DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

REFERENCE OR OFFICE SYMBOL	SUBJECT
NPSEN-PL-ER	Environmental Evaluation for Skagit River Basin Emergency Levee Repairs Skagit County, Washington

TO for Ch, Engrg Div FROM District Engineer DATE 22 April 1976 CMT 1

McClish/pq/2635

1, The attached environmental evaluation and the statement of findings, below, constitute an environmental assessment for reconstruction of flood damaged water-containment structures under Public Law 84-99 in the Skagit River Basin, Skagit County, Washington.

2. Statement of Findings. Disaster recovery construction performed under authority of Public Law 84-99 is specifically excluded fron environmental impact statement requirements by pertinent Corps of Engineers regulations. This work is deemed to be of such urgency that any delay may adversely affect the public interest. The environmental evaluation, in this instance, indicates that reconstruction of flood damaged and destroyed containment structures will not result in significant adverse environmental impacts. Restoring preflood protection will result in benefits by allowing community activity and production (primarily farm) to resume and achieve preflood conditions.

3. In light of these findings, I am convinced that the action outlined in the attached environmental evaluation has been critically evaluated in terms of possible adverse and long-lasting environmental impacts, that the action is fully consistent with national policy, statutes, and administrative directives; and that on balance, the total public interest is best served by its implementation.

Raymond Einegl

RAYMOND J. EINEIGL
Colonel, Corps of Engineers
District Engineer

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ENVIRONMENTAL EVALUATION

SKAGIT RIVER BASIN EMERGENCY LEVEE REPAIRS

SKAGIT COUNTY, WASHINGTON

INTRODUCTION

Emergency rehabilitation of damaged flood control structures is necessary for protection against future high-water conditions. The levees being repaired protect agricultural land, homes, buildings, roads, machinery, vehicles and other valuable property, as well as human and animal life located on the natural flood plain. Even though levee rehabilitation results mainly in human benefits, adverse impacts also occur to the human environment, during and as a result of construction. This evaluation documents project influences. Only rehabilitation impacts will be treated in detail; however, impacts from other causes and alternatives will be considered for comparative purposes in order to gain a perspective of the whole situation. Alternatives in these situations are limited to: (1) whether or not to rehabilitate, and (2) how to rehabilitate (access and construction methods). Public Law 84-99 stipulates that rehabilitated structures cannot exceed the degree of flood protection afforded by the original preflood structures. All damaged levees are field inspected by an engineer and an economist. Job costs and benefits are determined under existing criteria and all information is placed in a letter report. If the benefit/cost ratio is favorable, the letter report is submitted for approval and funding.

ENVIRONMENTAL EVALUATION
EMERGENCY LEVEE REPAIR
SKAGIT RIVER BASIN

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1975 ENVIRONMENTAL ASSESSMENT

(Impacts of Corps of Engineers Flood Corrective Work on Skagit River following Flood of December 1975)

1. PROJECT DESCRIPTION

a. Background. Between 1 and 4 December 1975, the Skagit River flooded low-lying lands, damaged levees and caused approximately 2.2 million dollars in damages.

b. Authorization. Completion of levee repairs was authorized by Public Law 84-99 Emergency Flood Damage Repair Act.

c. General Description. The project provides for works to repair levee damage on the Skagit River, with repairs located between the towns of Lyman and Hamilton, located in secs. 14, 15, and 22, T35N, R6E. The work is arranged into three jobs - Skagit 1, 2, and 4, with some jobs including several individual parts.

d. Project Features. The project includes:

(1) Replacement of granular fill by truck duming with a 2:1 slope on both sides, excepting where a class III riprap is on the water side where the $1\frac{1}{2}$ to 1 slope is maintained.

(2) Replacement of riprap rock with class III rock toe where the existing toe has been washed out or damaged.

(3) Reshaping of levee surface by caterpillar tractor (including some flood-fight construction).

(4) Individual levee reapirs for damages caused by the December 1975 floods are listed below:

Type of Construction Impacts

River Mile	Job No.	Location	Job Type	Length	Access Route	Vegetation Impacts
38.8	SKA 1	sec 15	slough	350	levee road	Sm. amt. of grass & forbs removed
38.1	SKA 2A	sec 15	break	125	levee road	Sm. amt. grass & forbs removed
38.3	SKA 2B	sec 22	slough	700	levee road	
39.8	SKA 4	sec 14	break & slough	110 375	levee road levee road	3/4 acre land cleared of lg. trees & brush (50x700) 2 acres pasture destroyed by equipment(50x2000)

2. EXISTING ENVIRONMENT

a. General Description of Area. The Skagit River basin in the northwestern part of the State of Washington comprises of an area of 3,105 square miles, including 400 square miles in Canada. The basin extends 90 miles in a north-south direction, and about 80 miles from east to west. It occupies approximately the northeasterly one-fourth of Snohomish County, the eastern three-fourths of Skagit County, and the eastern one-third of Whatcom County. The basin is bounded on the north by the Nooksack-Sumas Basins and Canada, on the south by the Stillaguamish and Snohomish Basins, on the east by the crest of the Cascade Mountain Range, and on the west by the Samish, Padilla, and Skagit Bays, arms of Puget Sound. The Skagit River has four principal tributaries: the Sauk, Baker and Cascade Rivers, and Thunder Creek.

Stream valleys are narrow and flanked by rugged mountains and foothills in the upper half of the basin (see plate 1 for basin map).

b. Description of Flood Plain.

The Skagit flood plain includes the entire floor of the Skagit River Valley, the deltas of the Samish and Skagit Rivers, and tidelands reclaimed by filling. The almost 100,000 acres of flood plain below the Baker River contains 68,000 acres in the

delta downstream of Sedro Woolley, and 22,000 acres upstream from this city. The valley upstream from Sedro Woolley is narrow and relatively undeveloped although farms and vacation cabins are scattered along the flood plain. In this upper reach, about two-thirds of the bottom land is uncleared or occupied by river channels and sloughs. The valley varies in width from less than 1 mile in the upper reaches to about 2 miles at Sedro Woolley, then opens into a broad delta outwash plain more than 15 miles wide.

c. Hydrology and Flooding. The flow of the Skagit River and its tributaries is characterized by sharp rises of relatively short duration from October through March. These rises are the results of concentrated two to four day storms that produce rapid runoff generally accompanied by snowmelt.

The Skagit River system produces more runoff than any other river basin in the Puget Sound area. Average annual runoff exceeds 12,000,000 acre-feet per year at Mount Vernon gage. The Baker River watershed produces an equivalent of 1,929,000 acre-feet per year with an average discharge of 2,660 c.f.s. at the Concrete gage.

The Skagit River and all of its major tributaries usually have low flows during August and September after the snowpack has melted and the groundwater flow has been partially depleted. With the occurrence of heavy precipitation in the fall and winter, the rivers experience a temporary flow increase. Discharges usually rise through October and reach a peak in November on the Baker and Upper Skagit Rivers. Winter flow peaks are typically delayed until December on the Sauk and Lower Skagit Rivers, but the Cascade normally has its greatest flow in October. From their winter peaks, the rivers drop to intermediate lows in February or March when temperatures are normally low. During these months, heavy precipitation normally replenishes the snowpack at high elevations from late fall through March. Although annual peak discharge is usually the result of winter rains, in some years the peak occurs during the spring snowmelt.

The Skagit River Valley has a history of flooding dating back before 1900. Floodflows have been recorded intermittently since October 1908 as follows:

Flow Type	Period of Record	Discharge (c.f.s.)	Date
Maximum Flow of Record	(1924-1976)	154,000	27 Nov 1949
Average Flow of Record	(1924-1976)	15,190	--
Minimum Flow of Record	(1924-1976)	2,160	1-24 Oct 1925
100-year Peak		266,000*	

* Published frequency curve dated 2 April 1974.

	Discharge
50-year peak	224,000 *
10-year peak	140,000 *
2-year peak	75,000 *
Zero Damage Flow	60,000

* Published frequency curve dated 2 April 1974

Table 1 lists flows above 60,000 c.f.s. at the Concrete gage. Discharges since 1953 include the effect of 120,000 acre-feet of flood storage established at Ross Dam.

TABLE 1

Date	Skagit River near Concrete Peak Discharge (c.f.s.)	Date	Skagit River near Concrete Peak Discharge (c.f.s.)
18 Nov 1908	97,000 2/	25 Oct 1945	102,000
30 Nov 1909	260,000 1/	25 Oct 1946	82,200
30 Dec 1917	220,000 1/	19 Oct 1946	95,200
13 Dec 1921	240,000 1/	27-28 Nov 1949	154,000
12 Dec 1924	92,500	10-11 Feb 1951	139,000
16 Oct 1926	88,900	1 Feb 1953	66,000
12 Jan 1928	95,500	3-4 Nov 1955	106,000
9 Oct 1928	74,300	20 Oct 1956	61,000
26 Jun 1931	60,600	20 Apr 1959	90,700
27 Feb 1932	147,000	23-24 Nov 1959	89,300
13 Nov 1932	116,000	16 Jan 1961	79,000
22 Dec 1933	101,000	20 Nov 1962	114,000
25 Jan 1935	131,000	22 Oct 1963	73,800
3 Jun 1936	60,000	21 Jun 1966	72,300
19 Jun 1937	68,300	28 Oct 1967	84,200
28 Oct 1937	89,600	31 Jan 1971	62,200
29 May 1939	79,600	13 Jul 1972	91,900
2 Dec 1941	76,300	16 Jan 1974	79,900
3 Dec 1943	65,200	4 Dec 1975	123,000
8 Feb 1945	70,800		

1/ Calculated by U.S.G.S.
2/ Calculated for Sedro Woolley by U.S.G.S.

The principal flood problems are in the section of the Skagit flood plain west of Sedro Woolley. This section comprises 75 percent of the flood plain. The present levee system in this area varies in level of protection provided, with safe channel capacity (2-foot freeboard allowance) ranging from 84,000 to 130,000 cubic feet per second, representing 3- and 11-year average recurrence intervals, respectively. Flood stages capable of doing major damage usually occur in the fall and winter months.

Existing protective works on the Skagit River system are composed of levees, which prevent water from flowing over land during low stage floodflows, and bank protection which prevent bank erosion and the destruction of levees. The present levee system extends along both banks of the north and south forks from their mouths to the junction forming the Skagit River. Continuous levees extend up the main Skagit River channel past Mount Vernon to a point just above Burlington on the right bank and about 1/2 mile above the Great Northern Railway Bridge between Mount Vernon and Burlington on the left bank. A levee on the right bank (facing downstream) extends about a mile downstream from Hamilton. The entire city of Burlington relies on levees for flood protection. Conway, West Mount Vernon, the central business district of Mount Vernon, and residential areas to the south are protected by levees. In all, the levee system on the Skagit protects about 46,000 acres of valley land or less than 50 percent of the flood plain.

Recently, the flood damage potential has been increasing in areas upstream of Sedro Woolley, as much of the river shoreline has been particulaly attractive for summer home developments. Many of these developments are located on reaches where the riverbank is low, resulting in damages from bank erosion, and from overtopping of low riverbanks and low levees. The greater part of past flood damage has been to land and crops in the lower valley. Major damage results from the drowning of grasses and other plants, loss of livestock, sheet erosion caused by overflow of fallow ground, leaching of fertilizer, infestation by weed seed, carrying away of fences, the deposition of sand, gravel, and driftwood, temporary loss of pasture because of ground saturation and loss of land through streambank erosion. Additional damage is caused to buildings and their foundations as well as damage to the contents of commercial inventories from businesses in the flood plain.

d. Existing Flood Control. Presently, there are seven dams located on the Skagit River system. Ross, Diablo, and Gorge on the Upper Skagit River are owned and operated by Seattle City Light. The Upper and Lower Baker River Dams are

owned and operated by Puget Sound Power and Light Company. The Lone Star Cement Company owns two small power dams on Bear Creek; however, these structures are no longer in operation.

The Ross and Upper Baker dams and reservoirs, in conjunction with channel improvements and a levee system, are the only structures providing flood control for the Skagit River basin. Ross Dam controls about 30 percent of the basin's runoff with 120,000 acre-feet of storage space reserved for winter flood control. The Upper Baker Reservoir has a flood storage capacity of 16,000 acre-feet as required by its FPC license to compensate for natural channel storage lost by construction of the dam. The Baker River dams do not contribute to dependable flood control beyond the 16,000 acre-feet reservation. Flooding recurrence of the Skagit River under present conditions with existing flood control projects can be expected to occur on an average of every 3 years.

e. Water Quality. Water quality of the Skagit and Baker Rivers is generally regarded as excellent. The Washington State Department of Ecology has classified the Baker River as AA, extraordinary. The Skagit River is classified as A, excellent, from its mouth to river mile 17 (Mount Vernon), and AA, extraordinary, from river mile 17 to the Canadian border.

Previous investigations found that bacteriological concentrations varied over the length of the Skagit River, showing a trend of decreasing quality downstream from Marblemount. Coliform counts measured in numbers of organisms per 100 milliliters of water ranged from a low of 0 to a high of 230 at Marblemount, and from a low of 0 to a high of 24,000 at Mount Vernon. Waters with coliform concentrations of 1,000 per milliliter or greater are considered as unsafe for domestic water supply and contact recreation.

f. Water Uses. The Department of Ecology states that permits for the withdrawal of up to 160.7 cubic feet per second (c.f.s.) have been granted from the Skagit River. Ninty-three percent of this is for the Anacortes water supply, seven percent for the irrigation of farms, and less than one percent each for domestic use and manufacturing use. In addition, applications have been accepted for non-consumptive uses by the city of Seattle for 27,500 c.f.s. for power generation, and 30 c.f.s. by the Department of Fisheries. The chart below gives the amounts:

Consumptive water uses	Non-consumptive uses
.07 c.f.s. manufacturing	27,500 c.f.s. power generation
10.60 c.f.s. irrigation on farms	30 c.f.s. Department of Fisheries
.03 c.f.s. domestic systems	27,530 c.f.s. Total
150.00 c.f.s. Anacortes water system	
160.70 c.f.s. Total	

g. Climate

The climate of the Skagit Basin is classified as midlatitude, West Coast, marine. Due to its loation on the windward slopes of the Cascade Range, the area around Baker Lake is dominated by marine influences throughout the greater part of the year. The climate is characterized by heavy rain and snow during the late fall, winter, and early spring. The average annual snowfall varies from 525 inches at Mount Baker Lodge to 5.6 inches at Anacortes. The total annual percipitation varies from 103 inches at Mount Baker Lodge to 27 inches at Anacortes, but averages about 45 inches at Sedro Woolley. The average high temperagute is 60 degrees F. and the average annual low is 41 degrees F. The mean length of the growing season is 193 days.

h. Air Quality. As there are no significant major manufacturing plants in Skagit County, there are no major air pollution sources.

i. Vegetation. The Upper Skagit basin is forested predominately with dense stands of conifers typical of the Western Cascades and includes Douglas fir, mixed with cedar and hemlock. A portion of the lower basin lies within the boundaries of the Baker National Forest, while the upper basin is within the North Cascades National Park. The lower elevations of the Skagit Valley are forested primarily by red alder, cottonwood, and maple. The understory consists primarily of vine maple and other shrubs, vines, and herbs, with salal, huckleberry, trailing blackberry, thimbleberry, boldhip rose, salmonberry, snowberry, broken fern, sword fern, and Oregon grape occuring in the more open areas.

j. Fish Resources. The Baker River drainage includes the Baker River, Lake Shannon, Baker Reservoir, and several tributary streams, which, along with lands within the drainage area, support a wide variety of fish and wildlife. Fish resources of the basin include Dolly Varden, resident rainbow, cutthroat and brook trout, and whitefish and kokanee. Anadromous species include chinook, coho, sockeye, pink and chum salmon, and steelhead and searun cutthroat trout. Rainbow trout, planted in Baker Lake by Puget Power, support a put-and-take

type of fishery. Puget Power, in cooperation with Washington Department of Fisheries, maintains an anadromous fish collection facility at Concrete. During the 1972-1973 collection period, nearly 14,400 salmon were captured, trucked, and released into Baker Lake and adjoining artifical spawning beaches. They consisted of 10,000 sockeye, 4,000 coho, 250 chinook, and 30 chum. In addition, 50 steelhead trout were captured and released. The Washington Department of Fisheries maintains artificial spawning beaches at the mouth of Channel Creek at the upper end of the reservoir. These beaches provide spawning habitat for 3,000 sockeye salmon to make up for the natural spawning lost as a result of construction of Upper Baker Dam. To pass juvenile fish downstream, the Baker project uses a fish attraction barge, which starts operation in March. Puget Power also maintains a trout stocking program to enhance Baker Lake sport fishing.

The waters of the Baker drainage are extremely clean and provide an excellent habitat for fish rearing. Little rock flour from melting glaciers enter the Baker River, since the glaciers feeding it lie on the east side of Mount Baker and receive little direct sunlight during the hot summer months. The spawning habitat provided by the lake, its tributaries, and artifical spawning beaches, contributes to the sport and commercial fisheries of the Pacific Ocean, Puget Sound, and the Skagit River.

k. Wildlife Resources.

The chief big game mammals of the basin are elk, deer, black bear, mountain goat, and cougar. Deer, and occasionally black bear and cougar, occupy the lowlands. Rabbits and snowshoe hare are the common small game mammals, and mink, muskrat, otter, beaver, marten, weasel, skunk, bobcat, fox and coyote are the common furbearers. Numerous other mammals commonly found in the basin include raccoons, porcupines, opossums, squirrels, chipmunks, moles, voles, shrews, mice, and bats.

The chief upland game birds of the basin are blue, ruffed, and spruce, grouse, and band-tailed pigeons. Waterfowl species include mallard, bufflehead, scoup, ruddy, widgeon, ducks; and Canada and snow geese. Numerous species of songbirds, shore birds, and raptors are also present. Some of the more notable raptors are bald and golden eagles, osprey, red-tailed hawks, and great-horned, barn and short-eared owls.

Reptiles and amphibians include western gartersnake, several species of lizards, tailed and northern tree frogs, and several species of salamanders.

1. Recreation. Recreational development around Baker Lake includes two Forest Service campgrounds, a Puget Power campground, and a commercial resort.

Puget Power and the Forest Service estimate that 222,000 people visited the Baker River drainage area during 1972. Although Puget Power's developed campground was not officially open during 1972, it was full of campers nearly every weekend throughout the summer months.

Skagit County is a popular tourist and recreational attraction as well. Along with other counties in northwestern Washington state, it shares the impressive Cascade Mountain Range. Portions of the North Cascades National Park and the Glacier Peak Wilderness area are located in eastern Skagit County, and the principal access is through the Skagit River Valley. Its economic potential has yet to be realized, but the recent completion of the North Cascades Highway, which opened hitherto inaccessible natural attractions, should be a major stimulant to tourist and recreational activity in the county.

In addition, the Skagit River itself, famed for steelhead fishing, and the position of Skagit County as the point of departure by ferry (from Anacortes) to the San Juan Islands make the county important to vacationers. The islands of Skagit County, which include Fidalgo, Guemes, and Cypress, are a part of the San Juan Archipelago. Fidalgo Island, connected by a bridge to the mainland, has experienced considerable recreational development in the past decade with land and marina development at Skyline representing a major investment. The combination of country roads, mild climate and flatland makes the lower valley ideal for bicycling, and that sport is gaining in popularity. In addition to fishermen, canoers and kayakers use the river.

m. Archeological and Historical Resources. There are no nationally recognized historical sites, nor are there known archeological sites [1/] in the vicinity on lands surrounding the project area, however, because of the fact that areas of concern are located immediately adjacent to a waterway which is known to have been the focus of considerable aboriginal activity, gives it a fairly high probability for having archeological sites.

n. Land Use. Land use with associated water requirements in Skagit County changes from sparsely habitated in the area around Baker Lake and associated uplands, to scattered structures in agricultural areas, to moderately intense urbanization on the valley floor. The primary land use is forests, with about

1/ National Register of Historical Places, Federal Register, Tuesday, February 19, 1974, volume 39.

77 percent of the area east of the Swinomish Slough put to this use. Agriculture and land uses occupy 20 percent and 2 percent of the land, respectively.[1/]

In the flood plain area agriculture is the leading economic activity while forest resources are relatively unimportant. Forage production in support of a dairy industry is the largest type of farming. The rich delta area of the Skagit River accounts for 90 percent of the nation's supply of cabbage seed and about 50 percent of of the nation's beet seed, as well as significant amounts of turnip and rutabaga seed. The climate is very mild in the western portion of the county and the land is fertile and highly productive. The bottom lands of the Skagit River plain require ditching and diking due to their close proximity to saltwater. Further up the Skagit River, the land becomes less fertile and the variety of agricultural products grown is limited. Most of the farms are in the fertile Skagit River delta. The number of farms in Skagit County has been decreasing while the average farm size has been increasing.

Although the amount of lands being farmed has decreased, the market value of all agricultural products sold has increased 65 percent from 1959 to 1969. The market value of all agricultural products sold in 1969 was $26 million. Over half of the total value was from livestock, poultry and their products, followed in importance by crops. Vegetable farming has been increasing, due to pressures for greater and more intensive utilization of land, and there has been a diminution in the numbers of animal stock.

When tidal dikes in the delta are breached, the resulting saltwater intrusion reduces productivity of temporarily inundated areas from 1 to 3 years. Existing crops in the flood plain affected by flooding are bulbs, hay, raspberries, strawberries, seed grass, and winter barley. Bulbs contributed to over half of the monetary crop damage caused by past flooding, and in 1969, the market value sold totaled $959,000. Average annual damages of $1,581,000 (1973 prices and conditions), are experienced by agricultural areas within the flood plain.

1/ Data conforms to the Skagit River flood plain and related uplands (east of the Swinomish Slough). Data obtained from: Comprehensive Land Use Planning Alternatives for the Skagit River Flood Plain and Related Uplands, Skagit Regional Planning Council, Mount Vernon, Washington, April 1973.

o. Transportation. The Burlington Northern Railroad system serves Skagit County with a Seattle to Vancouver, B.C. mainline through Mount Vernon and Burlington. Another line crosses western Skagit County with facilities in Sedro Woolley. A branch line services the upper valley. Greyhound Bus Lines have a scheduled system with a bus station in Mount Vernon. Interstate 5 is the principal north-south highway. State highways running east and west afford access to all cities and villages within the county. The construction and design of the highways is semi-adequate for present useage according to the Skagit Region Planning Council. State and private roads allow accesses to the more remote regions.

The majority of aircraft based in this area are light and privately owned. There is no scheduled air traffic. Local air traffic is of a sightseeing and flight instruction nature, and is greatest during the tourist season. Lower and upper valley landing facilities offer near complete air traffic coverage of the valley. Bay View Airport has the greatest potential for future development as a commercial air traffic operation center.

Barge and freight operations are centered in La Conner and at a sparse assortment of individual industrial locations. Accesses to Puget Sound Ferry systems are through Anacortes and Whidbey Island.

3. ENVIRONMENTAL EFFECTS OF THE PROJECT

a. Direct Flooding Impacts. The flooding itself probably caused the greatest damage to the natural environment on the lower Skagit because of a close levee confinement.

The damaged areas at the town of Hamilton, and the four damaged portions between Hamilton and Lyman occurred where the high water flow was either restricted or at a sharp change in direction without adequate floodway area to handle the resulting turbulence.

The floodwater was most destructive where the levee was breached; in some of these cases the water velocity cut a channel from the river through the vegetated bench and beyond into the agricultural area. The washouts resulted in loss of the riparian vegetation, plus that which will be lost during construction necessary to repair the levee.

b. Wildlife Impacts. Wildlife loss will be in direct proportion to the vegetation lost. Primary impacts on vegetation which are obvious result in wildlife impacts.

When any area of vegetation ceases to exist, animals which depend on this area also cease to exist.

The upland game birds, songbirds and others which were displaced by the rising water caused by levee failures will fly to adjacent uplands, causing overcrowding of these species and perhaps some subsequent losses. Small mammals on the flood plain would probably be eliminated by floodwaters. The flooded area was available to waterfowl during high water, and dabbler ducks could feed in the shallower areas. After the levees have been repaired and land placed back into production, some of the upland birds would repopulate the area; however, some of the food crop, consisting of seeds and insects, will have been destroyed.

Vegetation loss deprives wildlife of nesting habitat, cover, food, and perching sites. Many small songbirds nest in blackberry vines, and other brush species; furbearers, small game and upland birds find cover and food. Trees furnish perching and nesting sites for many other birds, including hawks, owls, eagles, and songbirds. Mammals, including bats, rodents and beaver use larger vegetation. Loss of large trees along the river will be harmful. Blackberries and brush can re-establish in a few years, but larger trees will require a much longer time (15 to 30 plus years) to grow.

c. Fish Impacts. Fish entering some of the flooded areas after levee failure were stranded as water receded from the farmlands. Although these fish represented only a small part of the total run, this loss can be significant. The greatest loss to anadromous fish will be the loss of eggs placed in the gravels by spawning fish prior to the flood. This damage will be reflected in reduced runs in subsequent years. Fish will be slightly affected by the removal of some stream size vegetation during the levee repair. This reduces the insect input to the water, makes spawning areas less suitable, increases water temperature slightly, and increases the sediment load by accelerating erosion. Sedimentation will also be increased by field operations which require dumping into moving water and repairs which require dragline operations in the river. Pumping to dewater washout holes and increased erosion from fill will also increase sediment load.

d. Vegetation Impacts. Small losses of upland vegetation will occur at rock quarry and gravel pit sites. This will be incremental damage because all borrow areas are established sites. More serious losses will occur on the benches riverward of the levees and on the levees themselves. Acreage loss in these areas will be small when compared with the total land in the flood plain. However,

areas of upland or riparian vegetation on the flood plain are scarce; therefore, even small losses are undesirable for wildlife. Many levee areas will be cleared of snowberry, blackberry, and other shrubs, and of tall forbs and grasses for access to damaged portions. Some bench areas having stands of tree and shrub species will be lost due to levee repair or riprap placement.

e. Water Quality Impacts. Bank sections with earthfill will undergo more active erosion until after the surface are completely covered by grasses. The bank sections covered by rock blankets will have little erosion following the replacement of the rock.

f. Air Quality Impacts. There may be temporary air pollution associated with burning, chainsaw fumes, and movement of construction vehicles. These short-term and localized impacts are not significant.

g. Other Physical Impacts. Riprapping and bank protection by the Corps, Skagit County, and local landowners have entrenched much of the lower river's present main channels and prevented portions of the river from meandering from its present course. This causes problems by creating higher water during floods because water cannot flood over lowlands as it did prior to diking. If dikes are breached, this causes more stress because water elevation changes occur more rapidly, and water remains in the area for longer periods of time.

h. Archeological and Historic Site Impacts. Restoration of levees and their continual maintenance could result in the destruction of presently unknown cultural resources. Because of the lack of any previous archeological reconnaissance in the immediate project area, as well as the favorable environemntal circumstances for sites being present, it is necessary that a cultural resources reconnaissance be conducted prior to construction, if it can be accomplished without impeding remedial construction activities, to assess the project's archeological potential.

i. Social Impacts. Beneficial short-term social impacts will be created by the levee repairs by placing farmland back into production, until the next periodic flood again breaches the levees.

Some of the residents of the flood plain area are apparently uninformed of the protection level of the levees. In addition, some apparently believe that projects like these are improving the level of protection.

j. Aesthetic Impacts. The repair work on the rock-blanketed levees will change the bankside appearance from a collapsed sandy levee to an undamaged dike with a rock blanket surfacing. The damaged earth levees will be reshaped, in some cases with trees and brush removed so that rebuilding of levee damage can take place. Dikes extending along creek banks at the right angles to the river exemplify this situation.

k. Public Health/Vectors Impact. Flooding inundated many septic tanks, manure piles, and other sources of possible contamination, which increased hazards to all human and animal life encountering the floodwaters afterward. Levee replacement will prevent such occurrences in lesser floods, but perpetuate the danger of public health problems if levees break during larger floods because most sanitary structures are built to operate under nonflood conditions.

l. Transportation. Large vehicular (mainly truck) traffic along the roads being used to convey fill material to construction sites will cause inconvenience and increased traffic hazards to other motorists and pedestrians. Small amounts of granular fill material will accumulate on road surfaces used to access sites. Road wear will temporarily increase in some areas, such as along secondary paved roads used for access to construction areas.

m. Commitment of Resources:

(1) Capital. Money expended on reconstruction will not be available for improvements over existing conditions or other uses.

(2) Manpower. Mandays spent on this effort are lost for all other purposes.

(3) Borrow Material. Earth and rock used in this effort will be lost for other purposes.

(4) Petroleum. Oil products used in this effort will be lost for all other purposes.

(5) River Flood Plain. If the containment structures are successful, natural rechanneling and meandering will be reduced and the river course will become more static.

4. COORDINATION WITH OTHER AGENCIES

All emergency work projects are coordinated with the following agencies:

Washington Department of Fisheries

Washington Department of Ecology