

SKAGIT COUNTY
SKAGIT RIVER FLOOD CONTROL COMMITTEE

Recommendation For A Flood Control Plan
For The
Skagit River Basin

Board of Skagit County Commissioners

Howard Miller, Chairman
Bud Norris, Commissioner
Jerry Mansfield, Commissioner

MAY 25, 1982

SKAGIT RIVER

FLOOD CONTROL PLAN

SKAGIT RIVER FLOOD CONTROL COMMITTEE

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TABLE OF CONTENTS

		<u>PAGE</u>
	PREFACE	1
	INTRODUCTION	2
	EXECUTIVE SUMMARY	2-A
CHAPTER I	BACKGROUND AND SCOPE	3
II	EVALUATION CRITERIA	6
III	SUMMARY OF ALTERNATIVES	7
	A. STORAGE (Reservoirs)	7
	B. CONTAINMENT (Dikes, Levees)	8
	C. CHANNELIZATION (Dredging, Maintenance)	8
	D. DIVERSION (By-Pass)	9
	E. FLOODPLAIN MANAGEMENT (including Early Warning and Flood Fight)	9
IV	ANALYSIS	11
V	CONCLUSIONS	15
VI	APPENDICES	
	A. SUB-COMMITTEES	18
	B. SUB-COMMITTEE REPORTS	19

PREFACE

"We feel the Skagit River Flood Control Committee should immediately restate that major flooding with severe loss of life, property, and long range environmental damage remains the major problem facing the Skagit Community today. We must lay to rest once and for all the view that a primarily agricultural community can tolerate a major flood. Everything the Committee has seen so far points out how serious and dangerous the situation is."

-Proceedings of the Upriver Storage
Sub-committee, July, 1981

INTRODUCTION

Due to the complex nature of the alternatives available for an effective flood control plan for the Skagit River, the Board of Skagit County Commissioners established the Skagit River Flood Control Committee in mid-1980.

The Committee, comprised of representatives from various areas of Skagit County, were to work as a unit studying the flood control alternatives available and develop an effective flood control plan acceptable to all of Skagit County.

The Committee consisted of a representative from each of the incorporated cities of Skagit County, selected by the mayor of each of those cities; a representative from each of the river diking districts, selected by the commissioners of each diking district; a citizens' representative from five special effected areas without city or dike district affiliation, selected by the citizens of that area; and three at-large members, selected by each of the Skagit County Commissioners.

The Committee met for the first time in December of 1980. Mr. Jess Knutzen was elected to serve as Chairman. The Committee has held a regular meeting each month.

The Committee made a review of the flood control alternatives available, compiled data from past studies, held meetings with representatives from the U. S. Army Corps of Engineers, Federal Emergency Management Agency, Skagit Wild and Scenic River Authority, and representatives of the U. S. Congressional delegation. Several field trips were also made.

Sub-committees were appointed for each viable alternative. Each sub-committee made an in-depth study and presented a recommendation for their findings to the regular committee.

The regular committee acted upon the recommendations of the sub-committees and developed this recommendation for a Flood Control Plan for the Skagit River.

EXECUTIVE SUMMARY

A. In these conclusions, reference is made to the near, middle, and distant future. Since at this time, the Skagit River Flood Control Plan is necessarily rather inexact, these terms are only loosely defined as "commencing now", "commencing in 2 to 5 years", and "commencing in 10 to 20 years." With this explanation of time frame in mind and with the understanding that a positive cost-benefit ratio must be established on any structure prior to commencement of construction, it is hereby established that Skagit County should:

1. Begin now to pursue and investigate a Sauk River dam by:
 - a. Obtaining and reviewing information from the Army Corps of Engineers derived from past studies of potential dam sites on the Sauk River.
 - b. Seeking support and interest for such a project from other local, state, and federal agencies, and our congressional delegation.
 - c. Including in such investigations consideration of combining the flood control structure with electrical power generation and fisheries enhancement.

If, at some point in the middle future, the project is determined to be feasible, effort will continue until the project is completed sometime in the distant future. IT IS NOTED THAT THIS IS THE ONLY ACTION THAT WILL GIVE MAXIMUM FLOOD PROTECTION TO THE MAJORITY OF SKAGIT VALLEY.

2. Begin now to plan and construct Limited Dike Improvements as follows:
 - a. The Skagit County Department of Public Works be authorized to make a detailed study of the data compiled by the Army Corps of Engineers in the recent proposed Lower Levee Project and to collect whatever new data as may be necessary to determine the existing condition of the entire levee system.
 - b. The highest present level of levee protection be determined from this study. By mutual agreement between the Dike District Commissioners and Skagit County, a priority construction program will be established over the next several years to improve the entire levee system to its present highest level. Priorities for construction will be determined by the highest need.
 - c. Skagit County participates with the Diking Districts in this program through such authority as the River Improvement Fund on a 50-50 basis.
 - d. Said fund should consist of no less than \$400,000 per year with a like sum from the Diking Districts.

Project completion is scheduled for sometime in the middle future.

3. Begin now to plan for and implement selected Debris Removal by petitioning the Corps of Engineers to undertake this project. Any incorporated city benefiting from the project would join with Skagit County in such a petition. It will thereafter be the responsibility of the local governments to maintain the river in its open state.

Project is scheduled for completion sometime in the middle future, but maintenance would require on-going effort.

4. Take no action in the near future on a By-Pass proposal. If at some point in the middle future the Sauk River Dam proves to be unfeasible, and if the Limited Dike Improvements, Debris Removal and Floodplain Management are still not enough, Skagit County should then commence to pursue and investigate a By-Pass, with project completion scheduled for the distant future.
5. Maintain and support current floodplain management programs. Along this line it is further considered that:
 - a. Floodplain management, defined herein as human adjustment to floods, shall form the basis of this Skagit River Flood Control Plan, to be augmented by such flood control works as are shown to be cost effective.
 - b. Cost/benefit analysis shall include all costs, including fertility change in farm lands that are protected from flood and the possibility of diked rivers to require higher and higher dikes.
 - c. The possibility of providing elevation, floodproofing, and/or relocation assistance as an alternative to flood control projects shall be investigated.
 - d. Existing floodplain management regulations shall be made as simple and easy to live with as possible.
 - e. Strong support shall be given to improved methods of forecasting, early warning, flood fighting, and disaster planning in general. The installation of highly technical, sophisticated Flood Emergency Warning System is particularly important and should receive number one priority, and
 - f. Local government ordinances shall be revised to require the following or similar wording to be placed on all newly approved plats and short plats located in the floodplain. NOTE: "This property lies within the Skagit River 100-Year Floodplain and is subject to local ordinances governing floodplain development."
6. Begin now to collect cross-sectional data at various locations along the river in order to monitor stream change characteristics and check for aggragation of the riverbed.

CHAPTER I. BACKGROUND AND SCOPE

A. SCOPE

It is the intent of this plan to establish a comprehensive strategy for coping with floods of the Skagit River and its tributaries in Skagit County, Washington. Other rivers and streams outside the Skagit system (such as the Samish River) or outside Skagit County (such as the Suiattle River) are discussed only to the extent to which those rivers contribute to the flood hazard on the main stem or are effected by the alternative flood control measures.

No attempt will be made in this Plan to thoroughly analyze the historical, hydrological, or engineering aspects of flooding by the Skagit River or to reproduce the entire educational process undergone by the Skagit River Flood Control Committee since its first meeting on December 4, 1980. Rather, some brief comments will be made and source material cited for persons interested in more detailed information.

B. GEOGRAPHY

The Skagit River is the largest river flowing into the Puget Sound and has the highest potential for flood damage in this area if not in the entire Pacific Northwest.

The main stem of the Skagit River begins in British Columbia. The portion lying in Whatcom County is now mostly taken up by the reservoirs created by Gorge, Diablo, and Ross dams operated by Seattle City Light. Thereafter, the Skagit River is a free-flowing river and is joined by the Cascade River at Marblemount, the Sauk River at Rockport, and the Baker River at Concrete. Of these tributaries, all are free-flowing with the exception of the Baker River which has two dams (upper and lower Baker) operated by Puget Sound Power and Light Company. Thus, the Baker River and the main stem of the Skagit River, upstream of the Gorge Dam, are dammed to provide approximately 100-year flood protection while the remainder constitutes the principal flood source.

The Skagit River flows through a clearly definable valley penetrating the North Cascades and its foothills until it reaches Sedro Woolley, at which point it meanders across a large fan-shaped delta and empties into Skagit Bay. The river is diked from the Burlington area to the mouth which consists of the North and South Forks between which lies Fir Island. The Skagit River watershed is approximately 3,095 square miles in size. Most of it, above 500 feet, is forested and is owned by timber companies, the State, and the Federal Government. Timber harvest and management effect the function of a watershed to regulate the runoff and infiltration of precipitation. The State Forest Practices Act regulates timber harvesting on state and private lands. The federal lands are managed in accordance to their own regulations with no County input into their forest practices. As a result of state and federal control of forest practices, the County is limited in its ability to develop and implement policies related to watershed management in most of the watershed.

C. CLIMATE

Rapid snowmelt is probably the primary cause of Skagit River flooding, though this is often combined with heavy rainfalls. Most floods occur during the months of November, December, and January as a result of warm, wet storms from the Pacific Ocean. However, there is an amazing diversity among the floods of different years which underscores the danger of over-generalizing.

D. HISTORY OF DAMAGES

The worst floods of historic record were those of 1909 and 1921 in which discharges of 220,000 and 210,000 c.f.s. occurred at Sedro Woolley. These, of course, occurred before the upriver dams were constructed. More recently, the floods of 1975, 1979, and 1980 did considerable damage as well. Whereas the entire Skagit system is subject to flooding, certain areas are more vulnerable than others or are vulnerable in different ways. Cape Horn, Hamilton, and parts of West Mount Vernon, for example, are vulnerable to relatively high frequency floods whereas downtown Mount Vernon and most of Burlington are protected by dikes. When a lower frequency flood occurs, however, such as one of 50- or 100-year frequency, those more built-up areas will suffer by far the most financial damage because the dikes will have been overtopped.

E. STATUS OF FLOOD CONTROL PLANNING

Skagit County's Comprehensive Plan gives background information on flooding, but few policies. They are: 1) existing urban areas should be protected from flood; 2) floodplain management techniques should be considered as alternatives or supplements to flood control works; 3) floodplain policy should be consistent with other policies, such as agricultural preservation; 4) flood control works that stimulate increased development on the floodplain should be avoided or other steps taken as necessary to protect prime farmland and prevent escalation of flood damage potential.

In terms of flood data, the U. S. Army Corps of Engineers, under contract to the Federal Emergency Management Agency, has prepared preliminary maps depicting elevations of the 100-year flood and delineating the floodplain plus floodways where such have been established. Skagit County and its incorporated cities are all participants in the Emergency National Flood Insurance Program and, as such, have adopted floodplain regulations. As those regulations are refined, the jurisdictions will enter the "regular program" in which premium rates will be on an actuarial basis and amount of coverage will be expanded.

F. SOURCES OF FURTHER INFORMATION

For further information, please refer to the following sources:

1. U. S. Army Corps of Engineers (1966) "Skagit River Basin Study" Preliminary Study for Dam Construction on the Sauk River and Tributaries.

2. U. S. Army Corps of Engineers (1952) "Report on Survey for Flood Control of the Skagit River and Tributaries"
3. U. S. Army Corps of Engineers (1963) "Avon By-Pass, Reactivation Report"
4. U. S. Army Corps of Engineers (1965) "Skagit River Flood Control and Other Improvements"
5. U. S. Army Corps of Engineers (1966) "Floodplain Information Study, Skagit River Basin"
6. U. S. Army Corps of Engineers (1975) "Puget Sound and Adjacent Waters, Upper Baker Project"
7. U. S. Army Corps of Engineers (1979) "General Design Memorandum, Skagit River Levee Improvements" Vol. 1 and 2
8. U. S. Geological Survey (yearly) "Water Data Report"
9. U. S. Department of Agriculture (1977) "The Skagit River Wild & Scenic Rivers Classification" Environmental Statement
10. Federal Register, Vol. 46, No. 18 (1981) "National Wild & Scenic Rivers System, Draft Revised Guidelines for Eligibility, Classification and Management of River Areas"
11. Title 44, Section 59 (1979) "National Flood Insurance Program, General Provisions"
12. Department of Natural Resources (1981) "Aquatic Lands Management Plan for the Skagit River"

CHAPTER II.. EVALUATION CRITERIA

The alternative methods of coping with flood hazards will be judged by the extent to which they are:

- A. Comprehensive (take into consideration, though not necessarily protect, all areas of the County).
- B. Engineering and physically feasible.
- C. Financially cost effective.
- D. Financially equitable.
- E. Environmentally acceptable.
- F. Socially acceptable.
- G. Legal.

CHAPTER III. SUMMARY OF ALTERNATIVES

The Skagit River Flood Control Committee broke up into sub-committees to study each of the following alternatives. The membership of those sub-committees is available from the Skagit County Public Works Department.

The sub-committee findings were intended to better inform the full committee and, as such, have been rephased for the purposes of this plan.

The alternatives as broken down in this chapter are felt to comprise the logical range of actions designed to minimize flood damages. In this chapter, each is discussed but final conclusions are not given. For that information, see Chapter V.

A. STORAGE

"Storage" refers to the temporary storage of water in upriver reservoirs in order to achieve a more even rate of flow and eliminate the peak discharges that cause damage.

As stated in Chapter I, storage is already in place in the amount of 73,000 acre feet at Baker Dam and 120,000 acre feet at Ross Dam, thus providing approximately 100-year flood protection on the Baker River and on the main stem of the Skagit upriver from Newhalem. Thus, the Sauk River is the main uncontrolled tributary of the Skagit River basin and, in fact, contributed over half of the floodwaters experienced during the December 1980 flood.

U. S. Army Corps of Engineer's studies indicate possible dam sites at several locations in the Sauk-Suiattle Basin. The lower Sauk site, about 5 miles upstream from the mouth of the Sauk River, could provide a very desirable level of flood protection.

A flood control structure on the Sauk River is the only solution offering relief to virtually all of Skagit Valley downstream from Rockport. Of all the alternatives, it offers the greatest protection for the greatest number of people.

A combination flood control and hydroelectric dam on the Sauk River may be more cost-effective than flood control alone given projected energy shortages. Such a structure would be of interest to private utilities as well as public agencies.

A Sauk River dam providing flood control only would leave the river essentially free-flowing except in times of high runoff. Coupled with a fish enhancement project environmental impact would be mitigated.

It is recognized that there are potential obstacles in the way to realization of a dam on the Sauk: 1) the Wild and Scenic Rivers designation, which presently makes such a structure illegal; 2) tribal fishing rights;

3) unproven cost-effectiveness; 4) environmental impact, and 5) decreased federal spending.

These potential obstacles, though significant, do not negate the compelling logic of a Sauk River Dam.

B. CONTAINMENT

"Containment" refers to containing the river within its banks by means of artificial dikes or levees.

About 50 miles of dikes are already in place in various sections of the Skagit River, especially the delta portion. Most are administered by Diking Districts. The existing dikes provide a non-uniform level of protection commencing east of Burlington and are capable of conveying a flood flow of 130,000 cubic feet per second for a short period of time with effective flood fighting. They consist of earth and sand berms of various heights, widths, and material composition and are inadequate in both height and strength to provide protection against major floods.

Whatever other flood control measures are taken, the dikes will always play an important role. The present dike system needs to be maintained and brought to a uniform level of protection taking into consideration all adverse impacts on the surrounding community, but major improvements appear to have been ruled out by the 1979 defeat of the Skagit River Levee Improvement Project. A limited improvement program must be within the financial capability of the County and Diking Districts and would probably be a cumulative on-going program as resources allow.

Levee improvements in the delta area would not, of course, benefit other parts of the County and some adverse flooding consequences on nearby unprotected areas are likely to occur.

C. CHANNELIZATION

"Channelization" refers to keeping the river within its banks by increasing the channel's hydraulic capacity; that is, by dredging, straightening, or removal of obstructions.

Those portions of the Skagit system within the Wild and Scenic Rivers designation are severely restricted in terms of dredging and other methods of channelization. Dredging has generally proven to be uneconomical as a flood control measure due to the tendency of the river to reassert its old profile. Similarly, straightening schemes must take into account the fact that those forces which caused the river to meander in the first place will remain and must be guarded against by massive bank erosion control.

One option that is allowable under the Wild and Scenic Rivers designation and which is more likely to be cost-effective, is the cleaning out of log jams and debris which cause water to be diverted into unprotected, populated areas. Such action would provide relief at high water stress points and help prevent bank and dike overtopping.

Another topic related to channelization is the assertion that is frequently made on some portions of the river that the river is aggregating or filling in and getting higher in relation to the surrounding ground. This is impossible to ascertain since baseline cross-sectional data has never been collected. If such data were collected now, future riverbed dynamics could be monitored.

D. DIVERSION

"Diversion" refers to providing an artificial channel which allows floodwaters to by-pass developed areas, often by means of an alternate outlet to the sea.

In 1963, the U. S. Army Corps of Engineers reactivated a report for Skagit River flood control known as the Avon By-Pass. This report proposed the construction of a by-pass channel to divert flood waters from the Skagit River in the vicinity of Mt. Vernon-Burlington area and discharge them into Padilla Bay.

The "Avon By-Pass" has always been controversial due largely to the large amount of land that would be required. A by-pass into Padilla Bay today is even less likely due to its designation as a National Estuarine Sanctuary.

Nevertheless, some sort of by-pass would be an effective flood control work for the delta area, though there would be many technical problems. The most frequently discussed by-pass technique is currently a wide, non-excavated area with dikes on both sides that would be dry farmable land except in times of flood.

E. FLOODPLAIN MANAGEMENT

"Floodplain Management" refers to adjustment to, as opposed to control of floods. This definition recognizes the fact that while floods are natural phenomena, they only become disasters to the extent that humans expose themselves to flood risk.

1. Limitations to the Engineering Approach

Structural flood control works form an important part of the response to flood hazard, but by the same token have at times been over-emphasized. Despite vast federal expenditures, flood damages still continue to rise due to the following reasons:

- a. Such works encourage increased floodplain development so that when a flood beyond the design capacity occurs, the damage is generally much greater than if the structure had never been built, and
- b. such federal spending, plus extensive disaster relief programs, tend to remove the floodplain occupant from responsibility for his own actions with the result that he develops in areas that he otherwise would not.

2. Types of Adjustment

The simplest form of adjustment to the flood hazard is to avoid floodplain uses which are not justified in light of the potential risk.

In many cases, however, elevation on fill or pilings is the answer. This can apply to both new and existing structures and has some strong advantages in that it is: 1) permanent, 2) a one-time expense, 3) of some help in even the worst floods, and 4) not susceptible to failure due to human error.

From elevation we go to the various floodproofing and damage mitigation schemes of permanent nature, such as impervious walls, sealable openings, and anchorage of floatable items.

Finally, there are the emergency measures such as removal of people and goods, sandbagging, and rescheduling of activities. These rely heavily on adequate forecasts and early warnings.

3. Role of Government in Adjustment to Floods

The current floodplain management regulations which Skagit County and its cities have had to adopt are the inevitable result of accepting federal assistance in the form of flood control, disaster relief, and subsidized flood insurance. These regulations are quite stringent and no more are needed. Every attempt should be made to make them simpler and easier to live with, such as liberal listing of things that can be done in the floodway. The "regulated density floodway" proposed for the delta area should be designed to minimize hardship yet meet the necessary criteria.

Besides regulations, government has a role in providing adequate forecasts, early warnings, technical assistance on adjustment techniques, and flood fight coordination.

Grants or purchase programs are in general not recommended. In some cases, however, it may be cheaper to purchase and remove a structure or pay for having it elevated than to provide it with flood protection or flood insurance.

CHAPTER IV. ANALYSIS

A. INTRODUCTION

Chapter III discusses the various alternatives. In this chapter, those alternatives will be reviewed against the evaluation criteria discussed in Chapter II, then overall strategies will be discussed for determining the best combination.

B. EVALUATION

1. Comprehensiveness

This is meant to judge the overall good done to the community by way of flood damage reduction and takes into account negative impacts on areas outside the area to be benefited.

The Sauk River dam and Floodplain Management are probably the highest scorers in this category. The limited dike improvements (outlined in Section on Containment), debris removal, and by-pass all score lower since they are either smaller in scope of benefits or have potential impacts on other areas.

2. Engineering Feasibility

All the recommended alternatives appear to be feasible from an engineering standpoint.

3. Financial Cost Effectiveness

This is difficult to judge without detailed studies. Cost effectiveness of the Sauk River dam and the by-pass are totally unknown, whereas the others are felt to have a high probability of cost effectiveness.

4. Financial Equitability

This too is difficult to judge at this point since methods of funding have by and large not been addressed and it is not known what money will be available.

It can be generally stated, however, that:

- a. Federal assistance should be sought if programs exist to which the County is eligible.
- b. In most, if not all cases, some funding from the County general fund will be appropriate due to the need to protect public improvements and the tendency for floods to indirectly disrupt even upland areas.
- c. Where an incorporated city, dike district, or other local governmental body is the primary beneficiary, it should contribute a significant share.

- d. In some cases, it may be feasible to break the responsibility down into even smaller units to better balance cost and benefit. For example, assessor's records could be coded to show what properties are in the designated floodplain. Flood control works could then be financed through an additional assessment of those properties which would directly benefit. This method rises legal questions but deserves study.
- e. The net result should be that all citizens pay for flood control in approximate ratio to the benefit they receive.

5. Environmental Acceptability

This topic is necessarily subjective since in its full scope it means many different things to many different people. The discussion here is confined to impacts on the natural environment more than the human environment since the latter is covered under Item 6, Social Acceptability.

The Sauk River dam would have major environmental impacts through the flooding of lands and destruction of fish and wildlife habitat. Some of these impacts could be mitigated by fisheries enhancement and other measures.

Limited dike improvements would have very little environmental impact.

At this point, it does not appear that debris removal would be environmentally damaging either, depending on how it is accomplished.

The By-Pass would have environmental impact through use of farm lands and possibly through introducing pollutants and sediment into Padilla Bay. Here again the degree of impact depends on the specifics of the proposal.

6. Social Acceptability

This criterion is meant to assess impact on people, disruption, dislocations, aesthetics, and so forth.

The Sauk River dam fares well in this category since it is relatively removed from areas of high population.

Limited Dike Improvements should be socially acceptable as should Debris Removal.

The By-Pass, depending on where it goes, will not be acceptable to many people since it must pass through some developed areas in order to reach the Puget Sound.

Floodplain Management is a controversial subject due to the impact it is seen to have on property rights. Another viewpoint, however, is that Floodplain Management regulations merely reflect physical limitation in such a way as to protect the general public. In any case, the concepts outlined in Chapter III should be acceptable since no new regulations are proposed.

7. Legality

The Sauk River dam is legally impossible at this point and would require an act of Congress to change the law.

Limited Dike Improvements are legal though they could conceivably be affected by the proposed regulated density floodway. Hopefully and logically, diking improvements will be allowed in the "regulated density floodway".

Debris Removal appears to be within the Wild and Scenic Rivers guidelines. Some review from the Department of Fisheries would probably be involved to avoid fisheries impact.

According to Milt Martin, of the Olympia Office of the Department of Ecology, a By-Pass outletting into Padilla Bay would not be illegal per se, but obtaining the necessary permits may be impossible due to Padilla Bay's recent designation as a National Estuarine Sanctuary.

All the Floodplain Management recommendations are legal.

C. PERFORMANCE MATRIX

The following matrix is intended to summarize the previous section and to identify problems for a quick reference. Since the alternatives are generally not "either/or" situations but rather require a coordinated strategy, the matrix is not intended to eliminate alternatives or point out the best alternative; therefore, points are not totalled.

	Comprehensiveness	Engineering Feasibility	Financial Cost Effectiveness	Financially Equitability	Environmental Acceptability	Social Acceptability	Legality
SAUK RIVER DAM	2	2	unknown	unknown	1	2	0
LIMITED DIKE IMPROVEMENTS	1	2	probably good	unknown	2	2	2
DEBRIS REMOVAL	1	2	probably good	unknown	2	2	2
BY - PASS	1	2	unknown	unknown	1	0	1
FLOODPLAIN MANAGEMENT	2	2	2	2	2	1	2

2-Good; no problem identified

1-Average

0-Poor; problem identified

D. COMBINING STRATEGIES

The matrix points out that each of the alternatives is important but in different ways.

1. The Sauk River dam stands out as the best source of protection for the largest number of people, but the obstacles are such that it can only be considered a long range solution.
2. Limited Dike Improvements do not provide the same scope of protection but should be included in any case due to the lack of impact, lower cost, and the fact that it represents a logical consolidation of existing resources.
3. Debris Removal has promise as a relatively small scale means of providing relief to localized high impact areas.
4. The By-Pass, though controversial and problematic, cannot be totally ruled out since it may someday turn out to be a viable alternative.
5. Floodplain Management, defined as adjustment to rather than control of floods, must form the basis of the Plan to be augmented with those flood control works that prove to be most cost effective. In other words, until we can control the flood, we must adjust to it and in many cases adjustment will be cheaper than control.

CHAPTER V. CONCLUSIONS

A. In these conclusions, reference is made to the near, middle, and distant future. Since at this time, the Skagit River Flood Control Plan is necessarily rather inexact, these terms are only loosely defined as "commencing now", "commencing in 2 to 5 years", and "commencing in 10 to 20 years." With this explanation of time frame in mind and with the understanding that a positive cost-benefit ratio must be established on any structure prior to commencement of construction, it is hereby established that Skagit County should:

1. Begin now to pursue and investigate a Sauk River dam by:
 - a. Obtaining and reviewing information from the Army Corps of Engineers derived from past studies of potential dam sites on the Sauk River.
 - b. Seeking support and interest for such a project from other local, state, and federal agencies, and our congressional delegation.
 - c. Including in such investigations consideration of combining the flood control structure with electrical power generation and fisheries enhancement.

If, at some point in the middle future, the project is determined to be feasible, effort will continue until the project is completed sometime in the distant future. IT IS NOTED THAT THIS IS THE ONLY ACTION THAT WILL GIVE MAXIMUM FLOOD PROTECTION TO THE MAJORITY OF SKAGIT VALLEY.

2. Begin now to plan and construct Limited Dike Improvements as follows:
 - a. The Skagit County Department of Public Works be authorized to make a detailed study of the data compiled by the Army Corps of Engineers in the recent proposed Lower Levee Project and to collect whatever new data as may be necessary to determine the existing condition of the entire levee system.
 - b. The highest present level of levee protection be determined from this study. By mutual agreement between the Dike District Commissioners and Skagit County, a priority construction program will be established over the next several years to improve the entire levee system to its present highest level. Priorities for construction will be determined by the highest need.
 - c. Skagit County participates with the Diking Districts in this program through such authority as the River Improvement Fund on a 50-50 basis.
 - d. Said fund should consist of no less than \$400,000 per year with a like sum from the Diking Districts.

Project completion is scheduled for sometime in the middle future.

3. Begin now to plan for and implement selected Debris Removal by petitioning the Corps of Engineers to undertake this project. Any incorporated city benefiting from the project would join with Skagit County in such a petition. It will thereafter be the responsibility of the local governments to maintain the river in its open state.

Project is scheduled for completion sometime in the middle future, but maintenance would require on-going effort.

4. Take no action in the near future on a By-Pass proposal. If at some point in the middle future the Sauk River Dam proves to be unfeasible, and if the Limited Dike Improvements, Debris Removal and Floodplain Management are still not enough, Skagit County should then commence to pursue and investigate a By-Pass, with project completion scheduled for the distant future.
5. Maintain and support current floodplain management programs. Along this line it is further considered that:
 - a. Floodplain management, defined herein as human adjustment to floods, shall form the basis of this Skagit River Flood Control Plan, to be augmented by such flood control works as are shown to be cost effective.
 - b. Cost/benefit analysis shall include all costs, including fertility change in farm lands that are protected from flood and the possibility of diked rivers to require higher and higher dikes.
 - c. The possibility of providing elevation, floodproofing, and/or relocation assistance as an alternative to flood control projects shall be investigated.
 - d. Existing floodplain management regulations shall be made as simple and easy to live with as possible.
 - e. Strong support shall be given to improved methods of forecasting, early warning, flood fighting, and disaster planning in general. The installation of highly technical, sophisticated Flood Emergency Warning System is particularly important and should receive number one priority, and
 - f. Local government ordinances shall be revised to require the following or similar wording to be placed on all newly approved plats and short plats located in the floodplain. NOTE: "This property lies within the Skagit River 100-Year Floodplain and is subject to local ordinances governing floodplain development."
6. Begin now to collect cross-sectional data at various locations along the river in order to monitor stream change characteristics and check for aggragation of the riverbed.

These elements are summarized in the following diagram:

	Near Future	Middle Future	Distant Future
SAUK RIVER DAM	-----	(-----)(.)	(-----)
LIMITED DIKE IMPROVEMENTS	-----	-----	-----
DEBRIS REMOVAL*	-----	-----	-----
BY-PASS		(-----)(.)	(-----)
FLOODPLAIN* MANAGEMENT	-----	-----	-----

-- indicates effort . indicates completion ----- indicates benefit
 () indicates uncertainty * indicates on-going process

SKAGIT RIVER FLOOD CONTROL COMMITTEE

Sub-Committee Assignments

STORAGE - CONTROLS

Bob Hulbert, Chairman
 Bill White
 Bob Dean
 George Dynes
 John Thompson
 John Leonard
 Doug Martin
 Stan Zyskowski
 Louie Parker

BY-PASS - DIVERSIONS

George Dynes, Chairman
 Owen Tronsdal
 Denny LeGro
 Steve Ladd
 Gerald Mapes
 Ken Moore
 Don Wright
 Leonard Halverson

CONTAINMENT - LEVEES - DIKES

Richard Smith, Chairman
 Denny LeGro
 Bob Dean
 Bob Hulbert
 Neil Hamburg
 Gerald Mapes
 Don Wright

FLOODPLAIN MANAGEMENT &FLOOD FIGHT - EARLY WARNING

Arnold Hansen, Chairman
 John Leonard
 Larry Kunzler
 Neil Hamburg
 Steve Ladd
 Stan Zyskowski
 Ken Moore
 Bud Meyers

DREDGING - CHANNELIZATION

Louie Parker, Chairman
 Richard Smith
 Owen Tronsdal
 John Thompson
 Carl Vandesar
 Bud Meyers

EXECUTIVE COMMITTEE

Jess Knutzen
 Bob Hulbert
 Arnold Hansen
 George Dynes
 Louie Parker

SKAGIT RIVER FLOOD CONTROL COMMITTEE

Report of the Upriver Storage Sub-Committee

Some introductory comments to the Board of Skagit County Commissioners and the community.

The Sauk is now the major contributor to the Skagit River flood problem. The Baker River, in particular, has significant flood protection afforded by Puget Power dams. The upper Skagit also has some flood protection benefits from Seattle City Light's projects. The Sauk remains the major uncontrolled tributary of the Skagit River Basin.

A flood control structure on the Sauk River is the only solution offering flood relief for all of the Skagit Valley, particularly the upriver areas above Sedro Woolley. It also offers the greatest protection for the greatest number of people in the river basin and it would have the least social impact. The further the Flood Control Committee goes in its study, the more evident it becomes that other alternatives, like a by-pass, major levy construction, and floodway designations will have a very major impact, much of it adverse to the environmental, social and economic life of the Skagit community. Control of flood water in the upper river basin will greatly reduce such adverse impacts.

A combination flood control and hydro-electric dam on the Sauk River would offer immediate returns in power and income to help pay for the project. Both public agencies and private utilities need to support a study to determine the feasibility for this type of project.

A Sauk River structure providing flood control only would leave the river essentially free-flowing except in times of emergency. Such a structure coupled with fish enhancement as a part of the project would also provide immediate economic benefits. The present fish catastrophe certainly bares a major federal responsibility; a turnaround of this valuable natural resource should have considerable support from wide areas of the state and nation as a whole.

The Up-River Storage Sub-Committee makes the following recommendations to the Skagit River Flood Control Committee:

1. That the Skagit River Flood Control Committee recommend to the Board of Skagit County Commissioners that Skagit County explore, along with all federal, state, and local agencies involved and our congressional delegation, the study of a flood control structure on the Sauk River. We recommend that such a study be the number one flood control priority for Skagit County at this time.
2. That the study include the possibilities of an energy producing structure along with flood control.
3. That the study include a fish enhancement program to restore the tragic decline of the Skagit River's sport and commercial fishing recognizing that the Sauk River is a very important part of this fisheries. We recognize that no structure on the Sauk River for either flood control or hydro-electric power can be built without protection and enhancement of the Skagit River fisheries. We feel the technology exists for restoration of the Skagit fisheries once proper conservation methods are put into practice.

-2-

4. We initially request from the U. S. Army Corps of Engineers all pertinent data, information, and conclusion they have available from past studies of flood control structures for the Sauk River. Such data, we realize, is outdated but may give us some preliminary answers.

In conclusion, we feel the Skagit River Flood Control Committee should immediately restate that major flooding with severe loss of life, property and long range environmental damage remains the major problem facing the Skagit community today. We must lay to rest once and for all the view that a primarily agricultural community can tolerate a major flood. Everything the Committee has seen so far points up how serious and dangerous the problem is. At the time of the inclusion of the Skagit River into the Wild and Scenic River system, Skagit County, the conservation district, the existing diking districts, the Skagit Council of Governments and the Governor of the State asked that this legislation include a promise^{provision} that a study of the effect and feasibility of a flood control structure on the Sauk River be included in the legislation and that such a structure could be built if found to be feasible, without jeopardizing the Wild and Scenic Rivers classification of the Skagit River or its tributaries. Congressman Meeds wrote such a proposal into the bill though it didn't appear in the final form.

We feel the community should now urgently ask for this study and find out once and for all whether this option is open to us.

Respectfully submitted,

Robert J. Hulbert, Sub-Committee Chairman
Bill White
Bob Dean
George Dynes
John Thompson
John Leonard
Doug Martin
Stan Zyskowski
Louie Parker

We move the adoption of this report by the full Committee and its presentation to the Board of County Commissioners.

July 16, 1981

Jess Knutzen, Chairman
Skagit River Flood Control Committee
1185 Avon-Allen Road
Burlington, Washington

Re: Sub-Committee Report on Containment (Dikes and Levees)

Current dikes and levees have presently enclosed approximately 45,000 acres of farm land in the flood plain delta west of Sedro-Woolley. Some of these diking districts were originally formed in the late 1800's when the land was first farmed. We acknowledge that our present dikes by no means afford the margin of safety from flood that we desire, with numerous floods occurring during the past 80 years when our present diking systems failed in a particular area during periods of peak river flow. To quote the Army Corps of Engineers in referring to the flood of February, 1951, "with a flow of 144,000 c.f.s. at Mt. Vernon, the flood remained at its peak for 6 hours at Mt. Vernon, a fact that contributed significantly to the severity of the flood damages. During this flood many dikes failed because they lacked sufficient height and width to withstand saturation."

Recently, there has been a major joint effort by the Army Corps of Engineers, County officials, Dike Commissioners and some people of Skagit County to substantially improve the dikes to obtain relief from flood threat. This project failed to move forward after rejection by the voters of Skagit County. In spite of the vulnerability of our current diking system to persistent flood threat, it is still our first line of defense in time of high water and will continue to be so in the foreseeable future.

Therefore our recommendations to the full committee are as follows:

1. In preparation for the anticipated Skagit River Levee and Channel Improvement Project, the Army Corps of Engineers gained a wealth of information on the lower dikes of the Skagit River during the latter part of the 1970's through extensive engineering studies. We would recommend that the Skagit County Flood Control Engineer, in conjunction with the Army Corps of Engineers compile pertinent information as may be available from these engineering studies regarding the various individual Diking Districts. Hopefully this information would include:

- a. present dike heights and widths
- b. anticipated Skagit River heights in a 50 year flood (190,000 c.f.s.)
- c. cross sectional dike profiles

With this information, we recommend that the County Engineers Office make a critical review of the primary Diking Districts of the lower Delta and assess their relative vulnerability and/or ability to withstand an anticipated water level which could be expected in the event of a 50 year flood.

2. We would encourage the County Engineers and Army Corps of Engineers to hold a dike or flood fight school for the various diking district commissions to discuss flood water considerations, diking materials, dike heights and even, but not limited to, sand bagging ideas. Preferably this would be at some late Fall date.

As recently as 1977, the Army Corps of Engineers estimated a cost in excess of \$15,000,000 for the Lower Levees and Channel Improvement Project which only went upstream as far as the BNRR bridge. There is no way the local taxing

districts can hope to accomplish what the Corps intended for flood protection; however with this information supplied to the various Diking Districts, some districts may be encouraged to undertake a more extensive improvement schedule than is currently employed.

Richard H. Smith

Richard H. Smith

Chairman

Sub-Committee on Containment

CONTAINMENT, LEVEES & DIKES

All Skagit River Flood Control programs proposed thusfar, including the flood plain management concept, use the ability of the existing levee system to convey a portion of the flood flow. It would appear that the existing Skagit River Levee System is a vital part of any Skagit River Flood Control Program.

The present levee system starting east of Burlington and running downstream to the mouth of both forks is capable of conveying a flood flow of about 130,000 c.f.s. for a short period of time with the help of heavy and effective flood fighting. All of the flood control programs considered make use of this flow capability. The existing levee system is comprised of some 50 odd miles of levees. No two miles of levee provide the same degree of protection. These levees presently consist of earth and sand berms of various heights, widths, and material composition. It is questionable that this existing levee system, in its present state, can provide the flood protection imposed upon it for any long period of time.

Therefore, this committee makes the following recommendations:

1. The Skagit County Department of Public Works be authorized to make a detailed study of the data compiled by the U. S. Army Corps of Engineers in the recent proposed Lower Levee Project and to collect whatever new data may be necessary to determine the existing condition of the entire levee system.
2. That the highest present level of levee protection be determined from this study. That by mutual agreement between the Dike District Commissioners and Skagit County, a priority construction program be established over the next several years to improve the entire levee system to its present highest level. Priorities for construction to be determined by the highest need.
3. That Skagit County participate with the Diking Districts in this program through such authority as the River Improvement Fund on a 50-50 basis.

-2-

(\$ 400,000) by Committee motion
August 20, 1981

4. Said Fund should consist of no less than ~~\$200,000~~ per year with a like sum from the Diking Districts.

Summary:

Recognizing the levee system to be a vital part of any Skagit River Flood Control Program, this program is well within the existing authority of both the Diking Districts and Skagit County. The proposed construction program, for each year, is realistic and within the capability of both the Diking Districts and the County. A measure of additional flood protection will be realized with the first year's project and increased each successive year.

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REALTY, INC.

SKAGIT COUNTY

September 1, 1981

Mr. Jess Knutzen, Chairman
Skagit River Flood Control Committee
Mount Vernon, Washinton 98273

Dear Sirs:

The committee on "By-Pass and Diversiions" have come up with the enclosed "Brochure" as a report of the Committee.

We are recommeding to the overall committee the following in importance:

1. The committee on "By-Pass and Diversions" supports 100% the up river storage committee report on the "Sauk River Dam" as our primary procedure.
2. Low levees as alternate #2, as outlined in the Studygram from the U.S. Army Corps of Engineers as of December 1979; with the recommendations that Levees be extended to Sedro Woolley.
3. In case the Sauk River Dam is not feasible to build a By-Pass be constructed ~~either at "Sterling Bend" or at Aven~~ to handle 90,000 cubic feet or water per second needed to control a 100 year flood.
4. From Alder Creek to Cockrehaur Island the construction of a dike to handle a hundred year (100) flood level, which would divert water to the South East past Hamilton. Also open up old flood channels that are now plugged with logs and sand.

Yours truly,

G. M. D.

George M. Dynes

George M. Dynes, Chairman
BY-PASS DIVERSIONS COMMITTEE

DIRECTOR	
ASST DIR - ENGR	
ASST DIR - OPER	
ASST DIR - PMT CTR	
SAFETY	
EM. SERVICES	
ADMIN ASST	
ACCOUNTING	
DESIGN/CONST	
FLOOD - DRAIN	
PUMPING	
PLUM	
OFF ENGR	
FILE	

220 RIVERSIDE DRIVE

MT. VERNON, WA 98273

September 17, 1981

To: Skagit River Flood Control Committee.

From: Dredging and Channellization Subcommittee.

Although there are many restrictions on what may be done with in the wild and senic portion of the Skagit River, there are options available that would allow relief at many high-water stress points, and prevent bank and dikes overtopping. There are many old River Channels and Sloughs that, over the years have become plugged by log jams and debris. This causes diversion of water toward populated and unprotected areas.

We recomend Skagit County and all incorporated cities Petition The Corps of Engineers to remove those obstructions in critical areas, therefor providing more area for dissipation of water during flood stage.

Respectfully submitted,

Louie Parker
Richard Smith
Owen Transdell
John Thompson
Carl Vandesar
Bud Meyers

FLOOD PLAIN MANAGEMENT RECOMMENDATIONS

August 20, 1981

Definitions

By flood plain management we mean adjustment to, as opposed to control of floods. This definition recognizes the fact that while floods are natural phenomena, they only become disasters to the extent that humans expose themselves to flood risk.

This is not to imply that the risks are never warranted. On the contrary, flood plains are an indispensable resource that have always and will always be made use of. But this use must be based on an intelligent response to the hazard of rising water.

Limitations to the Engineering Approach

Flood control (storage, channelization, and diversion) forms an important part of the response to flood hazard, but by the same token has at times been over-emphasized. Between 1936 and 1966, for example, the federal government spent some \$7 billion on flood control, yet flood damages still continue to rise drastically. There are two reasons for this:

- 1) such works encourage increased flood plain development so that when a flood beyond the design capacity occurs, the damage is generally much greater than if the structure had never been built, and
- 2) such federal spending, plus extensive disaster relief programs, tend to remove the flood plain occupant from responsibility for his own actions with the result that he develops in areas that he otherwise would not.

Types of Adjustment

The simplest form of adjustment to the flood hazard is to avoid flood plain uses which are not justified in light of the potential risk.

In many cases, however, elevation on fill or pilings is the answer. This can apply to both new and existing structures and has some strong advantages in that it is 1) permanent, 2) a one-time expense, 3) of some help in even the worst floods, and 4) not susceptible to failure due to human error.

From elevation we go to the various floodproofing and damage mitigation schemes of a permanent nature, such as impervious walls, sealable openings, and anchorage of floatable items.

Finally, there are the emergency measures such as removal of people and goods, sandbagging, and rescheduling of activities. These rely heavily on adequate forecast and early warning.

-2-

For more detail, see the attached tables 8.2 and 13 (reprinted from Floods, A Geographical Perspective, Ward, 1978; and Human Adjustment to Floods, White, 1945).

Role of Government in Adjustment to Floods

This falls into three categories: 1) regulation, 2) informational and technical assistance, and 3) grant or purchase programs.

- 1) The current flood plain management regulations which Skagit County and its cities have had to adopt are the inevitable result of accepting federal assistance in the form of flood control, disaster relief, and subsidized flood insurance. These regulations are quite stringent and no more are needed. Every attempt should be made to make them simpler and easier to live with, such as a liberal listing of things that can be done in the floodway (see the Hamilton Flood Plain Ordinance). The density floodway already recommended by this subcommittee should be designed to minimize hardship yet meet the necessary criteria.
- 2) Adjustment to floods is still an individual responsibility and this should be encouraged. Government can help by providing adequate forecasts, early warning, technical assistance on adjustment techniques, and flood fight coordination.
- 3) Grant or purchase programs are not necessarily a recommendation of this subcommittee, but are offered as a possibility. For example, it may be cheaper to elevate or remove a structure than to provide it with flood protection.

Conclusions

In conclusion, this subcommittee recommends that:

- 1) adjustment to floods, as defined herein, should form the basis of the Skagit River Flood Control Plan, to be augmented by such flood control works as are shown to be cost effective.
- 2) cost/benefit analysis should include all costs, including fertility change in farmlands that are protected from flood and the possibility of diked rivers to require higher and higher dikes.
- 3) the possibility of providing elevation, floodproofing, and/or relocation assistance as an alternative to flood control projects should be investigated.
- 4) existing flood plain management regulations should be made as simple and easy to live with as possible, including liberal listing of things that can be done in the floodway,
- 5) strong support should be given to improved methods of forecasting, early warning, flood fighting, and disaster planning in general. The installation of a highly technical, sophisticated Flood Emergency Warning System is particularly important and should receive number one priority, and
- 6) local government ordinances should be revised to require the following or similar wording to be placed on all newly approved plats and short plats located in the

-3-

flood plain. NOTE: "This property lies within the Skagit River 100-Year Flood Plain and is subject to local ordinances governing flood plain development."

Respectfully submitted,

Arnold Hansen, Chairman
Larry Kunzler
Neil Hamburg
Steve Ladd
Stan Zyskowski
Ken Moore
Bud Meyers