | 10 | NA |
| December 26, 1980 | 148,700 | 17 | -- | 113,900 | 10 | NA |
| December 4, 1982 | 100,000 | 5 | -- | 71,370 | 2 | NA |

[a] Flows from USGS records except as noted.
[b] Estimated by Corps of Engineers.
[c] Ross Dam began storing water in March 1940, and affects downstream flow and flood recurrence intervals.
[d] Includes effect of 120,000 acre-feet of flood storage established at Ross Dam in 1953.
[e] Upper Baker Dam began storing water in July 1959.
[f] ENR = 4800, equivalent to mid-1987 costs.
[g] First official recorded flood.
NA = Data not available.

# LOCATION AND IDENTIFICATION OF PROBLEM AREAS

Specific problem areas can be identified for each of the typical watershed flooding problems listed previously. Some of the problems are too widespread or have frequent changes in location and cannot be pinpointed specifically. These areas need to be addressed when it is apparent that a problem is developing. Existing flood control works which are in the main watercourse of the river are subject to constant abuse, and must be maintained continually.

## Specific Problem Areas

Several areas have or are developing problems that need additional attention. These areas are numbered in Figure 2-2. This list is not self inclusive, as problem areas frequently develop unexpectedly.

Area No. 1: Friday Creek bank erosion, Section 32, Township 36 North, Range 4 East--At this location, Friday Creek makes a 90-degree turn. The stream force is directed into a high, unstable bank and considerable erosion has occurred. The possibility of a major landslide exists. This could cause a temporary dam on Friday Creek that could overtop, causing a surge of water and debris downstream.

Area No. 2: Gilligan's Creek bar accumulation, Section 24, Township 35 North, Range 5 East--A large amount of erosion has occurred to the right bank of the Skagit River near the entrance of Gilligan's Creek. A large sand bar is building along the left bank. The velocity is quite high and it is likely that a channel change could occur at this location.

Area No. 3: Lyman point bar accumulation, Section 18, Township 35 North, Range 6 East--About 600 feet of the right bank of the Skagit River has eroded. A large sand bar is building on the left bank, and a channel change could occur at this location.

Area No. 4: Van Horn channel change, Section 24, Township 35 North, Range 8 East--Much of an old log jam has been washed away from the mouth of an old slough along the left bank of the Skagit River. The river could re-enter the slough, causing a channel change.


Figure 2-2 Specific Flood Problem Areas

SKAGIT COUNTY

LEGEND

① POTENTIAL FLOOD DAMAGE AREA NUMBER
SEE LIST OF SPECIFIC PROBLEM AREAS
IN TEXT

SCALE IN MILES

Area No. 5: Cape Horn road bank erosion, Section 12, Township 35 North, Range 7 East--The Skagit River makes a long curve along a high gravel bank about 60 feet high. The right bank of the river has eroded to within about 30 feet of the Cape Horn Road.

Area No. 6: Big Ditch pass deterioration, Section 30, Township 33 North, Range 3 East--At this location, the Big Ditch pass is under Fisher Creek in a large concrete box culvert. Fisher Creek is diked along both sides. This underpass was constructed in approximately 1936. It appears that the forms were never stripped from the structure and are now rotting away. Some problems have been experienced with water flowing under the structure and through the dike. It may be that some major repair will be needed should this problem continue.

Area No. 7: North Fork sloughed levee, Section 9, Township 33 North, Range 3 East--The levee along the left bank of the North Fork of the Skagit River has sloughed badly. The levee is quite narrow at this point with very steep slopes, less than 1:1. Also, the levee is very close to the river channel. About a 1,000-foot section of this levee is in need of major repair.

Area No. 8: Padilla Dike deterioration, Section 1 and 12, Township 35 North, Range 2 East and Section 18, Township 35 North, Range 3 East--The Padilla Dike along this area is protected from a strong wave action by a long row of piling. This piling was placed many years ago. The piling is now in very poor condition and as it falls down, more and more of the dike is exposed to the wave action.

Area No. 9: Hansen Creek deposition, Section 17, Township 35 North, Range 5 East--Large amounts of gravel and silt are being deposited in the bed of Hansen Creek. A holding and settling pond is being considered for this stream.

Area No. 10: Highway 9 bridge bank erosion, Section 35, Township 35 North, Range 4 East--Left bank of Skagit River for about 2,000 feet downstream from Highway No. 9 bridge at Sedro Woolley is showing erosion and is considered a problem area.

Area No. 11: Channel change near Burlington, Section 34, Township 35 North, Range 4 East--Sharp bend just upstream and east of Burlington could cause a major channel change should a large flood of considerable duration occur.

Area No. 12: Gages Slough blocked drainageway, Township 35 North, Range 4 East--Gages Slough is probably an old channel of the Skagit River. Floodwater will enter this slough as State Highway 20 is topped. The effectiveness of this slough to carry floodwater is in question due to neglect, abuse, and undersized culverts. It would serve to help remove floodwater from the City of Burlington once the flood started to recede. With considerable work, Gages Slough could be improved both as a drainageway and floodway.

Area No. 13: Cockreham Island levee failures, Sections 15 and 22, Township 35 North, Range 6 East--Levee along east boundary of Cockreham Island has been topped in the last three major floods (1975, 1979, 1980) with major levee failures in 1979 and 1980.

Area No. 14: Hamilton flooding, Section 16, Township 35 North, Range 6 East--Hamilton has been flooded and evacuated in the three recent floods noted above. The entire town is in the floodway of the river.

Area No. 15: Section 10, Township 35 North, Range 7 East--Grandy Creek was rechanneled under a wood pile railroad bridge with pile lines at about 8-foot intervals just upstream of Highway 20. The restriction has caused a buildup of gravel and silt and a log jam problem at times of high water.

Each of the problem areas will be addressed in Chapter 8 in the discussion of prioritization.

Continuing Flood Control Projects

Existing flood control works are continually subject to high water and natural forces and must be continually monitored and maintained. These areas are inspected after every flood to determine rehabilitation needs. All known existing facilities are shown in Figure 2-3. Each of these areas should be considered a problem area:

- All existing dikes and levees require continual maintenance and, therefore, should be considered problem areas.


Figure 2-3 Existing Flood Control Facilities
SKAGIT COUNTY
LEGEND
DRAINAGE PUMP STATION
MAJOR TIDE GATE OUTLET
HOLDING POND
LEVEE OR DIKE
ROCK RIP-RAP
SCALE IN MILES
0 1 2 3 4
ANACORTES
BURLINGTON
MOUNT VERNON
SEDRO WOOLLEY
LA CONNER
HAMILTON
CONCRETE
ROCKPORT
BELLINGHAM BAY
PADILLA BAY
SKAGIT BAY
CYPRESS ISLAND
GUEMES ISLAND
FIDALGO ISLAND
WHIDBEY ISLAND
ISLAND COUNTY
MT. BAKER NATIONAL FOREST
NORTH CASCADES NATIONAL PARK
ROSS LAKE NATIONAL RECREATION AREA
SKAGIT RIVER
INTERSTATE 5

- All existing rock riprap areas require continual maintenance and should be considered problem areas.
- All pump stations require continual maintenance and, in some cases, will require upgrading as drainage volume increases.
- All tide gate structures require continual maintenance and will, at some time, require upgrading or replacement.

Additional Problem Watch Areas

The above listed problem areas are known and are monitored frequently. There are other areas in the County that are subject to flooding problems when certain uncontrollable conditions exist. The exact location of future problems in these areas is impossible to predict, but the County, through past experience, has come to expect problems in these areas.

The areas downstream from timber lands have problems at times. The streams feeding down from the timber land for the most part follow a well-defined channel down the steep slope through the timber land then flow across a flat plain to the river. As the timber is removed, an increase in runoff and erosion occurs, causing large deposits of material in the channel of the flat plain.

The timber practices are the main contributors to flooding problems in the feeder stream areas. The increased flows in the small feeder stream subbasins are small in comparison with the Skagit and Samish River flows, and do not cause appreciable damage further downstream. The location of timber harvesting is frequently changing. In the past, the flood damage done in the feeder stream areas has been addressed and mitigated by flood damage reduction practices.

Both log and gravel deposits collect at various locations along the upper part of the river. It is not possible to predict exactly where the accumulations will occur year by year. The log jams and debris bars are in a constant state of change. As the bars and jams build, the main flow of the river is changed, causing erosion. In a number of cases, this erosion and bar buildup is to the point that a major channel change could occur. The debris accumulation must be cleared before it causes major problems.