WILLAPA BAY

VOLUME II

CHANGES AND USEAGE IN WILLAPA BAY

PART I Tidelands

PART II Water

PART III Recreation

PART IV Natural Disasters

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INTRODUCTION

The Willapa Estuary is a physical feature of the southwest coast of Washington. It includes Willapa Bay, its wetlands and the lower extent of the larger tributaries which enter the bay. It typically has a mixture of fresh and salt waters which results in a salinity always lower than that of the adjacent ocean but also separable from those of its tributaries. The distribution of these low salinity waters affected by the tides defines the extent of the estuary. Within the estuary a dynamic system of biological, chemical and physical forces interact to produce an environment which is highly productive and economically valuable to man. Through the action of the tide and wind the waters of the estuary mix and exchange with those of the ocean and at the same time the estuary receives fresh waters from its drainage area. Thus the estuary system is directly influenced by a much greater area than its own boundaries. Figure illustrates the extent of the estuary proper, its fresh water drainage area, and the area of ocean exchange with indications of the areas affecting the character of those waters.

The estuary is a resource which provides food, transportation, waste treatment, and recreation. Within limits these benefits are perpetual. Other uses of the estuary are made, which involve either removal of a portion of the estuary for other uses or changes in the character of the areas upon which the estuary is dependent. These later classes of use, which ordinarily are a conversion of the aquatic resource to an upland use, allocate the estuarine function and reduce the resource value as a productive system.

The various elements of the estuary system require a particular range of conditions in order to meet the needs of the system.

The tributaries have a direct effect on the estuary in their flow regime, that is the amount of water flowing into the bay and the time of year that the flow level occurs, and in the quality of the water. Sediments, pollutants and erosional products affect the character of the incoming flow. Some of the productive aspects of the estuary depend on the ability of the tributary streams to support various organisms through portions of their life history, such as the early life of salmon in fresh water. Additional requirements then exist in the tributary proper which eventually reflect in the ability of the estuary to function. Changes in the stream flow, impoundments and channelization, may interupt the stream as an ecological entity for considerable distances below the site of the causal activity. Changes in stream temperature, and

turbidity can limit the oxygen content and the ability of the aquatic plants to photosynthesize. Since leaf litter is a chief source of energy for much of the community that occupies the stream the loss of sources of this detrital material from flood plains affects the productivity of the stream. Upland uses in the area of a tributary may restrict its ability to function and thus allocate this element of the estuary to some other use.

The high marshes of the estuary supply a major portion of the energy for the life in the estuary. They require light, the free flow of tidal waters over and through them and an inflow of fresh water in order to produce this energy. Activities which limit these requirements are allocations of the resource.

Jetties, groins, bridges, dams, bulkheads, dikes, marinas, enclosed piers, etc., alter the currents and interchanges of water within the estuary and between the estuary and its fresh water sources or its exchange with ocean waters. Such changes alter erosional and depositional patterns and the distribution of nutrients producing changes in the estuary system. A structure then is an allocation of the resource.

Effects on the estuary may come from considerable distances away. The incoming tide brings a mixture of the waters including those which flowed from the bay on the previous ebb tide, waters flowing from the Columbia River or Grays Harbor and ocean waters. The character of these waters which reflect activities many miles away also influence the estuary. These effects may limit the use of the estuary and thus act as an allocation of the resource.

Obviously a significant portion of the estuary resources has previously been appropriated. Much of the tidelands have been sold by the state for the purpose of shellfish culture. Fishing regulations allot the amount and means of harvest of fish, crab and clams from the estuary. The placement of outfalls from waste treatment plants, drainage ditches, dumps etc., make use of the esturine capacity by means of permits. The designation of recreation areas, the development of parks and waterfowl hunting areas further allocate the resource. These are direct appropriations of the aquatic resource which take advantage of its capacity to renew the values extracted.

A large proportion of the tidal marshes of the estuary have been diked for pastureland, covered with dredge spoils or have been elevated to provide urban and industrial developments. Many of the tributaries have been altered in their flow by changes in the channel, dams, dikes, road construction, etc. Much of the upland area drained by the tributaries has been stripped of its vegetational cover. All of these activities withdraw portions of the estuary permanently or for very long times with little or

no chance of renewal of the value to the aquatic resource.

The following sections of this report describe in detail the nature of changes in the estuary, their history and geographic locations.

PREFACE

This report has been prepared to provide background information necessary to make decisions in the conservation of the fishery resources of Willapa Bay. A strong historical emphasis is intended in order to supply a perspective for current concerns about the fishery. The intent is to supply a factual basis for evaluating past and future actions related to Willapa Bay and to develop goals for these actions.

The preparation of this report was financially aided through a grant from the Washington State Department of Ecology with funds obtained from the United States Department of Commerce and appropriated for Section 305 and 306 of the Coastal Zone Management Act of 1972 (G-75-025D and G-76-025B and G-77-025B).

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TIDELANDS

Tides

Tidelands are those areas periodically covered by the ebb and flow of the tide. On the west coast of North America the two high tides of each day are of different heights, thus higher and lower high tides. This is also true of the low tides producing higher and lower low tides. These heights vary from day to day in a cyclic manner so that each has its highest and lowest level and a mean. These are commonly abbreviated, for instance; HHHW refers to highest higher high water or LLHW refers to lowest lower high water, etc. The mean of all high tides is referred to as mean high water and the mean of all low tides is referred to as mean low water. Means are computed over extended periods of time when they are to be used in a legalistic sense. The range period is usually 18.6 years. Mean sea level represents the average sea surface level over a 18.6 year period of observations.

At least sixteen tide levels are recognized. Only a few are in general use. For example zero tide level is mean lower low water. Mean sea level is the datum or zero point for upland elevations and in Willapa Bay represents approximately a five foot tide level. In Washington second class tidelands extend from mean high tide (ordinary high tide)down to lowest lower low water (extreme low tide).

A major factor in the environment of the intertidal area is the ebb and flow of the tide. Plants and animals are limited in their distribution vertically by the amount of immersion in salt water which they require or can tolerate. For instance organisms which can not tolerate exposure to the air more than once a day are limited to areas below the lowest higher low tide. This is close to mean lower low water in Willapa Bay. Or organisms which must be exposed to the air at least once every day and must also be covered by the tide once a day are restricted to an area between HLLW (highest lower low water) and LHHW (lowest higher high water). Or organisms which cannot tolerate tidal submergence more than once a day are limited to areas above the HLHW (highest lower high water). The net effect is that the limits of various attached organisms in the intertidal area appear as horizontal bands or zones where exposure to salt water or air is the controlling factor in their distribution. Figure 1 & 2 illustrates the various tide level terms superimposed on a tide curve for a typical summer day in Willapa Bay.

Because of the size and configuration of Willapa Bay tidal effects do not reach all areas at the same time or effect each area to the same degree. Tide levels may vary as much as two feetfrom one area to another. Table 1 indicates the

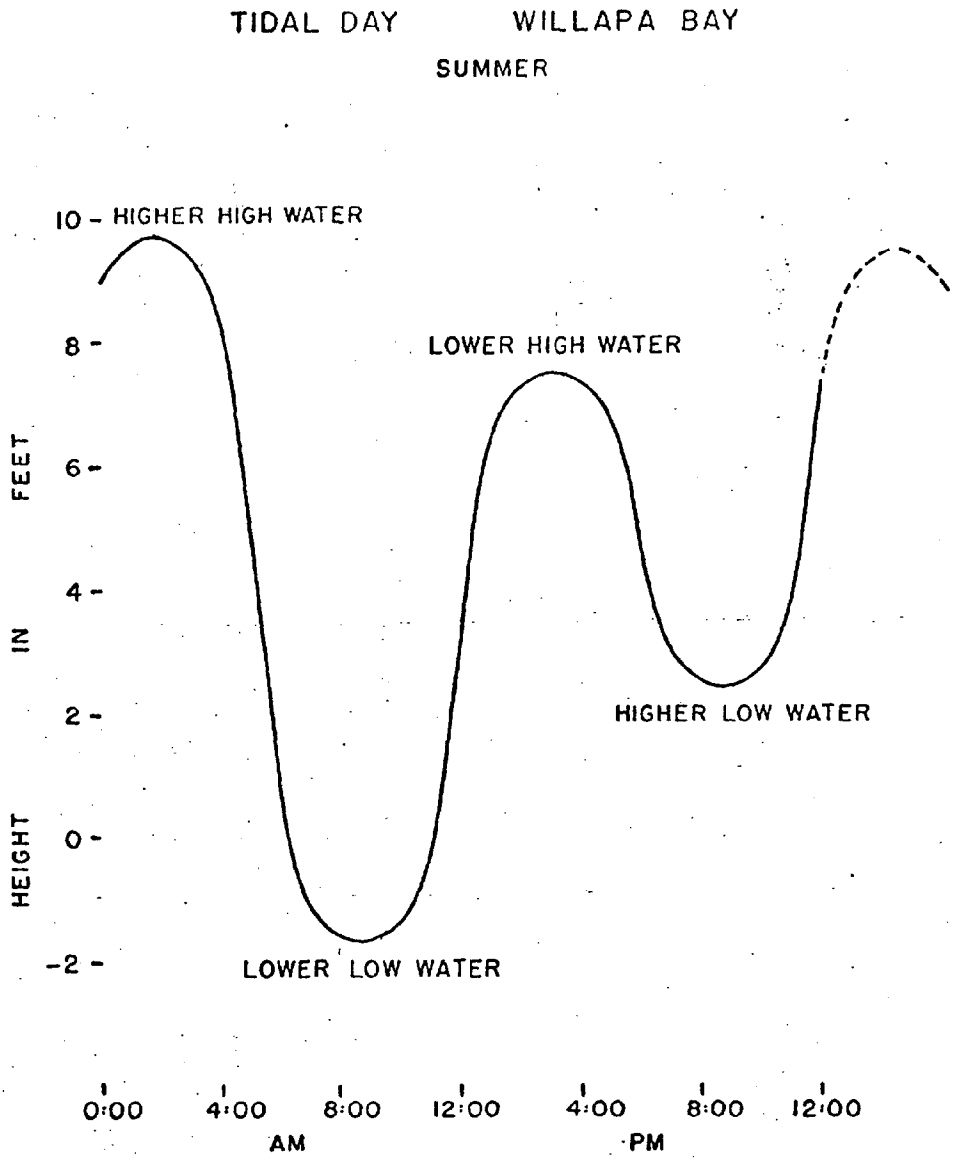
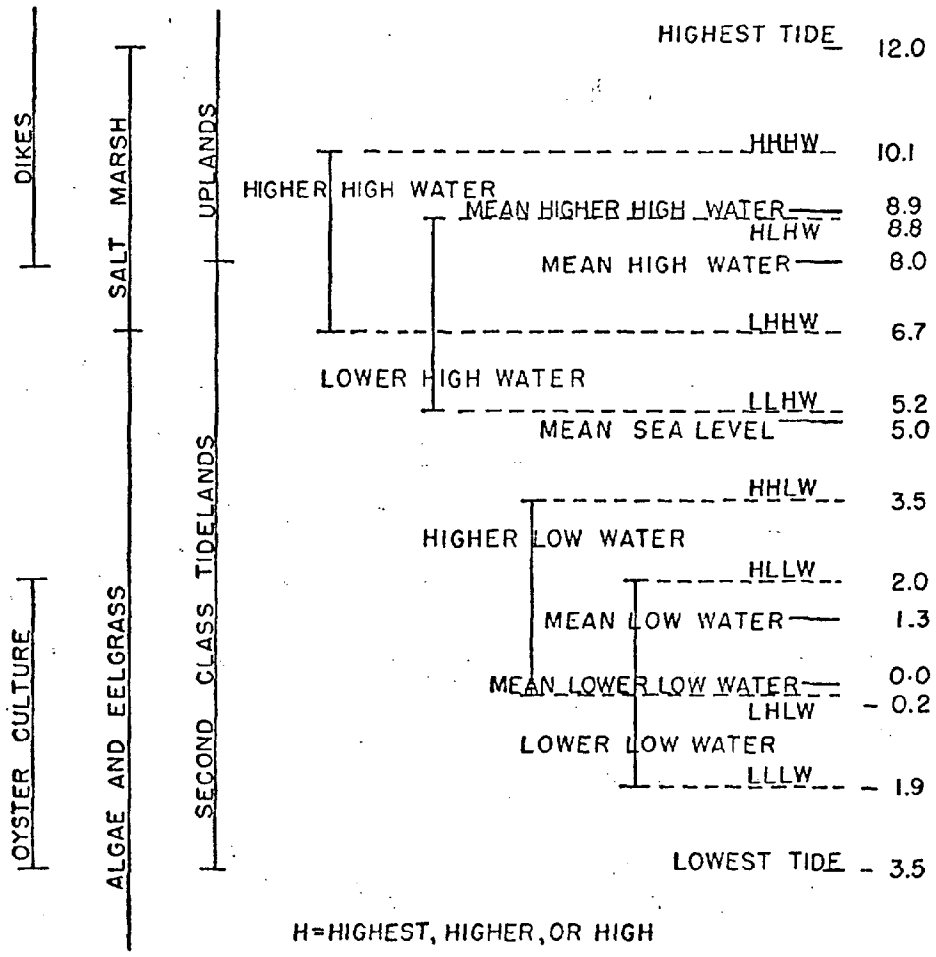

TIDAL DAY WILLAPA BAY
SUMMER
10 - HIGHER HIGH WATER
8 -
6 -
4 -
2 -
0 -
-2 -
HEIGHT IN FEET
LOWER HIGH WATER
HIGHER LOW WATER
LOWER LOW WATER
0:00
4:00
8:00
12:00
4:00
8:00
12:00
AM
PM

Figure 1

COMMON TIDAL TERMS
APPLIED TO
WILLAPA BAY ENTRANCE 1976



H=HIGHEST, HIGHER, OR HIGH

L=LOWEST, LOWER, OR LOW

MEANS AND EXTREMES COMPUTED OVER 18.6 YEAR PERIOD

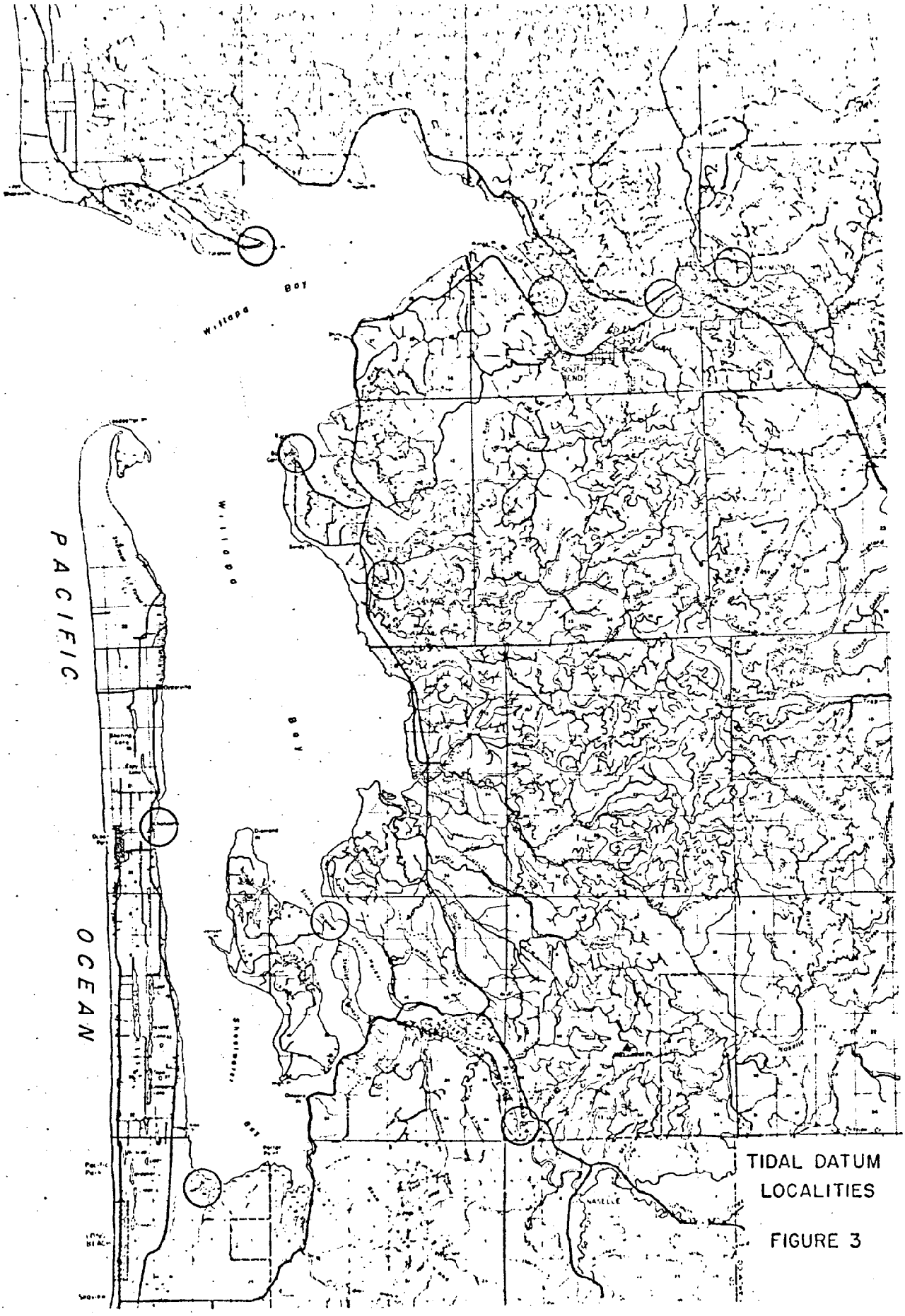
Figure 2

Table 1

TIDAL DATUM PLANES

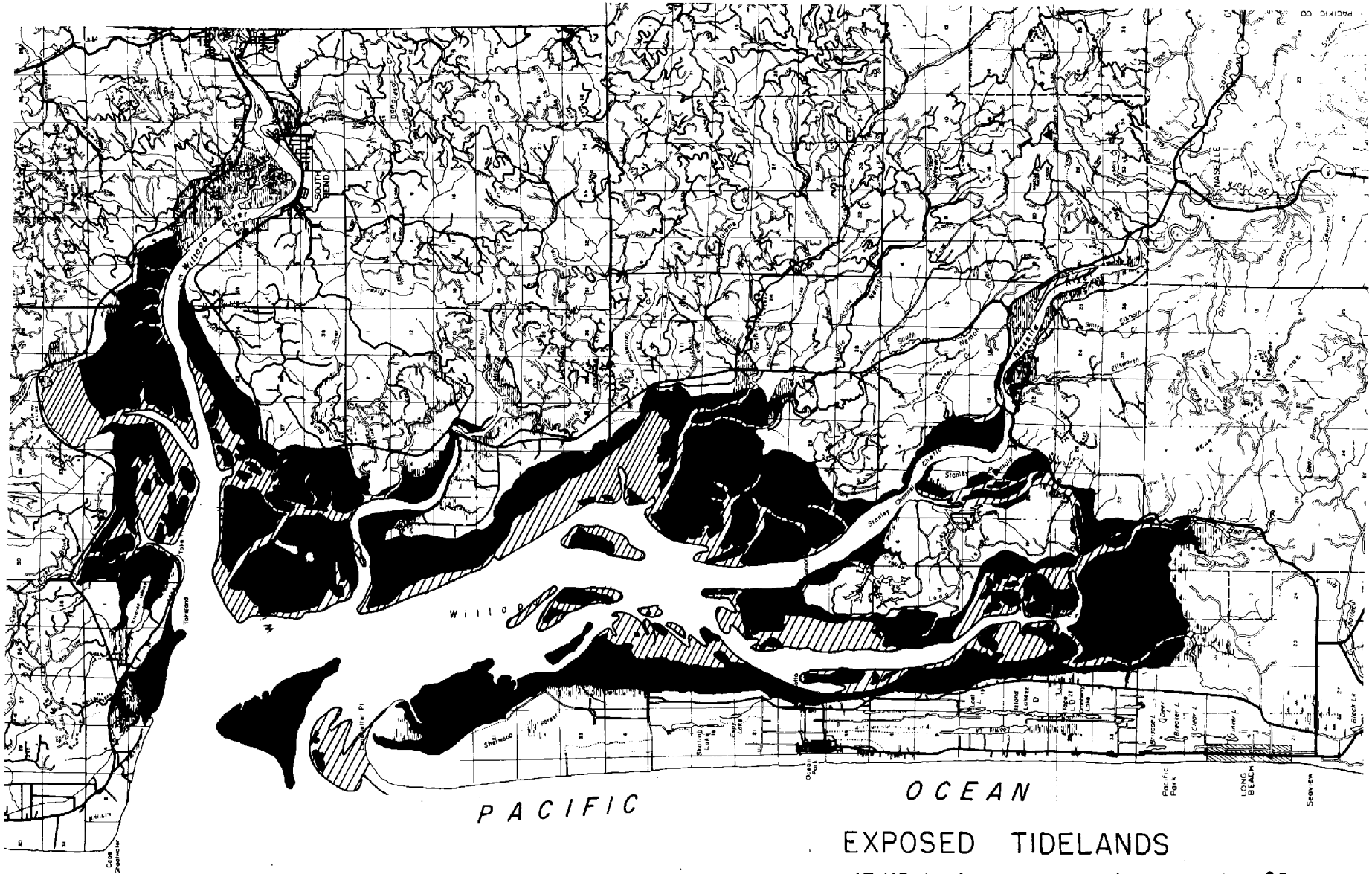
Location	Tokeland		Mailboat Slough		Raymond		Willapa		Bay Center		South Fork Palix		Mahcotta		Sunshine Point		Parpala Ranch		Tarlatt Slough	
Datum	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL	MLLW	MSL
Highest Tide	14.0	-9.78	13.0		15.5	-10.18	15.5		12.5		12.5		13.5	-8.38	14.5		14.5		12.5	
MHHW	8.9	-4.68	9.6		9.9	-4.58	10.3		8.9		9.3		10.2	-5.08	10.2		10.8		9.4	
MHW	8.1	-3.88	8.8		9.2	-3.88	9.6		8.1		8.5		9.4	-4.28	9.4		10.0		8.6	
Mean Half Tide	4.7	-0.48	5.1		5.3	0.02	5.5		4.7		4.9		5.4	-0.28	5.4		5.65		4.65	
Mean Sea Level	4.22	0.00		0.00	5.32	0.00		0.00		0.00		0.00	5.12	0.00		0.00		0.00		0.00
Mean Low Water	1.30	2.92	1.4		1.4	3.92	1.4		1.3		1.3		1.4	3.72	1.4		1.3		0.7	
Mean Lower Low Water	0.00	4.22	0.00		0.00	5.32	0.00		0.00		0.00		0.00	5.12	0.00		0.00		0.00	
Lowest Tide	-4.0	8.22	-3.5		-3.8	9.12	-3.5		-3.5		-3.5		-3.5	8.62	-3.5		-3.5		-3.5	
C.T.Datum	-0.21	4.43			-0.74	6.86														

MLLW Elevation referred to MLLW
MSL Constant to convert MSL elevation to datum shown
USGS Maps -Shoreline =Mean High Water
Ordinary High Water = Mean High Water
Shoreline Designations , MHHW = Ordinary High Water (Shorelines Management Act)



TIDAL DATUM LOCALITIES

FIGURE 3



EXPOSED TIDELANDS

AT MEAN LOWER LOW TIDE (ZERO TIDE)

WATER DEPTH LESS THAN 6 FEET AT MLLW

FIGURE 4

nature of the differences at ten sites in Willapa Bay and figure 3 illustrates the location of those sites. In addition the predicted tide levels differ from the observed levels on a short term basis because of the effects of run-off during and after heavy rains and the effects of wind on the tide during storms. Features of the bay which reflect tidal action occur at slightly different elevations in different areas of the bay because of the variations in the tide from place to place.

Tidal Wetlands

A significant feature of the tidelands are the marshes. In Willapa Bay they begin at about mean high tide level and extend to the highest areas affected by the tide. The plants of the marshes are a wide variety of salt dependent and salt tolerant forms. Those lower portions of the marsh which are covered by the tidal waters at least once, most days, characteristically have stands of pickleweed (Salicornia), worts (Glaux), arrowgrass (Triglochin) and rushes (Juncus). Intermixed withthe upper range of these forms and higher are the tideland greens (Plantago) and some true grasses. Still higher the marsh is characterized by almost pure stands of grass. All of these plants put on foliage from spring into summer and die back in the fall. The dead foliage reduces to detrital fragments whcih form part of the nutrient base for the bay. The cover provided by the plants and their root systems creates the habitat for a wide variety of organisms, many of which convert detrital material and natural wastes into useful inorganic or simplified organic compounds.

The marshes occupy the flood plain areas in the estuary and in this capacity can absorb large volumes of water over their surface during storm run off periods. The attached foliage acts as a filter and traps silt from the waters which pass over the marsh. In this way the marshes, which are primarily located on the tributaries to the bay, reduce the amount of sediment entering the bay to be deposited there. They also slow run-off flow to the bay and thus limit the effects of run-off on the hydrologic regime of the bay.

The salt marshes are essentially large mats of vegetation which convertsolar energy to food, convert natural wastes to a usable form and act as shock absorbers and filters during periods of high run-off. They have both an important role biologically andphysically in the food chain, hydrology and sedimentation of the bay.

Reduction of Wetland Area

Early settlers in the area found the tideland grasses to provide good summer pasturage. Low hand dikes were erected to hold off the summer high tides and to protect farm buildings. Higher dikes which could withstand winter high tides and allow drainage and improvement of pasture areas were constructed by some individual land owners but the diking district provided the basis for highdikes in most areas. Legislation provided diking districts with considerable power and the opportunity to spread the first cost of construction over a number of properties. (S.L. '95) Powers granted diking districts included: the right of eminent domain within the district boundaries; the right to straighten, widen, deepen, and improve rivers, watercourses or streams withinthe boundaries of the district and acquire the right-of-way to do so; the right to acquire the State's rights to wetlands and tidelands within the district boundaries; and the right to contract work and to issue bonds to cover costs of construction and acquisition of land. Five diking districts were formed along the borders of Willapa Bay. District No. 2 was established in 1912 on the Bay Center Peninsula, District No. 3 was formed at the same time in the Stuart's Slough area. District No. 4 was formed in 1919 along the Naselle River, and District No. 5 was established in 1920 along the north side of the Willapa River. These districts were all formed to protect and develop agricultural land. District No. 6 was established in 1950 on the Bone River but the dike constructed failed and has not been replaced. The bulk of the 3500 acres of former wetland now existing as diked pastureland was developed by means of the diking district.

Construction of roads around the borders of the bay required raising of the grade above highest tide level and effectively blocked off 330 acres of wetland from tidal exchange. Some of this land has been used as unimproved pasture but most has never been put to any higher use.

The early development of towns and industry on Willapa Bay extended over wetlands by the use of piling. This reflected the early dependence of the area on the bay as a transportation system and the lack of large areas of level land above the highest tide and flood levels. As industry and the population increased, wetlands were filled to provide more area and to provide support for structures previously on piling. A largeportion of the City of South Bend and the area occupied by its early industry was developed in this manner. Nearly all of the City of Raymond and its industry was developed over wetlands. About 650 acres of wetland now provides the land area for urban and industrial facilities.

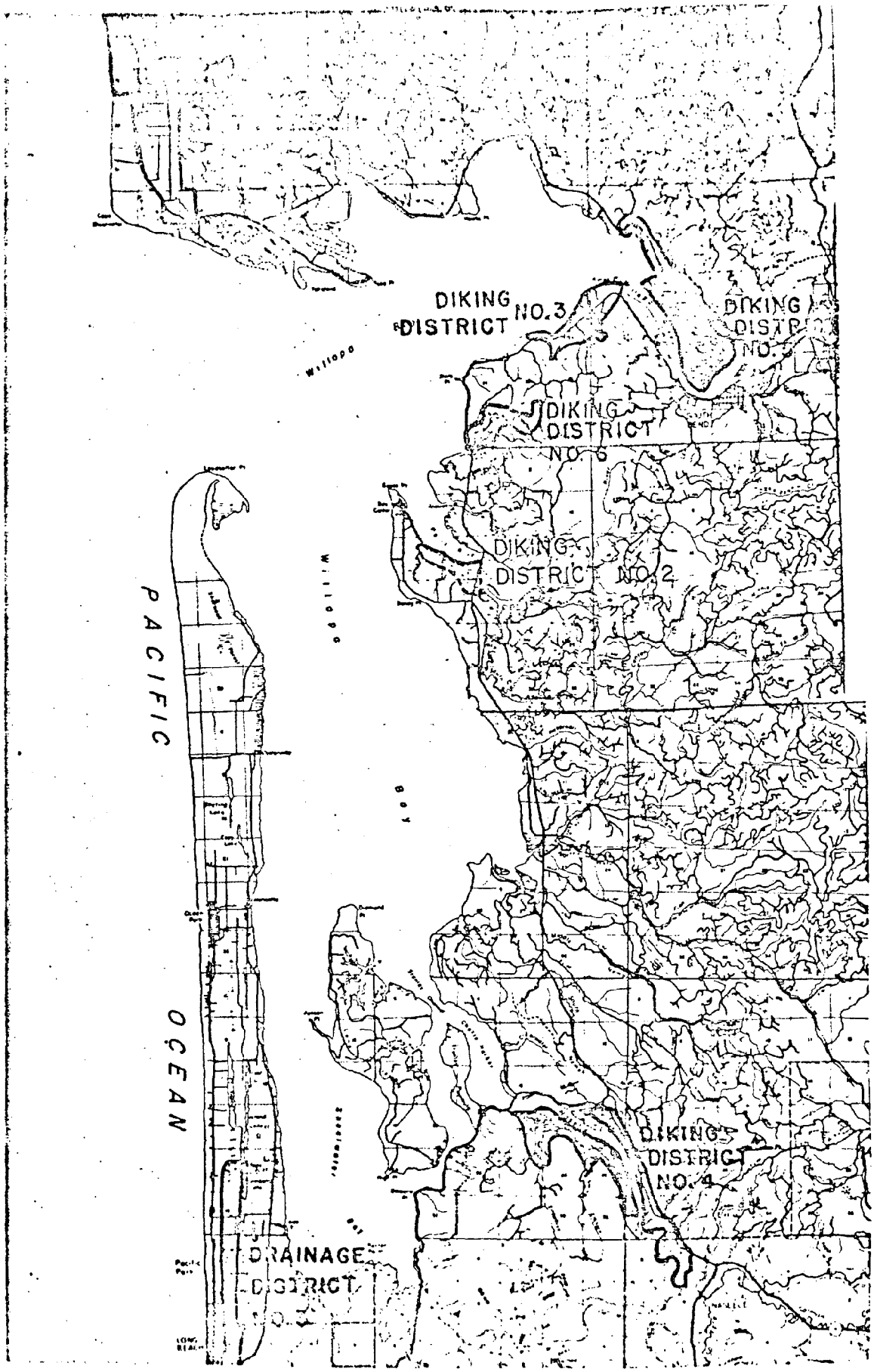

DIKING DISTRICT NO. 3
DIKING DISTRICT NO. 6
DIKING DISTRICT NO. 2
DIKING DISTRICT NO. 4
DRAINAGE DISTRICT
PACIFIC OCEAN

Figure 5

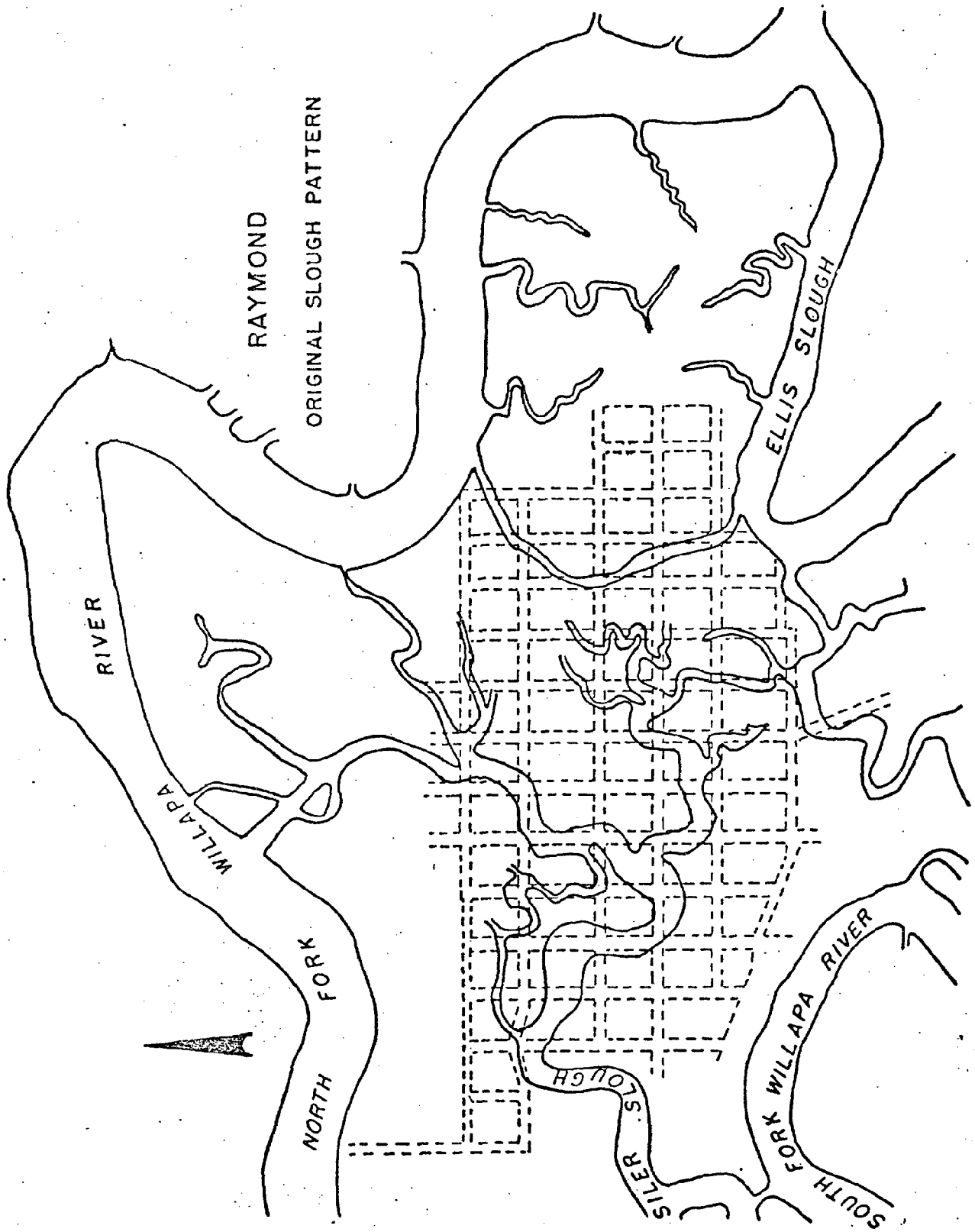
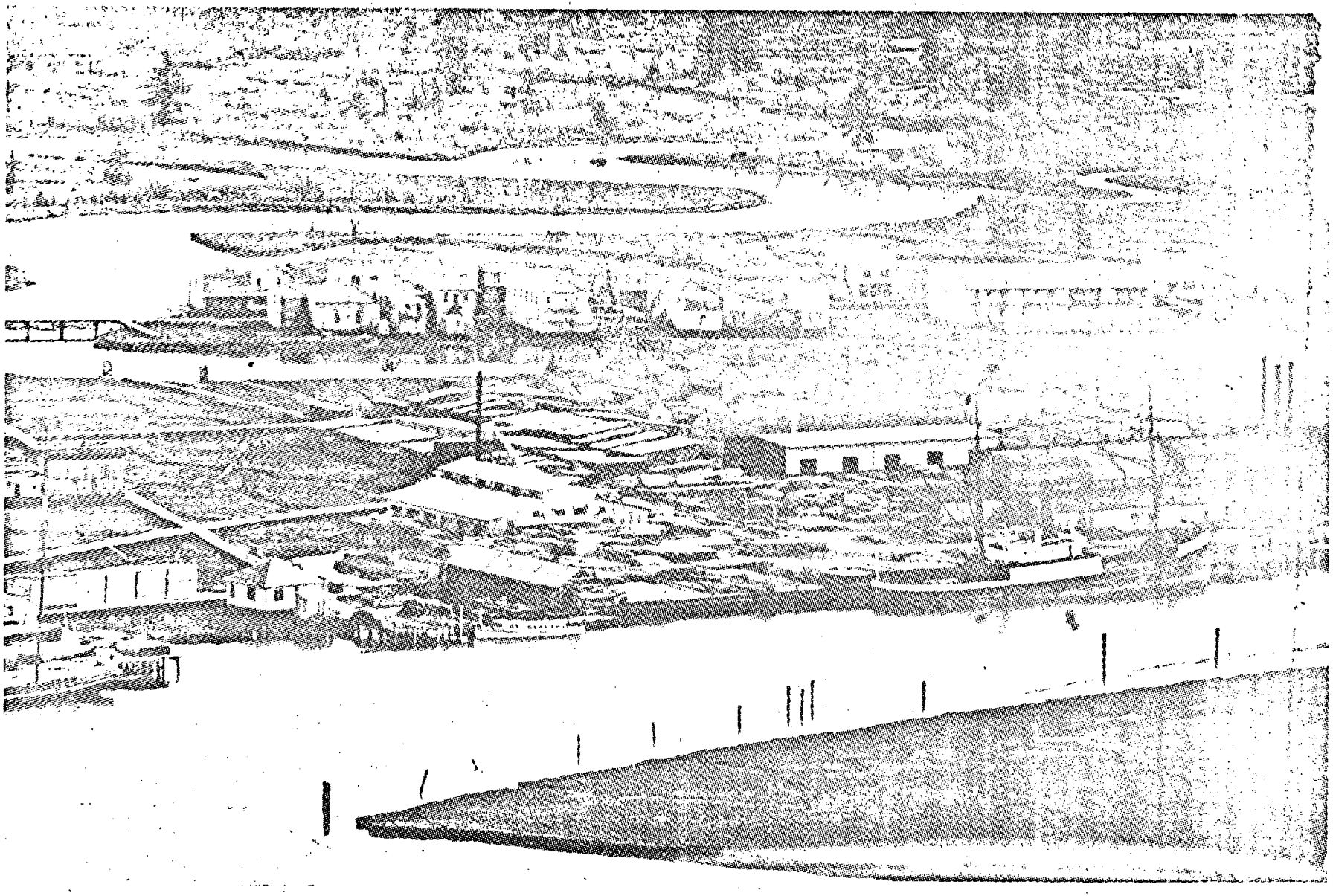
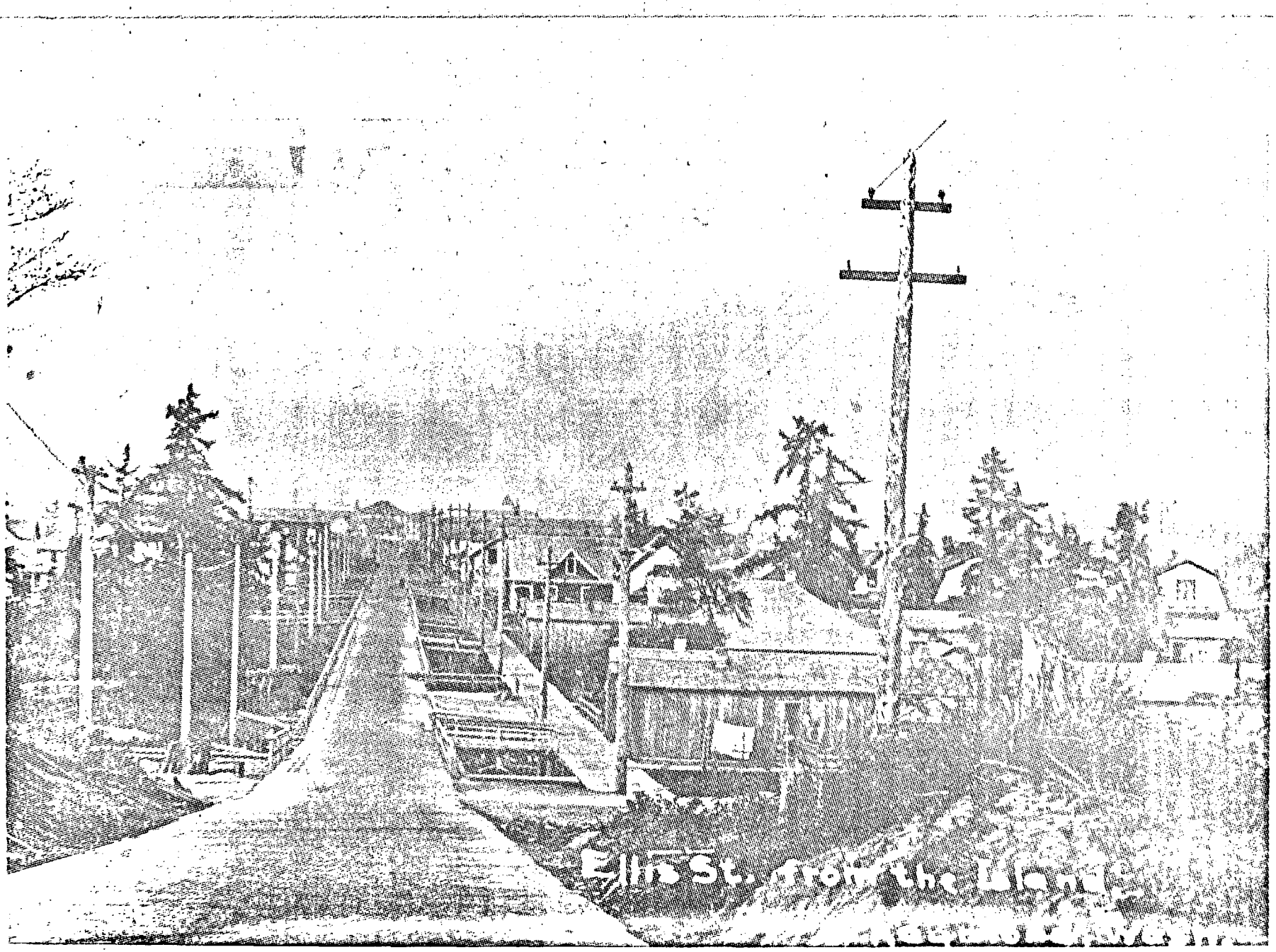

RAYMOND
ORIGINAL SLOUGH PATTERN
ELLIS SLOUGH
RIVER
WILLAPA
NORTH FORK
SILER SLOUGH
SOUTH FORK WILLAPA RIVER

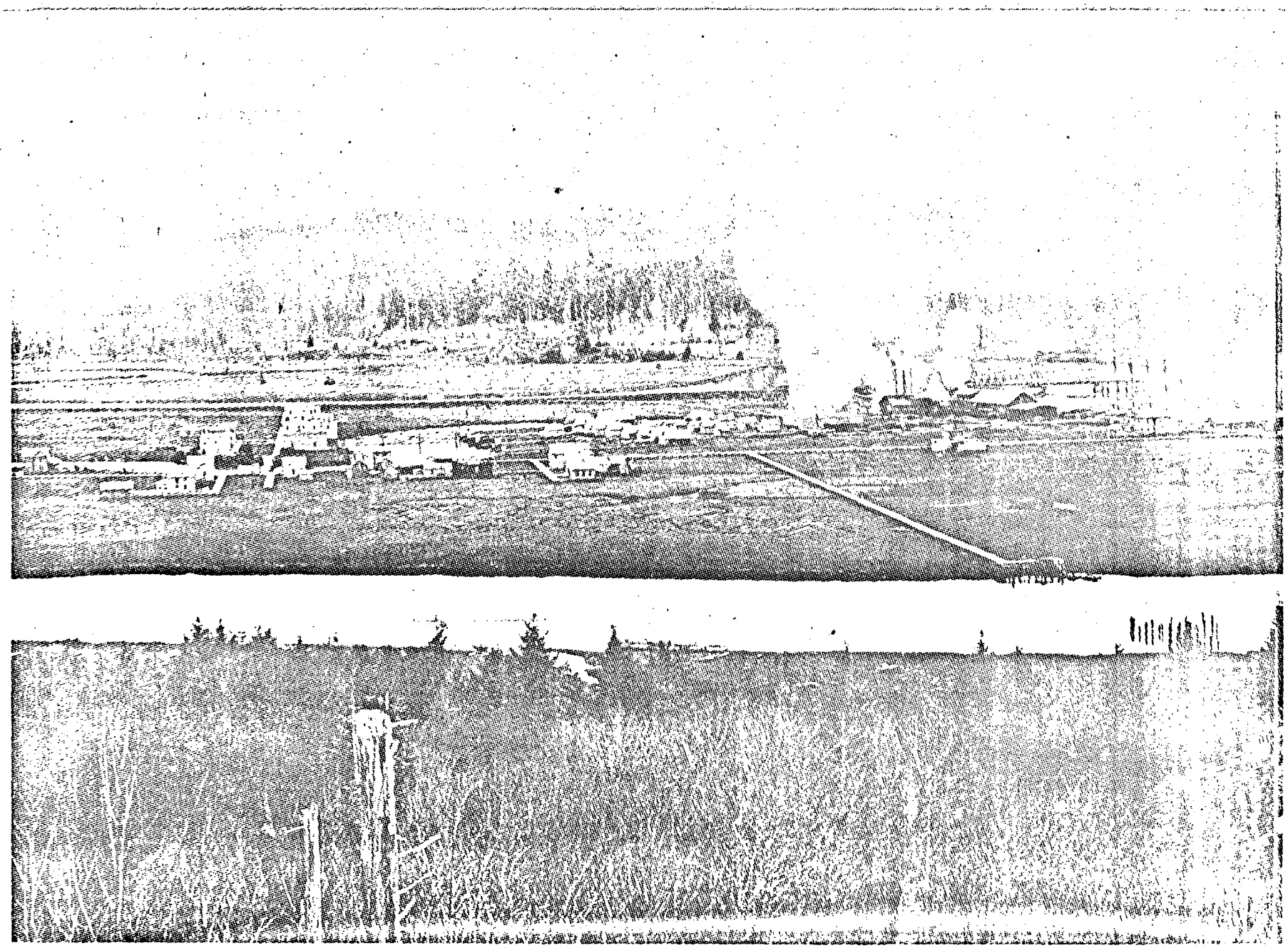
Figure 6



Raymond viewed from Northwest about 1910. Buildings are along First street. Intersection with Commercial street is at far right. Siler Slough winds around the business district.



Raymond looking west down Ellis Street showing the roads and walks supported by piling. Date is late 1920's or 1930's.



Raymond viewed from the North about 1910. Intersection in left center of the picture is First and Ellis Streets

The material needed to fill wetland areas was acquired by dredging in the tributaries of Willapa Bay. The purpose of some of the dredging was to supply the fill materials while some was a combination of the purposes of navigational improvements and development of urban and industrial sites. Later dredging was solely for the purpose of channel deepening and alignment changes. The spoils from this dredging, no longer needed for site development, were deposited on wetlands diked for this purpose. Over 800 acres of wetland have been covered by dredge spoils beyond that currently occupied by urban or industrial development.

Willapa Bay serves as an important stop over and breeding ground for many waterfowl. Federal and State game management agencies have in the past felt that the development of domestic grains rather than a dependence on those of native wetland grasses would provide the best food source for waterfowl. To rear these upland grasses 570 acres of wetland were diked and drained and thus removed from the estuary system.

Early removal of wetlands from the estuary system was largely for the purposes of the development of farmland, and to a lesser extent for urban and industrial sites. Later removal of wetlands has been for game management and spoils disposal from navigational improvement and maintenance programs.

Table 2 is an inventory of the wetlands of Willapa Bay indicating by area the proportion of wetlands removed for all purposes. Table 3 indicates the current use of the wetlands removed from the estuary system by acreage and proportion of the total removed. Table 4 breaks wetland removal into ten year periods by specific area. Figure 10 illustrates the rate of removal of wetlands as percentages of the total removed to date in ten year periods.

Maps (Figs. 11, 12 & 13) illustrate the original wetland area of the bay and that portion now removed from the estuary system. The maps also illustrate the degree of channel confinement which has resulted in the Willapa and Naselle Rivers and as a corallery the reduction of the capacity of these areas to absorb flood waters due to the elimination of flood plain.

The removal of tidal marshes reduces the productive capacity of the bay. Sediments loosened by upland land practices are carried out into the bay because of the lost floodplain and filtering capabilities of the tidal marshes. The diking and filling of tidal marshes has thus had a serious effect on the bay and undoubtably is a major factor in the decline of the oyster industry.

Table 2

WETLAND[1] INVENTORY OF WILLAPA BAY

Area	Diked [2]	Undiked	Total	% Removed
North Cove		375	375	0
Kindred Slough-Cedar River	519	510	1029	50
North River	420	245	665	63
Lower Willapa	888	300	1188	75
South Bend	1630	18	1648	99
Raymond	438	915	1353	32
Porter Point	691	640	1331	52
Naselle River	532	643	1175	45
Nemah River	158	405	563	28
Palix River	548	575	1123	49
Niawiakum River		295	295	0
Wilson Point	42	8	50	84
Bone River		208	208	0
N. Stony Point		8	8	0
Long Island	143	318	461	31
Stanley Peninsula	40	10	50	80
Long Island Slough		32	32	0
Long Beach Peninsula	128	787	915	14
Totals	6177	6292	12469	50

1. Wetlands referred to here are areas between mean high and highest high tide levels.
2. Diked includes; Dikes, undiked fill, road grades and other structures which effectively remove wetlands from the estuary system.

Table 3

CURRENT USE OF WETLANDS
REMOVED FROM THE ESTUARY SYSTEM

	Acreage	% Total Removed
Unused	565	9%
Dredge Spoils	820	13%
Pasture	3579	58%
Game Management	572	9%
Urban Development	454	7%
Industrial Development	192	3%

Table 4

HISTORY OF REMOVAL OF WETLANDS FROM THE ESTUARY SYSTEM

Area	1906-15	1916-25	1926-35	1936-45	1946-55	1956-65	1966-75
Palix River	457			13	52	26	
Nemah River	107				51		
Lower Willapa	627	161		21		28	51
South Bend	621	901				82	26
Raymond	33	128	70	3	56	46	102
South Bay				101		590	
Peninsula						128	
Naselle River		501		31			
Wilson Point		32				10	
North River					415	5	
Kindred Slough				510		9	
Long Island		40	143				
Totals	1845	1763	213	679	574	924	179
Cumulative total	1845	3608	3821	4500	5074	5998	6177
Cumulative Percent of total available	15	29	31	36	41	48	50

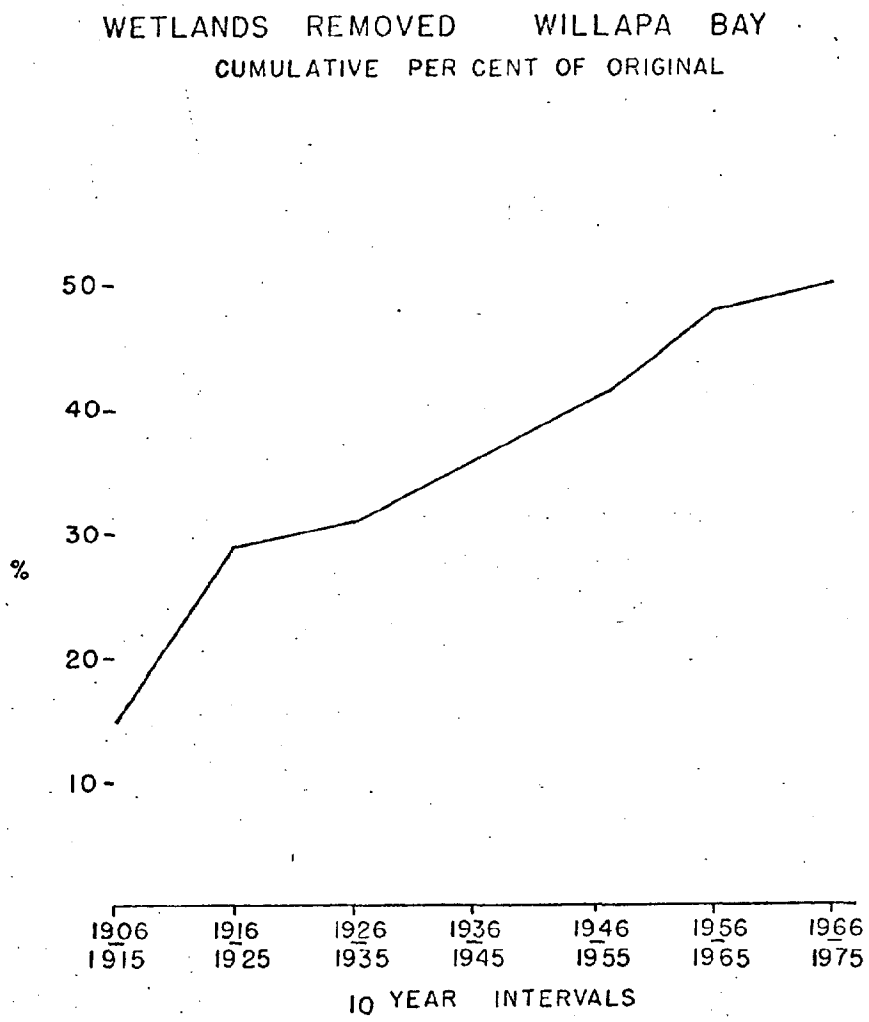

WETLANDS REMOVED WILLAPA BAY
CUMULATIVE PER CENT OF ORIGINAL
50-
40-
30-
%
20-
10-
1906 1915
1916 1925
1926 1935
1936 1945
1946 1955
1956 1965
1966 1975
10 YEAR INTERVALS

Figure 10

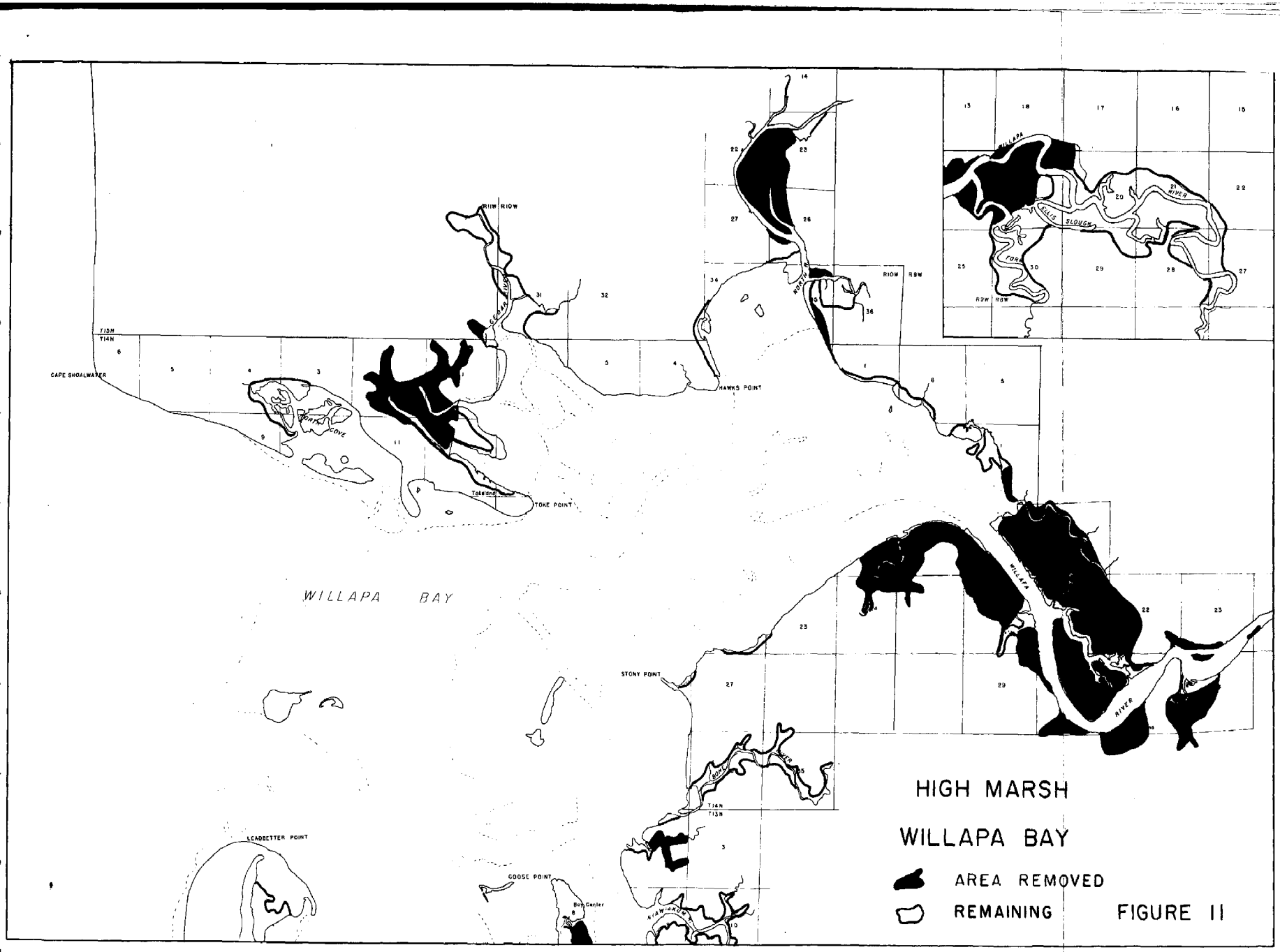

WILLAPA BAY
CAPE SHOALWATER
TOKE POINT
HAWKS POINT
STONY POINT
LEADBETTER POINT
GOOSE POINT
R11W R10W
R9W R8W
T15N
T14N
T13N
T12N
HIGH MARSH
WILLAPA BAY
AREA REMOVED
REMAINING

FIGURE 11

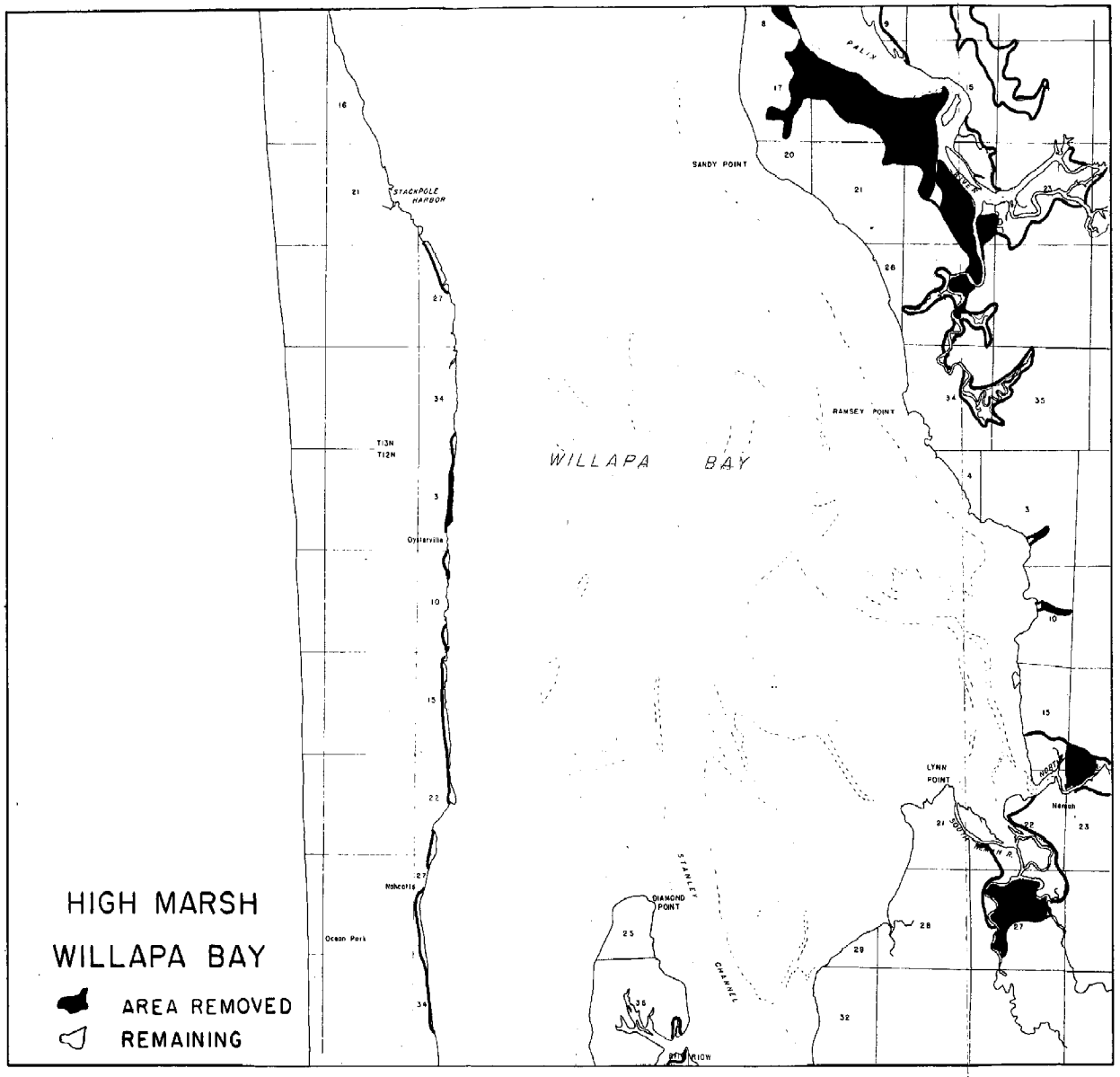

HIGH MARSH
WILLAPA BAY
AREA REMOVED
REMAINING
WILLAPA BAY
STACKPOLE HARBOR
SANDY POINT
RAMSEY POINT
LYNN POINT
DIAMOND POINT
STANLEY CHANNEL
T13N
T12N
Oysterville
Nahcotta
Ocean Park
Nemah
PALIX
SOUTH

FIGURE 12

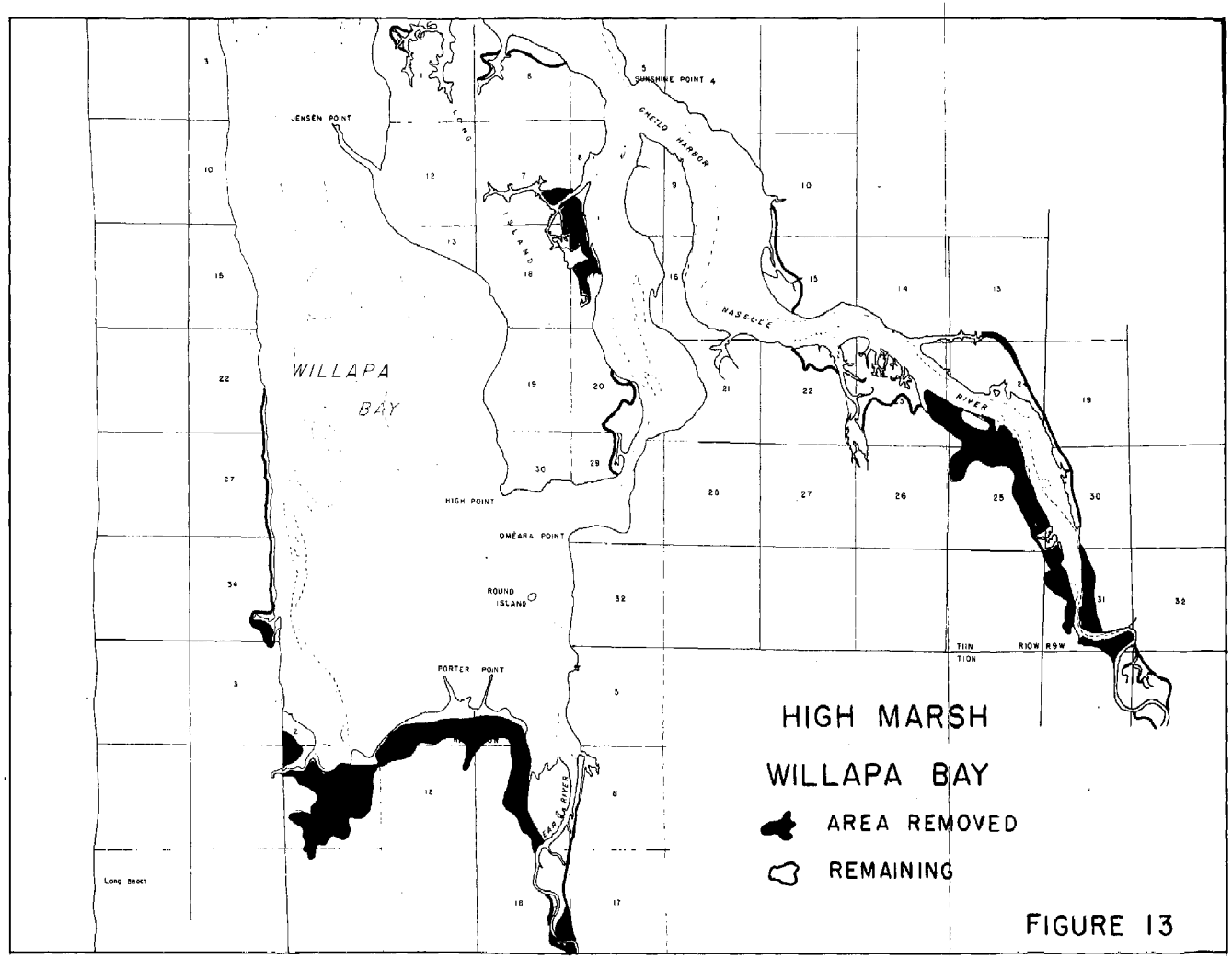

WILLAPA
BAY
JENSEN POINT
SUNSHINE POINT
CHEETO HARBOR
NASELLE
NASELLE RIVER
HIGH POINT
OMEARA POINT
ROUND ISLAND
PORTER POINT
Long Beach
T11N T10N
R10W R9W
HIGH MARSH
WILLAPA BAY
AREA REMOVED
REMAINING

FIGURE 13

The protection of tidal wetlands would appear to be of the highest priority in any effort to maintain a strong commercial fishery in Willapa Bay.

The economic benefits derived from tidal wetlands are directly related to the free ebb and flow of the tide over these lands and the functioning of the processes dependent on these conditions which are inherent aspects of the estuary system. The economic value is indirect in that the benefits of the tidal wetland are not harvested or incurred on the site of their origin. This is a natural process which is basic to the broad value of the estuary as a food production system. This is a case where the natural state of the land provides the highest and best use of that land. Removal of tidal wetlands from the estuary system consist of a change of use and deprives the public of the benefits realized and expected from these wetlands.

Past practice has been to view tidal wetlands in terms of upland values. As a result they have been regarded as wasteland. Improvements have been considered to be anything that allowed the wetland to be put to upland use. However general awareness of the values of wetlands in their unaltered state has resulted in the development of policies and laws to protect them.

A certain amount of protection is intended in the following ordinances and laws:

Pacific County Zoning Ordinance #41

Tidal wetlands are included in the Aquaculture use district in zoning ordinance #41. The maps indicate the upper limit of Aquaculture use districts to be the highest annual tide. However maps have been approved for only townships eleven through fifteen in range ten under the ordinance. Thus only the eastside of Willapa Bay from Round Island (Baby Island) in the south to the North River flats is covered by the aquaculture use regulations. These regulations are reproduced on page 18 . Conditional uses allow diking and filling andother destructive modifications of the tidal marshes. A public hearing is required to make a conditional use.

Pacific County Shorelines Master Program

Tidal wetlands are defined in the shorelines master program in Section 2.49 as "those tidal marshes, tidal mudflats and other tidelands which are inundated by the normal extreme high tide (High Water Elevation) as defined in official tide tables.

Nearly all of the tidelands below MHHW in the bay itself are included in the conservancy environment. Much of the adjacent shoreline is also in the conservancy environment. Uses which are permitted under the shorelines master program in areas of conservancy environment are as follows;

5.40 6.40 Agricultural and aquacultural uses are permitted on conservancy shorelines provided that they do not involve major construction of other activities which substantially change the character of the environment. It should be noted however that under policies in agricultural uses it states that "The creation of additional agricultural lands by diking and filling of tidelands and tidal marshes shall be controlled by the permit system." and under aquaculture policy "its the policy of this program to give a high priority to aquaculture whenever other uses come into conflict with or threaten it".

7.40 Timber harvesting and any tree-felling, vegetation-removing, road building or other forest management operation is permitted anywhere on conservancy shorelines. Only notification is required. Forest management regulations apply. Culvert installation requirements apply only to streams used by andromous fish. There are no limitations on placement of grade on tidelands. There is no protection of tidal marshes in this section.

8.40 Commercial uses are prohibited on conservancy shorelines except low intensity recreational development or activities which do not substantially change the character of the environment. Permit is required.

10.40 Mining operations which do not substantially change the character of the environment are permitted on conservancy shorelines. Permits are required.

11.40 Marinas shall be prohibited on conservancy shorelines.

12.40 Multifamily and single family residences are permitted on conservancy shorelines. No residential structure shall be closer than 100 feet from ordinary high water which is MHHW in the master program. No parking facilities permitted shoreward of upland side of a residential structure.

13.40 Public roads and bridges are permitted. Permit required. Filling of tidelands or tidal marshes for road right of way permitted on conservancy shorelines.

14.40 Utility systems are permitted on conservancy shorelines.

15.50 Deep-draft ports or water-related industries other than those covered in other sections shall be prohibited on conservancy shorelines

15.41 Log storage is permitted on conservancy shorelines

16.40 Shoreline works and structures such as bulkheads, breakwaters, jetties groins, piers and dikes are permitted on conservancy shorelines where they do notsubstantially change the character of that environment and where they are a necessary part of a project which is clearly dependent on a location near or adjacent to a body of water.

17.40 Dredging operations or landfills shall be prohibited on conservancy shorelines except where they do not substantially change the character of the environment and where they are a necessary adjunct to a project which is clearly dependent on a location near or adjacent to a body of water.

18.10 Solid waste disposal sites are prohibited on conservancy shorelines.

20.40 Low intensity recreation uses are permitted on a conservancy shoreline if they do not change the character of the bcal environment.

22.14 Soil absorption systems (drain fields) shall be prohibited on conservancy shorelines closer than 100 feet from ordinary high water (MHHW this ordinance). Setbacks greater than 100 feet may be required in order to adequately protect water supplies or waters used for producing shellfish or seafoods.

Tidal wetlands which occur along the Willapa River and several smaller areas adjacent to Willapa Bay are classed as urban or ruralshorelines. No specific protection is offorded in these areas for tidelands

One of the goals of the shoreline master program is stated to be; (3.70.01) Substantial effort must be made to preserve and/or restore areas of unusual natural productivity, such as shallow waters, tidelands, marshes and swamps.

Section 404 PL 92-500

Under section 404 of public law 92-500 the Corps of Engineers requires a permit for dikes, any impoundment structure, causeways or road fills, riprap, groins, seawalls, breakwaters and bulkheads, and fills.

The most severe environmental impact covered by the guidelines (sec. 404), from a national perspective, is the degradation of aquatic resources by filling operations in wetlands. The guidelines state--"the guiding principle should be that destruction of highly productive wetlands may represent an irreverseable loss of a valuable aquatic resource."

The district Engineer determines if there should be a public hearing on a permit application.

SECTION 8

AQUACULTURE USE DISTRICT (AQ)

8.01 INTENT: The purpose of this District is to assure continued development of the County's marine resources for food production and regulated outdoor recreational experiences.

8.02 PERMITTED USES:

.01) Marine-life raising or production area, including all fish/shellfish culture, and activities incidental to said aquacultural practices.

.02) Marine research and laboratory facilities, provided that said research and laboratory facilities are used exclusively for activities related to marine-life farming or enhancement.

.03) Wildlife or marine-life sanctuary or preserve, including recreational activities compatible with said use, such as regulated fishing, clam digging, hunting, boating, hiking, and tent camping.

.04) Pasturing of livestock, provided that no change is made in the natural characteristics or existing vegetation of the area used for pasture.

8.03 CONDITIONAL USES:

.01) Exploratory drilling for natural mineral resources.

.02) All park and recreational developments not specified.

.03) Public boat launches.

.04) Dredge spoils disposal. Diking and/or filling.

.05) Open construction docks, such as pilings or similar construction, where not in conflict with navigation.

8.04 PROHIBITED USES:

.01) All industrial uses not specified.

.02) All commercial uses not specified.

.03) All residential uses not specified, including trailer parks and house boat communities

.04) Woodwaste fills.

.05) All public facilities not specified.

8.05 GENERAL PROVISIONS: The provisions of this Chapter shall apply provided that the right of navigation and corollary rights incidental thereto shall not be impaired.

SECTION 24 - TIDAL WETLANDS OF WILLAPA BAY

POLICIES

24.01 The protection of existing tidal wetlands, as defined in provision 2.49, from developments or uses which would change their natural character is thought to be essential to maintaining the marine productivity of the Willapa Bay estuary and neighboring ocean waters. Such protection is thought to be necessary for a healthy economy in Pacific County through the maintenance and growth of a thriving seafood industry as well as for providing other benefits, such as food, recreation, commerce, protection of wildlife, and esthetic values, to the public at large.

24.02 The protection of existing tidal wetlands, while providing the public benefits described in provision 24.01, may under some circumstances limit uses of the wetland which would provide a greater return to the landowner. Also, variations in the elevation, vegetation, location and other natural characteristics of tidal wetlands may result in variations in their value relative to providing those public benefits. Therefore, there should be a balancing of the relative benefits and costs to the public and the landowner of modifying tidal wetlands.

24.03 The public, private and environmental considerations given in provisions 24.01 and 24.02 cannot be resolved for the Willapa Bay estuary on the basis of existing information. Study of the relevant biological, physical, economic and social factors should be carried out prior to establishing permanent policies and regulations relating to permitted uses of tidal wetlands. While these studies are being made, it is necessary to protect the existing character of the tidal wetlands so that a decision can be made in the future on how they should best be used. The study period would also allow public action to be taken to acquire property rights in tidal wetland areas using federal monies, such as those appropriated for acquiring estuarine sanctuaries under Section 312 of the Coastal Zone Management Act of 1972, and state monies as they become available

24.04 In view of provisions 24.01, 24.02 and 24.03, there should be a moratorium on diking and/or filling of tidal wetlands for a period long enough to allow the policies of those provisions carried out.

REGULATIONS

24.20 There shall be a moratorium until July 1, 1976, on all diking and/or filling of undiked tidal wetlands which have not previously been used as disposal areas for dredge spoils.

24.21 By the end of the moratorium period, this section shall be amended or completely replaced by action of the BOARD and approval of the Department of Ecology according to the procedures prescribed in the Act and in light of the circumstances existing at that time.

Evaluation of existing protection of wetlands

Tidal wetlands have been removed from the estuary system in the past by diking and filling to "create agricultural land", diking and disposal of dredge spoils, deposition of dredge spoils, placement of grades for roads and various other shorelines structures. One of the basic intents of the Shorelines management legislation was to protect wetlands through recognition of their value as an aquatic resource. The Pacific County Shorelines Master Program reflects this intent in a number of policy statements which occur throughout the program. However every practice which has in the past been the means of destruction of tidal wetlands in Willapa Bay is still allowed under the Pacific County Shorelines Master Program in the designated areas where these wetlands occur. All apparent prohibitions are qualified with the phrase "except where they do not substantially change the character of the environment". Since the terms of this disclaimer are not defined in the program they are likely to be of little value in prohibitions. The basic intent of the legislation and the policy statements of the local program were to recognize the high public value of wetlands. The regulations do not reflect this intent in their present form, and in fact contradict the intent and policies.

The Pacific County Shorelines Master Program provides little protection for the tidal wetlands in Willapa Bay.

The Pacific County zoning ordinance addresses tidal wetlands under the aquaculture use district section. Maps indicating this designation have been prepared and adopted for only about one half of the perimeter of Willapa Bay. Areas for which maps designating Aquaculture use district boundaries have not been adopted have no protection under the zoning ordinance. In those areas where maps have been adopted diking and filling and dredge spoil disposal is allowed as a conditional use in the aquaculture use district. Conditional use permits are granted by the board of adjustment. Notice of public hearings for conditional use permits are required to be sent only to adjacent property owners.

It is not possible to evaluate the federal permit system governing the activities in tidal wetlands since it has only recently been announced. However the fact that public hearings are not required and that general permits have been prepared for other 404 permit areas suggests that additional protection for tidal wetland areas will not be forthcoming from this program. The administrative agency is the corps of engineers which has been responsible for much of the wetland filling in the northern portion of Willapa Bay under their navigational improvement projects.

WATER

TABLE OF CONTENTS

FIGURES

TABLES

Water Quality Willapa Bay

In the undisturbed natural state the waters of an estuary such as Willapa Bay, are a mixture of the fresh water flowing from its tributary streams and those of the sea entering as the tide. There is a large variety of salts in this mixture of waters. Some in relatively high concentrations but most in very low to trace amounts. These salts have their origin in the solution of erosional products of the land and the chemical and biological processes carried on in the water or on the lands it periodically covers.

The biological processes produce wastes from plant and animal metabolism which become an integral part of the water. All of the plants and animals which occupy the estuary throughout their life history die and produce waste which in turn become part of the food chain and adds through their decomposition more compounds in the form of soluble salts or gases to the estuary waters. Gases in estuary waters include; carbon dioxide, hydrogen sulfide, and oxygen. Oxygen plus other gases from the air may become a part of the water through surface agitation and turbulence.

A fundamental element of these waters is the microorganisms; the bacteria, algae and single celled animals which combine and convert the many compounds of the estuary waters into living matter and more compounds. Because of their small size, usually poor capabilities of locomotion and direct relationship to the chemical constituents of the estuary waters, they must be considered to be a part of the water itself.

The water of the estuary is thus, in actually, not only a complex solution of chemicals but more accurately a living system. It is almost impossible to consider only the chemical aspects of estuarine waters. The living elements are too much a functional part of these brakish waters.

The energy which maintains this system is derived from the sun, (photosynthesis and heat), tides and winds.

Physical characteristics of the waters of an estuary may vary in easily measureable ways such as temperature, salinity, acidity and clarity. Currents, winds, tides and other hydrologic factors supply movement of the waters to allow mixing and disbursement of the constituents of the waters.

In the natural state seasonal differences of weather, tidal cycles, various geological processes and other natural events produce variations in the characteristics of estuary waters, both chemical and biological. Change is thus another characteristic of these waters as well as the ability of the system to adjust.

The waters of the estuary act as a living media which produces and transports nutrients and treats the natural wastes which enter or are produced by the system. Although the physical, chemical, and biological attributes of the system vary considerably there are limits to these variations beyound which the system no longer performs its usual functions. Under these conditions the system becomes another type of system or if the conditions which caused the initial upset return to normal the system will eventually reestablish itself. These recoveries may be long term processes dependent on the nature of the causitive event. These disruptions may be natural from short or long term geologic or climatic changes or may be a result of the activities of man.

Drainage Areas

The tributaries which enter Willapa Bay drain an area of a little over 900 square miles. Most of this area is within Pacific County, however a large portion of the drainage of North River is in Grays Harbor County and a small part in Lewis County. The Naselle River drains a small area in Wahkiakum County. (See Figure 4) Not all of Pacific County is drained by the tributaries of Willapa Bay. The coastal areas drain to the ocean. Grays River and Deep River tributaries of the Columbia, drain the southeastern portion of the county and east central portion of the county is drained by the Chehalis River. Three major stream drainages enter Willapa Bay. These are the North River (including Smith Creek), Willapa River and the Naselle River. Lesser streams entering Willapa Bay are; Cedar River, Bone River, Niawiakum River, Palix River, Nemah River and Bear River. The peninsula and north coast area drain into the bay by means of a number of ditches and small streams. Details of the drainage of the Long Beach Peninsula and the North Cove - Tokeland area are shown in figures 1 and 2 .

The various activities in the uplands drained by the tributaries of Willapa Bay effect the character of the Bay, its waters, bottom and shoreline and even the circulation within the bay. Aspects of the major activities which may potentially effect the character of the bay are as follows:

FORESTRY
- Siltation from road building and clearcutting
- Spraying to remove unwanted broadleaf vegetation
- Fertilizer application to promote growth of young trees
- Log storage in or adjaecent to the water

AGRICULTURE
- Cattle and dairying
  - Spraying for noxious weeds
  - Animal waste concentration
- Cranberries
  - Spraying
  - Flow control in ditches

POPULATION CONCENTRATIONS
- Treated and untreated domestic waste
- Storm runoff modification

DUMPS
- Leachate production

INDUSTRIAL
Water quality degradation

HIGHWAYS
Roadside spraying to remove unwanted vegetation
Flow modification in streams and marshes by grades and structures
Sedimentation from maintenance and construction

Some of these activities, such as forestry occur in most of the drainage sub-basins to Willapa Bay while others, such as population concentrations or cranberry bogs are localized. The net effect that one drainage may be expected to have on the bay may be quite different than that of another. In order to anticipate what and where these effects may occur it is helpful to attempt to characterize each of the sub-drainages in terms of the upland activities peculiar to it.

North Cove-Grayland

Most of the area, about four thousand four hundred acres behind the dunes in the north beach area, forms a single drainage basin. It is included in drainage district number one and is highly modified by ditches. Outfall from this area enters the bay by means of a ditch emptying into North Cove. The drainage area has a rather well disbursed population of about four hundred. Most of the area is occupied by cranberry bogs which represent the major activity. There is a small amount of forestry along the eastern boundary of the sub-basin. An open dump occupies a small branch drainage near the mouth of the main ditch. There are 16.1 miles of improved state and county roads in the area.

Tokeland-Kindred Slough

Kindred Slough and Teal Slough drain an area of three thousand one hundred and fifty acres east and north of Tokeland. The lower drainage has been diked to produce a considerable area of pasture land. There is a small amount of forest land in the northern part of the basin. A population of about 200 is concentrated in the Tokeland area. There is a fish and crab processing plant in Tokeland. There are 5.5 miles of improved state and county roads in the area.

Cedar River

Cedar River drains an area of eight thousand and fifty acres on the north side of Willapa Bay. The area is primarily forest land with some pasture land. There are less than ten people living in the drainage and the only improved road is that which crosses the mouth of the river.

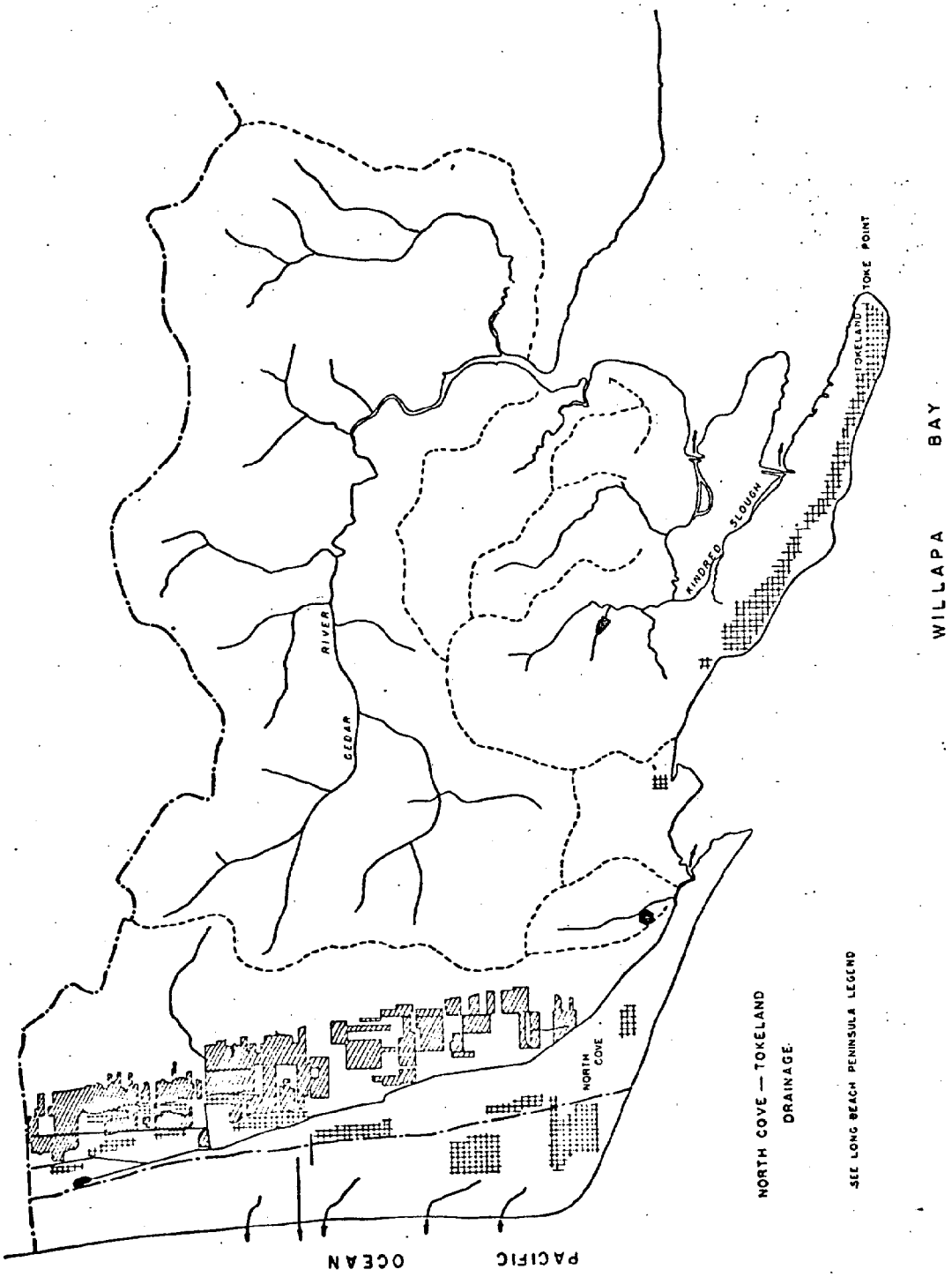

WILLAPA BAY
TOKE POINT
TOKELAND
KINDRED SLOUGH
CEDAR RIVER
NORTH COVE
PACIFIC OCEAN
NORTH COVE — TOKELAND DRAINAGE
SEE LONG BEACH PENINSULA LEGEND

Figure 1

North River - Smith Creek

Smith Creek enters Willapa Bay at the mouth of North River so that their drainage areas are considered here as a single sub-basin to Willapa Bay. This large east-west oriented basin includes a little more than two hundred thousand acres. Forest land accounts for the bulk of the area. A population of about 350 is widely dispersed along the upper North River drainage. A small amount of pasture land is present. There is an open dump high in the North River drainage. About 52 miles of state and county improved road are present in the eastern portion of the drainage.

Willapa River - Willapa Flats

The Willapa River drains an area of about one hundred sixty five thousand acres. It has a high concentraion of population in its lower reaches. Most of the 8000 people in the drainage are concentrated in the South Bend - Raymond area with lesser concentrations up river. About sixty percent of these people are served by three sewage treatment plants located low in the drainage. There is an open dump located low in the drainage and a number of wood processing and seafood processing plants. There is a significant amount of forest and pasture land in the drainage area. Much of the pasture land is diked tideland. One hundred and sixteen miles of improved state and county road serve the area outside the cities.

Palix-Niawiakum-Bone Rivers

These three small drainages include thirty three thousand acres of primarily forest land. The Palix River drainage is the largest. All have their mouths in close proximity. A population of about 450 is concentrated in the Bay Center area. Pasture land has been developed on the Bay Center peninsula from diked tideland. Seafood processing plants are located low in the drainage area. Twenty three miles of improved state and county roads serve the area.

Nemah River

Forest land makes up the majority of the thirty thousand acres included in the Nemah River drainage. Pasture land is located along the North Nemah River as well as a dispersed population of about 100. A seafood processing plant is located low in the drainage basin. Sixteen miles of state and county improved roads serve the area.

Naselle River

As in the adjacent Nemah River drainage, forest land makes up the bulk of the eighty thousand acres of the Naselle River Drainage. There is also a significant amount of pasture land, most of which is derived from diked tideland in the lower drainage. The population of a little over one thousand is concentrated in the area of the town of Naselle. A small sewage treatment plant serves an institution west of the town. An open dump is located low in the drainage. Fifty two miles of improved state and county roads serve the area.

Bear River

This small drainage including fourteen thousand acres is almost entirely forest land. Fewer than 10 person live in the area and three miles of state and county improved road pass through the lower drainage area.

Parker Slough

Parker slough drains about two thousand acres in the south end of Willapa Bay. The area is equally divided between forest land and agricultural land. The agricultural land consists of pasture and growing areas for migratory bird feed and largely occupies diked tidelands. Less that 50 people live in the area.

Long Beach Peninsula

The natural drainage of the Long Beach Peninsula is controlled by a series of long north-south oriented stabilized dunes. The gradients involved are low and lakes are a common feature of the many depression areas. This natural drainage has been highly modified by artificial drainage elements which has accelerated the drainage rates and interconnected many of the natural drainage areas. Figure 2 shows the nature of this artificial system and the outlets, both natural and artificial, to Willapa Bay. A series of highly modified drainages are thus recognized along the east side of the Long Beach Peninsula and are described below:

Southern Peninsula

An area of sixty six hundred acres at the south end of the peninsula drains into Willapa Bay by means of Tarlatt Slough but some may be alternately drained by way of Giles Slough or an outfall ditch in between them by manipulation of various gates in the drainage system. This area includes much of Drainage District Three. It is primarily cranberry bogs. There is a significant amount of housing in the area. The sewage treatment plant for Long Beach outfalls in this drainage and thus the effective population is about twelve

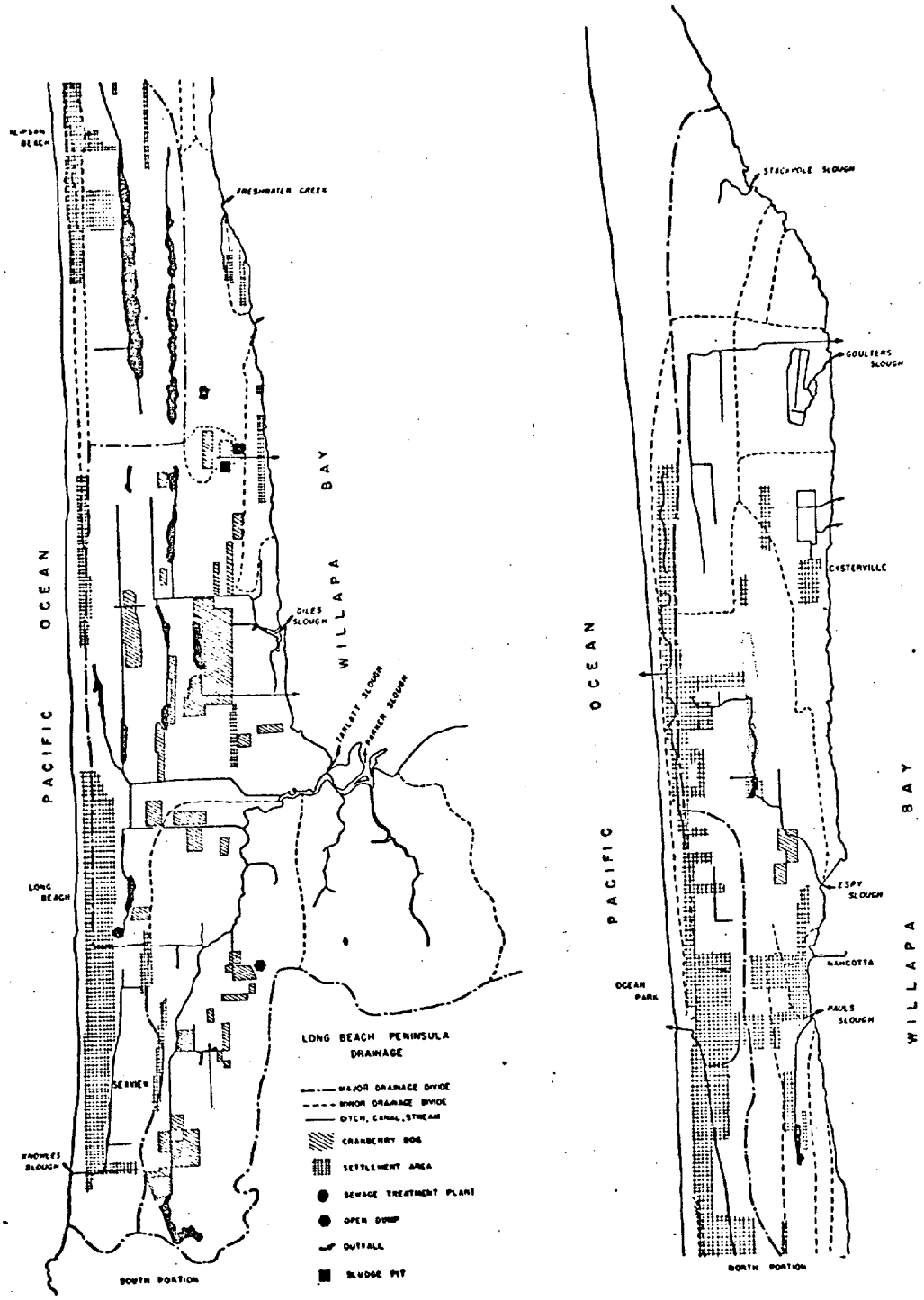

PACIFIC OCEAN
WILLAPA BAY
FRESHWATER CREEK
DILES SLOUGH
FARLATT SLOUGH
PARKER SLOUGH
LONG BEACH
SEAVIEW
KNOWLES SLOUGH
SOUTH PORTION
LONG BEACH PENINSULA DRAINAGE
MAJOR DRAINAGE DIVIDE
MINOR DRAINAGE DIVIDE
DITCH, CANAL, STREAM
CRANBERRY BOG
SETTLEMENT AREA
SEWAGE TREATMENT PLANT
OPEN DUMP
OUTFALL
SLUDGE PIT
STACKPOLE SLOUGH
GOULTERS SLOUGH
OYSTERVILLE
ESPY SLOUGH
NAHCOTTA
OCEAN PARK
PAULS SLOUGH
NORTH PORTION

Figure 2

hundred even though some of the housing involved is not actually located within the drainage area. About seventy five percent of the population in the area is served by this sewage treatment plant. There is an open dump low in the drainage. The area is served by twenty miles of state and county improved roads outside the urbanized area.

Freshwater Lake and Bayshore Area

This small drainage of twelve hundred acres includes a minor amount of cranberry bogs and a population of about 150. It enters the bay by means of Freshwater Creek, a ditch and several small streams. Four miles of improved state and county roads traverse the area.

Nahcotta-Skating Lake-Pauls Lake-Bayshore area

This is primarily an area of dispersed housing with the exception of Nahcotta. A population of about 1000 resides in the area. A minor amount of cranberry bogs occurs and several seafood processing plants are located at the edge of the bay. The area includes thirty two hundred acres. Seven miles of state and county improved roads serve the area.

Oysterville-Bayshore area

Most of the nine hundred acres of this drainage has no well defined entrance to the bay. In the northern portion a series of ditches drains directly to the bay. The area is one of dispersed housing including about 200 persons. Three and one half miles of state and county improved roads serve the area.

Goulters Slough-Stackpole Slough

There is very little housing or other activity in the twenty five hundred acres of this drainage. However the westerly portion has been heavily modified by drainage ditches emptying just north of Goulters Slough. There is no improved road in the area.

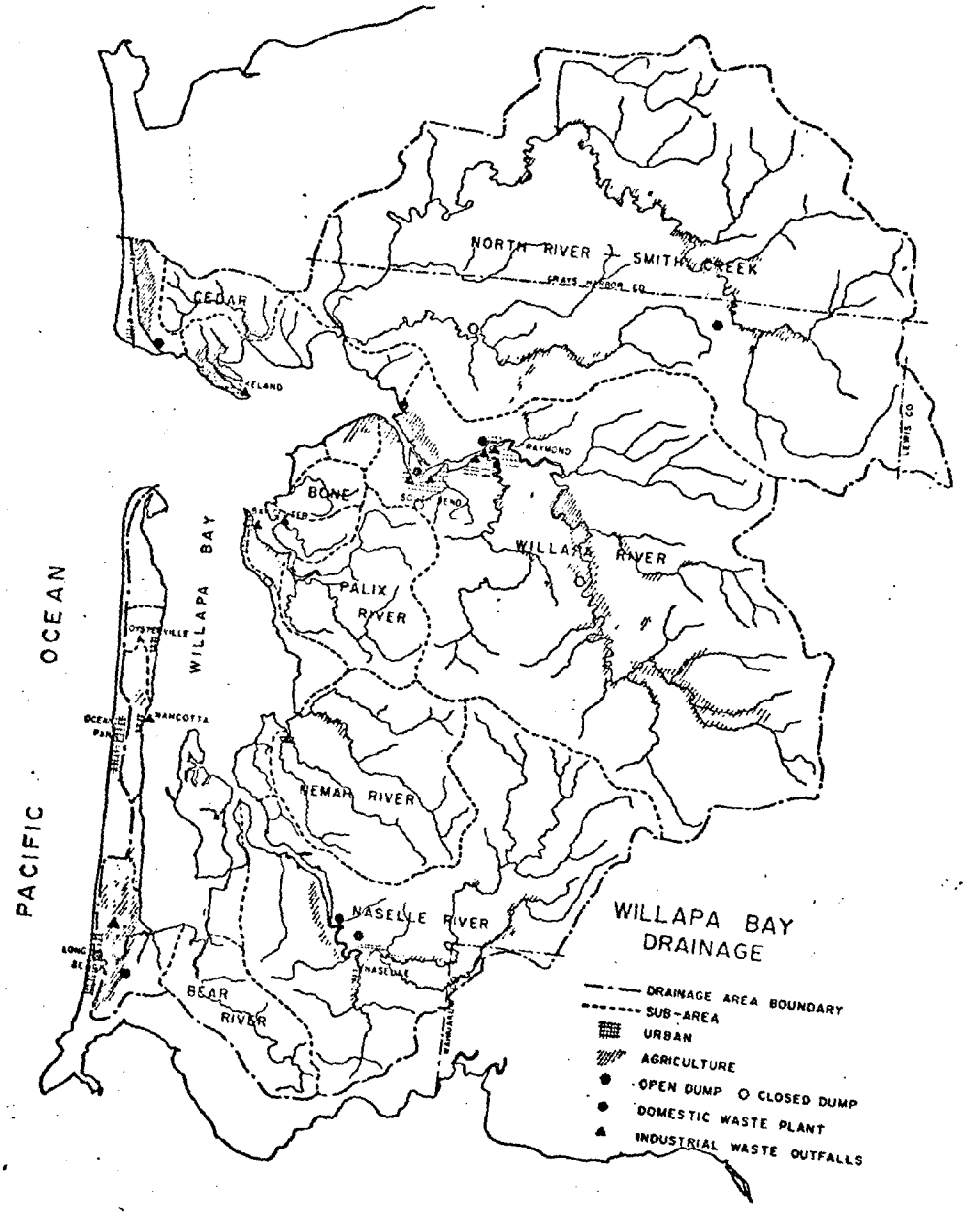

NORTH RIVER
SMITH CREEK
CEDAR
RAYMOND
BONE
WILLAPA RIVER
PALIX RIVER
WILLAPA BAY
OCEAN
PACIFIC
OCEAN PARK
NEMAH RIVER
NASELLE RIVER
BEAR RIVER
WILLAPA BAY DRAINAGE
DRAINAGE AREA BOUNDARY
SUB-AREA
URBAN
AGRICULTURE
OPEN DUMP
CLOSED DUMP
DOMESTIC WASTE PLANT
INDUSTRIAL WASTE OUTFALLS

Figure 3

Stream Runoff

Runoff from an area is a function of precipitation, topography, soil characteristics, ground water recharge areas, and vegetation. Stream flows from the various drainage basins are measured by gaging stations. However only a few streams in Pacific County have such stations and none of the drainage basins has all the stream flows measured. Runoff in inches per year has been determined and is presented in figure 4. Estimates of the total stream flow from a given basin may be made by refering to the available stream flow data and estimating the remainder of the flow from the area by comparing the additional area involved, its topography and runoff characteristics. Such estimates along with the total relief within the basin are presented in table 1. The runoff is also graphically presented in figure 4 by the relative size of the arrows depicting the outflow to the bay. The total stream runoff to Willapa Bay is thus estimated to be about 3,000,000 arce feet per year. These are rough figures but serve to give an idea of the relative effect each of these drainage areas may have on Willapa Bay.

TABLE 1

DRAINAGE RUNOFF ESTIMATES

Drainage	Relief in feet	Estimated acre ft/yr runoff to Willapa Bay
North Cove	300	14,000
Kindred Slough	390	10,000
Cedar River	480	37,000
North River-Smith Cr.	2200	1,000,000
Willapa River	2600	800,000
Bone River	365	
Niawiakum River	350	165,000
Palix River	1080	
Nemah River	1950	200,000
Naselle River	2600	600,000
Bear River	1620	85,000
Parker Slough	350	10,000
Long Beach Peninsula	72	60,000

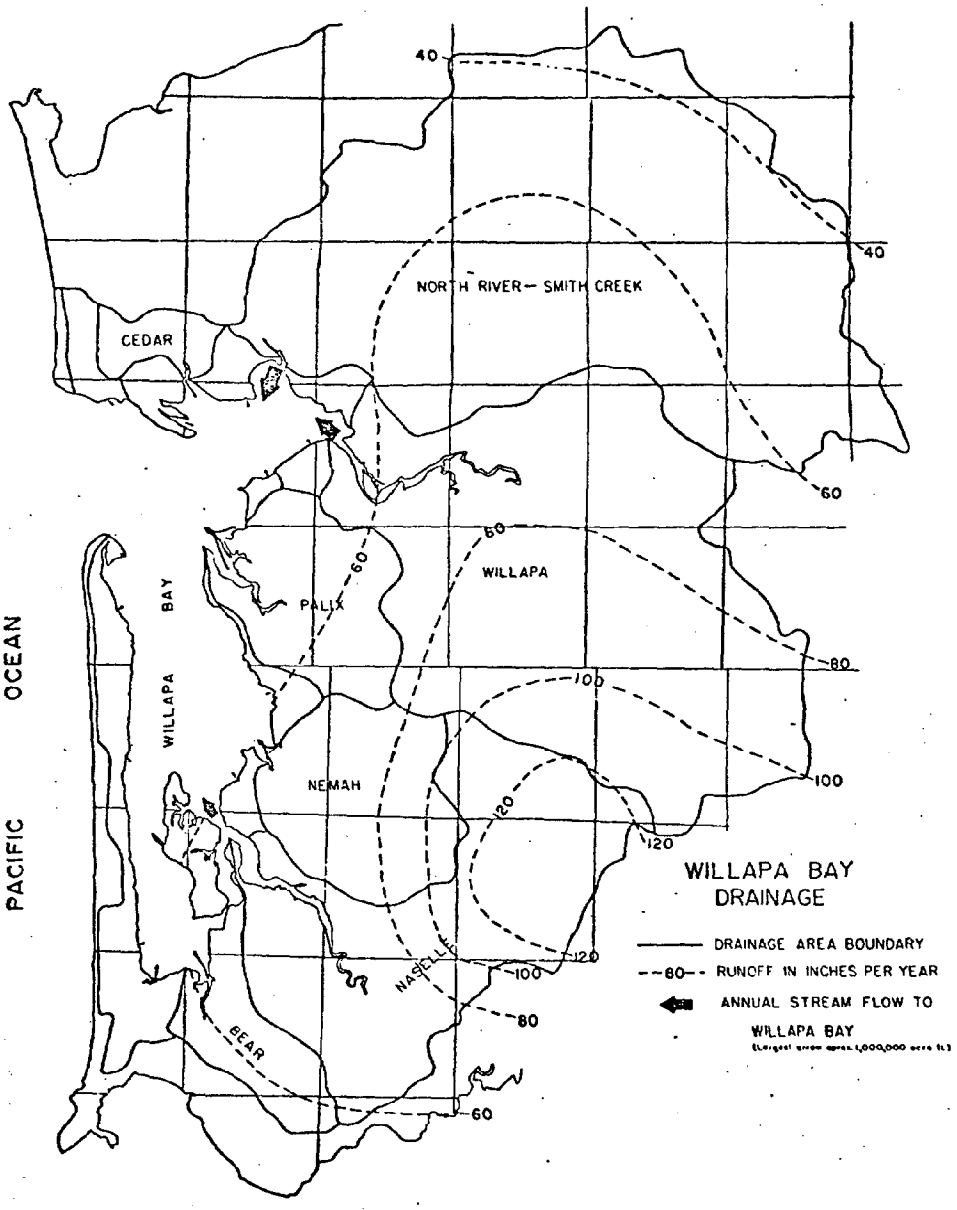

40
40
NORTH RIVER— SMITH CREEK
CEDAR
60
60
60
WILLAPA
PALIX
80
100
100
OCEAN
BAY
WILLAPA
NEMAH
120
120
PACIFIC
NASELLE
100
80
BEAR
60
WILLAPA BAY
DRAINAGE
DRAINAGE AREA BOUNDARY
--80-- RUNOFF IN INCHES PER YEAR
ANNUAL STREAM FLOW TO
WILLAPA BAY

Figure 4

Water Transportation and Storage of Logs

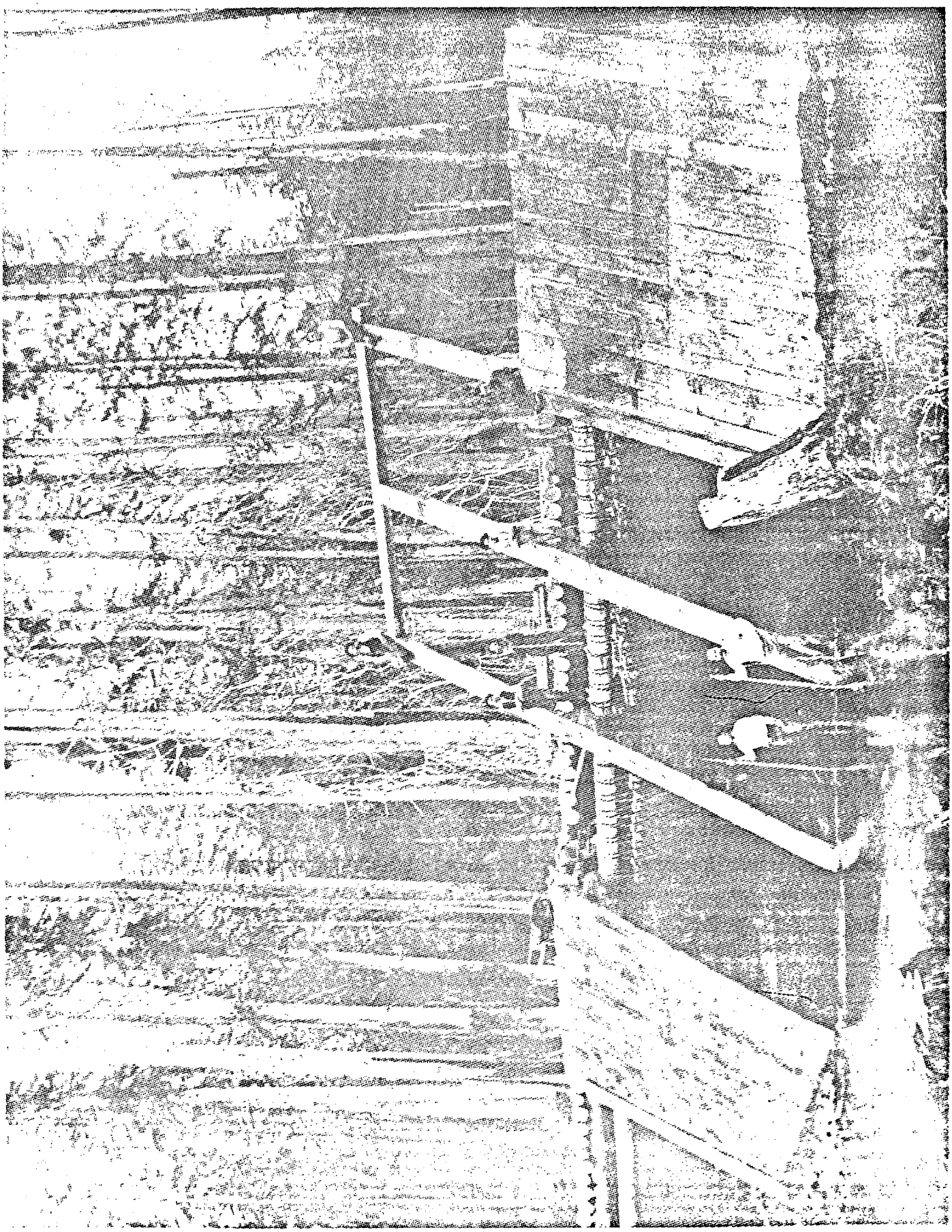
The tributaries of Willapa Bay and the Bay itself were used in the past as means of transportation and storage of logs. Smaller streams were used as conduits for the movement of logs. Flows in streams both large and small were augmented with the use of the splash dam. A head of water was allowed to develop behind these dams then large sections of the dam, sometimes the whole structure were opened to release the water and logs stored behind the dam into the stream bed.

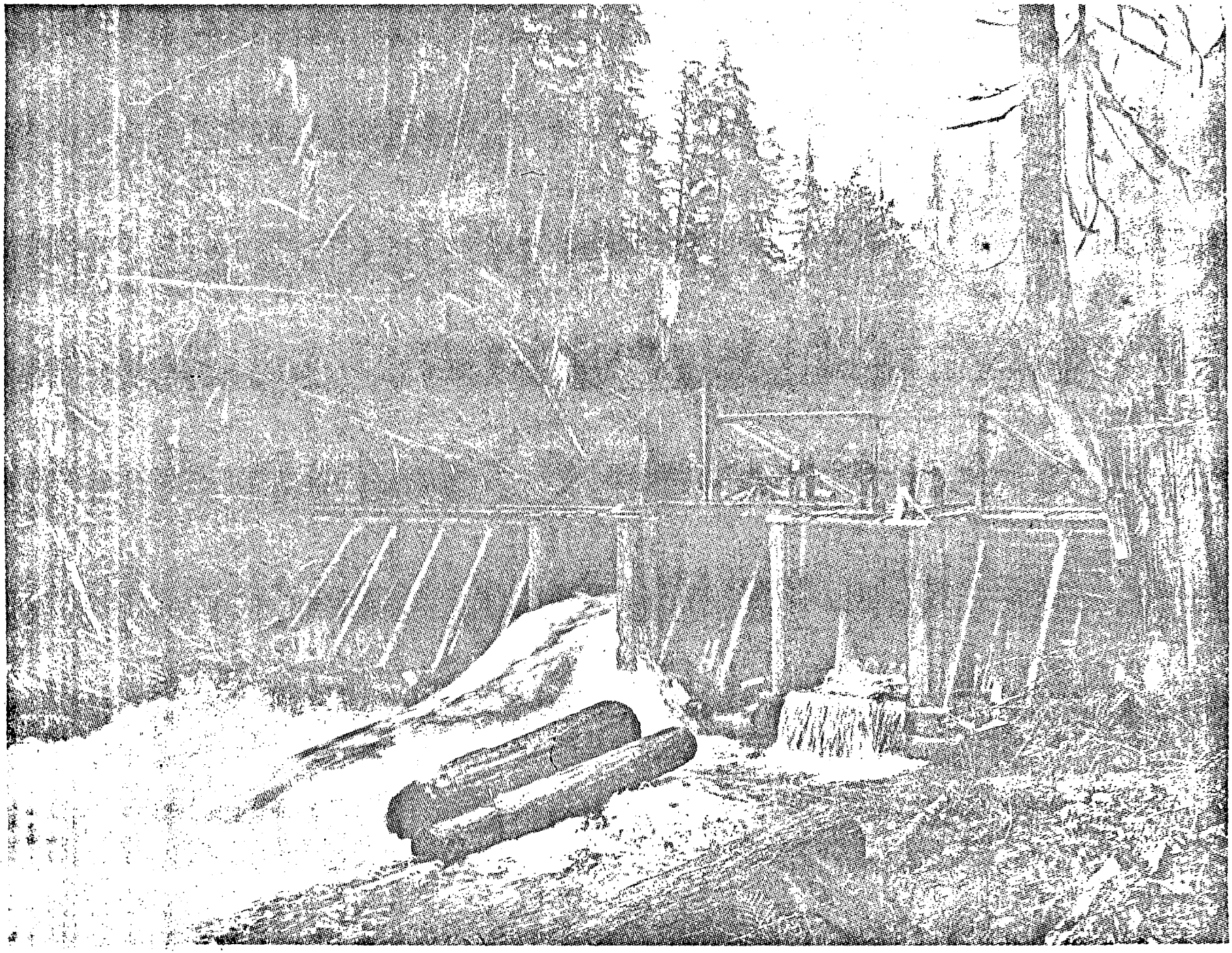
At the mouths of the tributary streams booming grounds were developed to sort the logs and organize them into rafts to be towed to areas near the mills. Storage in sloughs and along the channels of the larger streams was a common practice until recently. Very little log transportation and storage in water is carried on today.

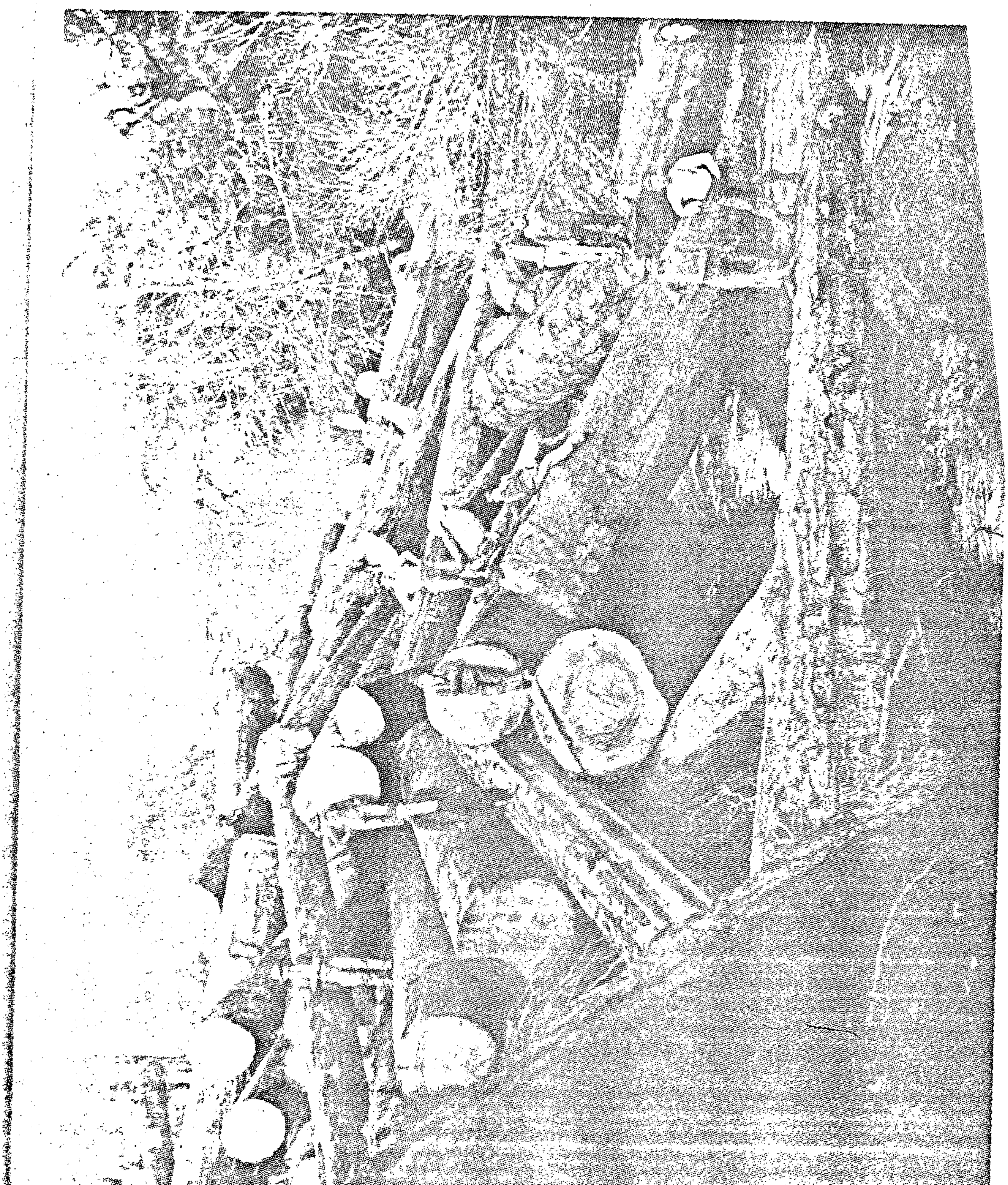
The photographs on the following pages illustrate some of these early practices in Pacific County.

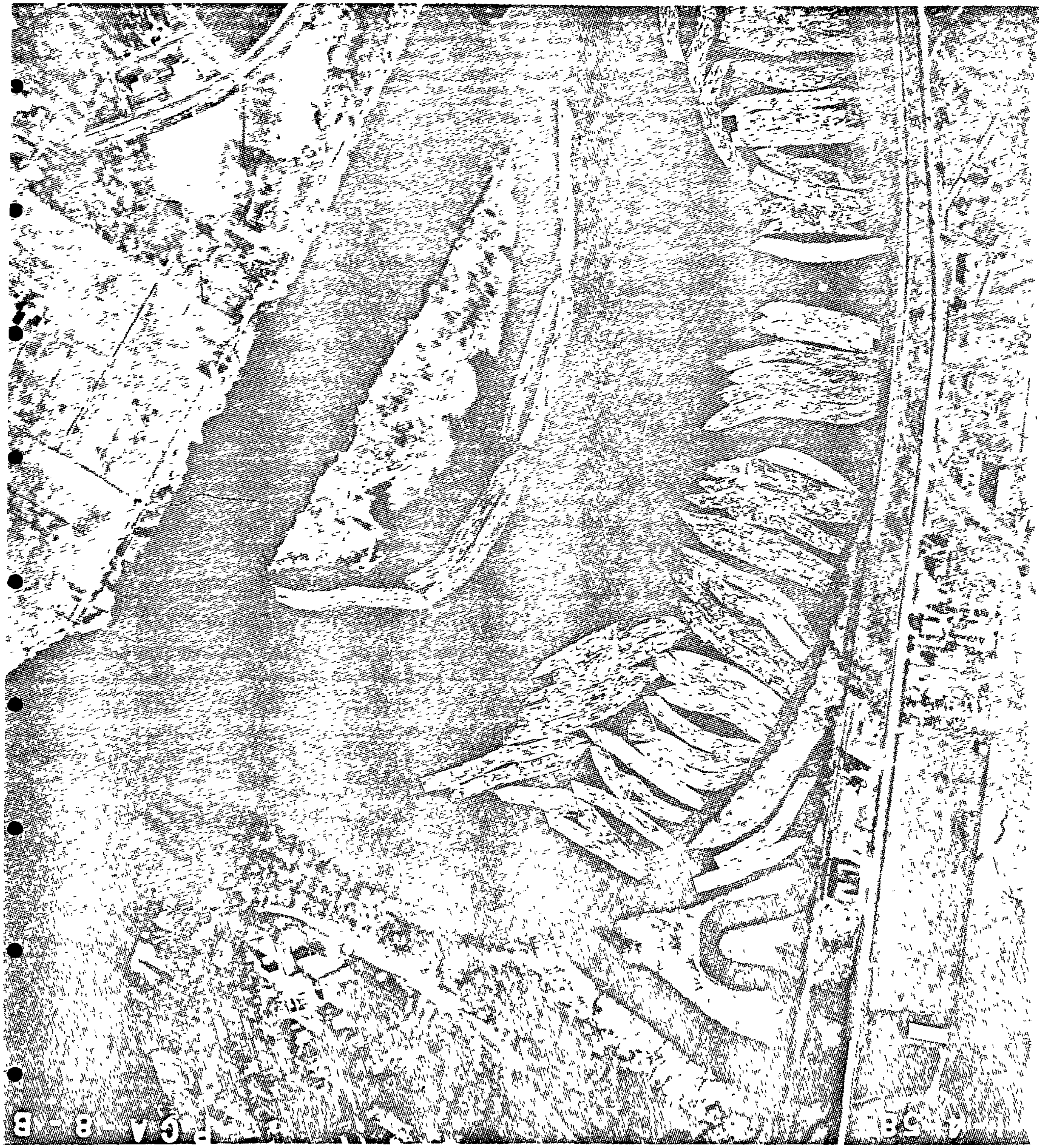
Log jams have resulted from the use of streams as transportation systems as well as from the collection of logging debris. Slides, blowdowns and other natural events also produce concentrations of debris. A recent inventory of the tributaries of Willapa Bay by the Department of Fisheries found 8 dams, 6 of which were barriers to salmon and 88 long jams, 15 of which were barriers to salmon. Natural stream barriers, such as falls and beaver dams are also identified in the inventory (see WDF, "A Catalog of Washington Streams and Salmon Utilization" Vol. 2)

Drainage	No. Log Jams	Barriers	No. Dams	Barriers
N. River-Smith Cr.	33	1	1	1
Willapa River	13	2	4	3
Palix, Niawiakum Bone	3	1	0	0
Nemah River	17	3	1	1
Naselle River	18	5	2	1
Bear River	4	3	0	0
Total	88	15	8	6









Sedimentation

Large quantities of sediment enter Willapa Bay and are deposited there. The major source of the sediments is from the erosion of uplands. These sediments are transported to the bay by the various tributary streams which empty into the bay. Other sources include the erosion of the shores of the bay itself, bay disposal of dredge spoils, and suspended loads brought in from the ocean. Erosion of the shores of the bay is primarily a result of wave action and is localized in areas exposed to long fetches of winter and summer wind generated waves. Some erosion results from changes in channel alignment. Ocean sediments are derived from the plume of sediment leaving the mouth of the Columbia River and Grays Harbor and from the seasonal coastal transport of sand. Figure 10 illustrates the location of the more significant areas of erosion in the bay. One of the primary sources of sediment from the upland is logging, road construction, the transportation of logs and clearcutting which expose large areas of soil to erosion. Figure 11 illustrates the area clearcut between 1950 and 1974. Much of the drainage area of the bay has been clearcut in the last 25 years as shown in figure 11. Figure 12 illustrates the available saw log resource as of 1950. Comparison of figure 11 and figure 12 indicates that most of the area of saw-log timber available in 1950 has subsequently been cut.

The removal of the flood plains in the lower reaches of the drainage areas by diking and filling also removes the natural depositional area for sediments carried by the streams during high runoff periods. The extent of diking and filling of flood plain areas is described and illustrated elsewhere in the discussion of tidelands. A high percentage of the flood plain in the lower reaches of the Willapa River has been removed. As a result sediment formerly deposited in the flood plain area is now carried on to the bay.

The deposition of sediment in the bay is a natural phenomenon. However when excessive amounts enter the system changes in the character of the bay occur. Tidelands are raised to a level which will not allow the culture of oysters (see oysterlands

section), the texture of the bottom may change and the hyrology of the bay must shift to accomodate a new set of conditions. Accumulation of sediment results in faunal and floral changes with the loss of the existing orgainisms. As the elevation of the bottom is raised sufficiently intertidal plants pioneer the area developing new grasslands as the process continues (see figure 10. Suspended sediment requires filter feeders, such as oysters, to expend significant portions of their energy expelling the silt particles and thus impairs growth rates.

Considering only the northern portion of Willapa Bay, over two thousand acres of productive oysterland was lost due to sedimentation in the period 1959-1970 (see oysterlands section). Figure 13 identifies the specific areas lost during that period. Where landmarks are available in the outer Stony Point area, there has been an elevation increase of 16 inches in the beds.

The deposition of sediment in the tributaries of Willapa Bay has destroyed many spawning areas for salmon. The fine sediment prevents the necessary aeriation of the eggs while they are incubating.

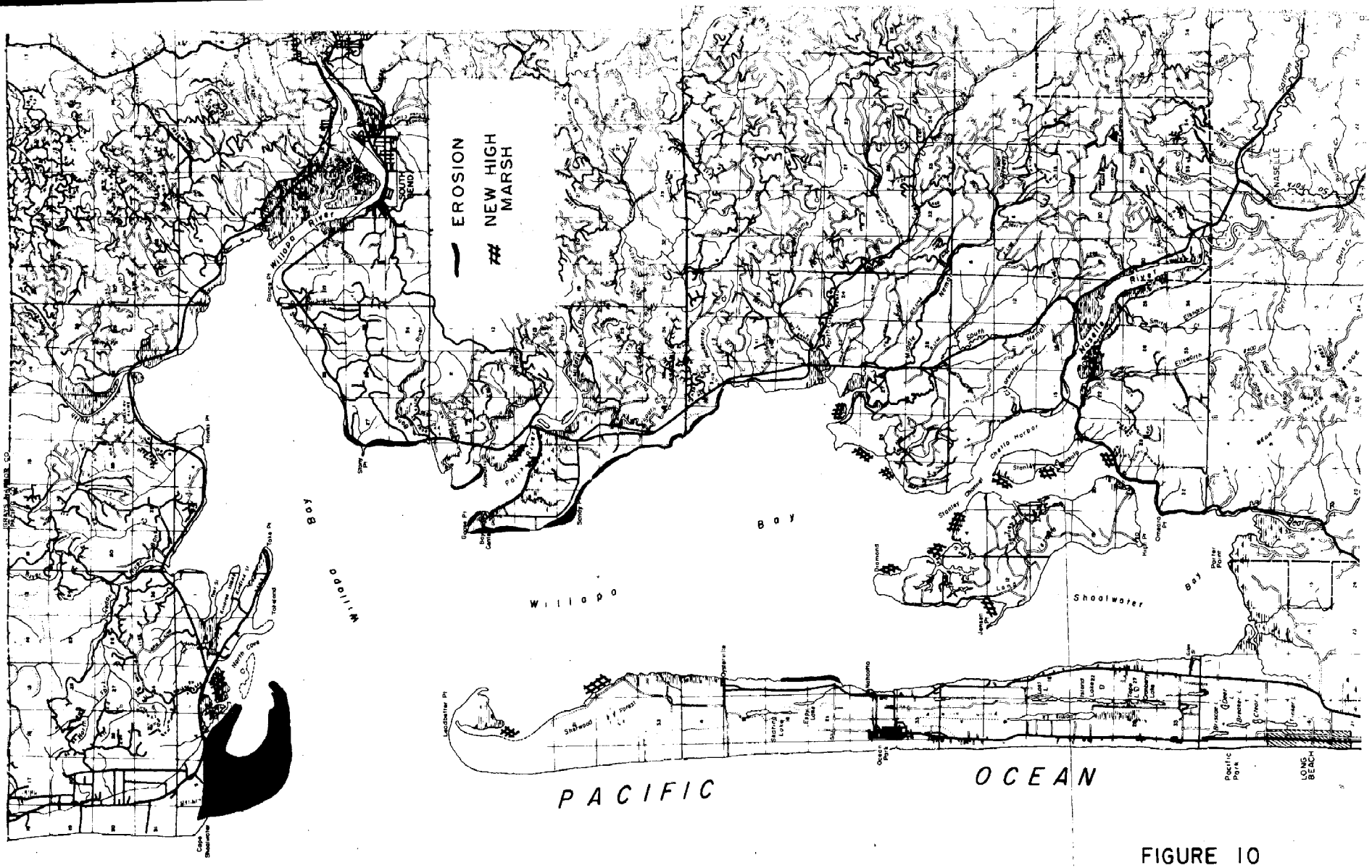

EROSION
NEW HIGH MARSH
Willapa River
SOUTH BEND
Willapa Bay
Shoalwater Bay
Willapa
Stanley Channel
Chesta Harbor
NASELLE
Tokeland
North Cove
Cape Shoalwater
Leadbetter Pt
Oysterville
Nahcotta
Ocean Park
Pacific Park
LONG BEACH
PACIFIC OCEAN

FIGURE 10

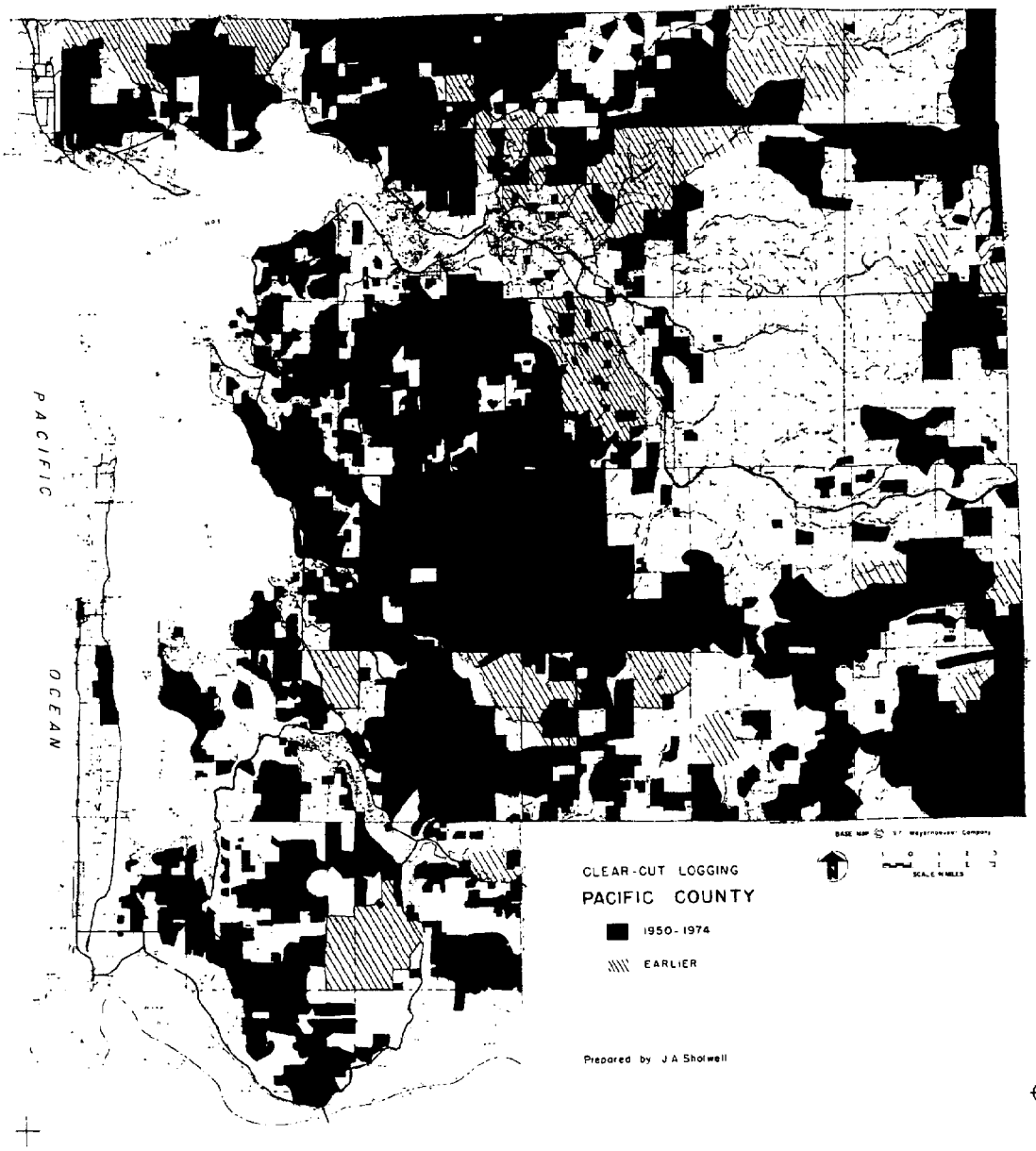

PACIFIC
OCEAN
CLEAR-CUT LOGGING
PACIFIC COUNTY
1950-1974
EARLIER
Prepared by J A Sholwell

FIGURE 11

FOREST STAND-SIZE AND CONDITION CLASSES
PACIFIC COUNTY, WASHINGTON
1950

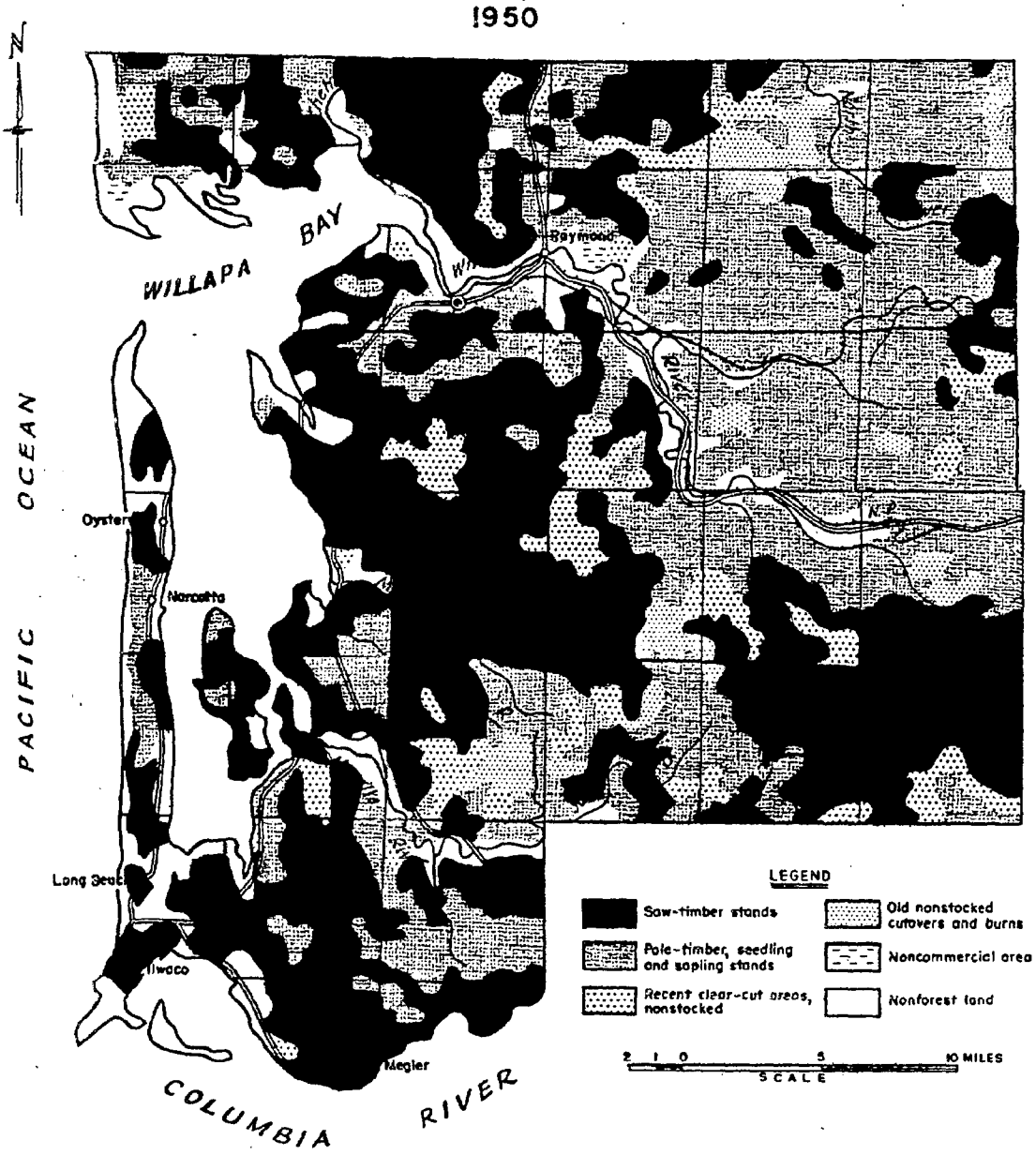
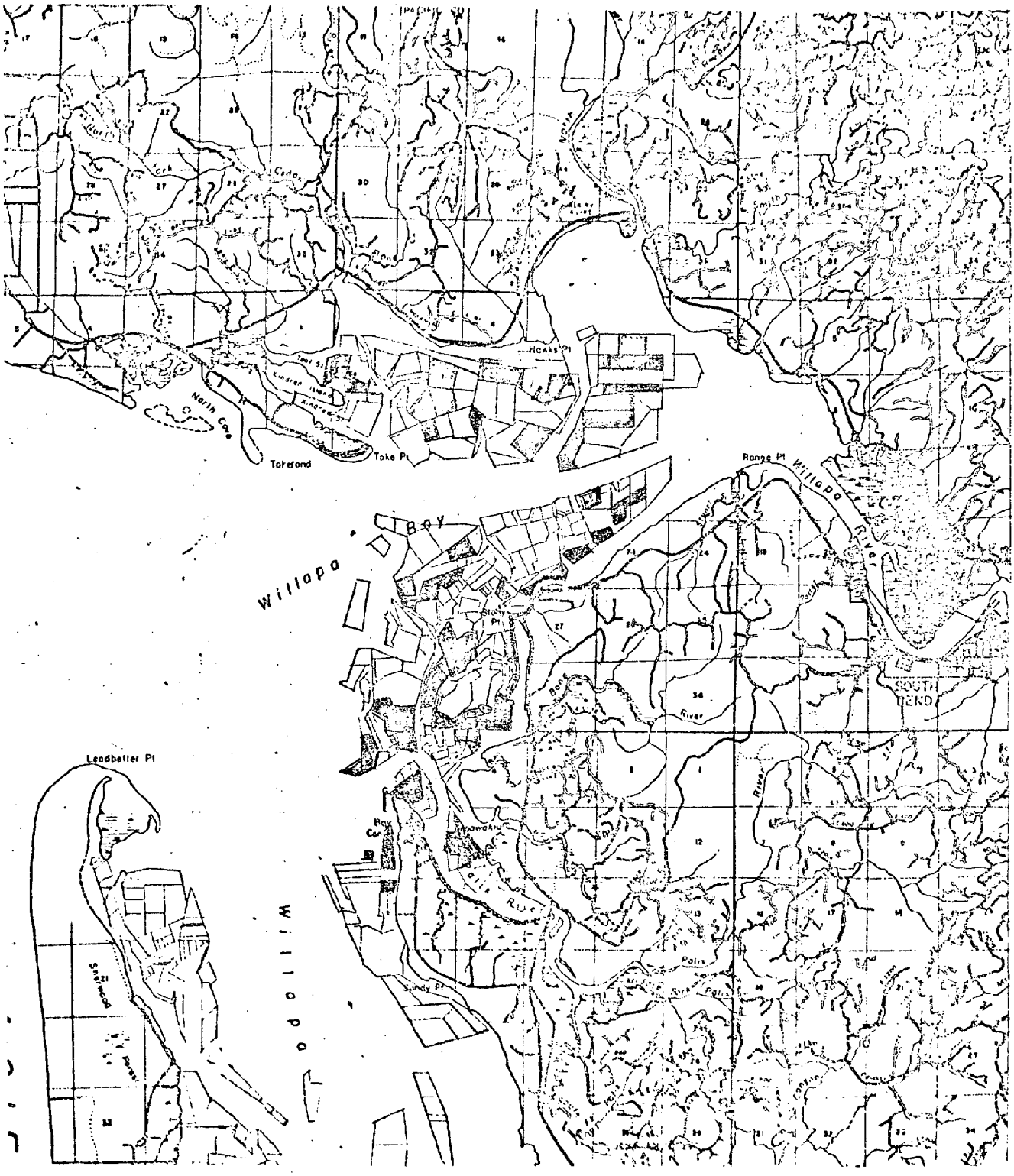


FIGURE 12



Location of Productive Oysterlands lost to Sedimentation
in Northern Willapa Bay
between 1959 and 1970
Figure 13

Chemicals

Many activities adjacent to Willapa Bay involve the use of chemicals. These chemicals may be sprays used as Herbicides, Insecticides and Fungacides, or chemicals used in processing and sanitation operations or chemical fertilizers. The effect these chemicals have on the character of the waters of the bay depends on the toxicity of the chemical, its access to the streams draining into the bay, the longivity of its effectiveness, the amounts used and the care used in their handling.

Chemicals are employed as an economic benefit to the user, except in sanitation. Their use appears as the cheapest way to control weeds, brush, pests, plant diseases etc.. However their effects, if not confined to the area where they are applied often results in an economic loss to other activities. A bay is particularly susceptible to such loss because it is the recieving water for stream drainages and waste outfalls and the basic elements of the food chain are particularly sensitive to most toxicants at very low concentrations.

Chemical useage in the drainage to Willapa Bay is as follows:

Herbicides

Weed and brush control are the major uses of herbicides. The largest volume of chemicals used are herbicides because of the large areas involved. They are used in noxious weed control on agricultural land, weed control in cranberry farms, brush control in forestry, right of way clearing and maintenance along county and state roads and power lines, and by house holders. Since they are most effective during growing periods the bulk of the herbicides are applied in spring and early summer. Table 2 outlines the specific forms applied.

TABLE 2

HERBICIDES

Chemical	Use	User	Rate	Time
Amitrol / BK64 mix	Brush Killer	Forestry	.5 gal / Acre .75 gal	Apr-June
2,4,D / Banvel mix	Brush Killer	Bonneville		
	Tansy Ragwort	Noxious weed	41b./Acre	May-June
2,4,D / 2,4,5,T mix	Brush Killer	County Roads		May-June
	Brush Killer	State Highway		Mar-June & Sept.
	Tansy Ragwort	Noxious Weeds	41b./Acre	May-June
	Brush Killer	Forestry	41b./Acre	Apr-June
2,4,D	Weed Control	Cranberry	41b./Acre	Nov-Dec
	Tansy Ragwort	Noxious Weeds	31b./Acre	Apr-May
CIPC	Weed Control	Cranberry		
Dalapon	Weed Control	Cranberry	1-81b/Acre	Nov-Jan
Evitan	Weed Control	Cranberry		
LV4	Tansy Ragwort	Forestry		Apr-June
Trinoyal / Diesel	Dormant Spray	Forestry	.5 gal / Acre 9.5 gal	Feb-Mar
Ureabor		Bonneville		

Insecticides and Fungacides

Insecticides and fungacides are used for pest and disease control. Ordinarily they are used only when there are symptoms of infestation and then in only limited areas. Their use is outlined in the following tables:

TABLE 3

Insecticides

Chemical	Use	User	Rate	Time
Guthion	worm & scale control	Cranberry	2 lb./Acre	May-June & mid July
Malathion	worm & scale control	Cranberry	3 pt./Acre	May-June & mid July
Parathion	worm & scale control	Cranberry	11/2 Pt/Acre	May-June & mid July
Seven	shrimp & worm	Oystermen	10 lb/Acre	July

TABLE 4

Fungacides

Chemical	Use	User	Rate	Time
Captan	Blight and Rot	Cranberry	6 lb./Acrea	April and August
Diathane	Blight and Rot	Cranberry	4 lb./Acre	April and August
Malachite green	Fungus	Fish Hatcheries		Sept-Nov
Wescodine	Fungus	Fish Hatcheries		September

Sanitizers and Purifiers

Strong oxidizing agents are used in a number of applications. Chlorine is the most common. Water treatment and sewage treatment plants use large amounts of chlorine in water purification. Food processors use chlorinated water in plant sanitation and in the production of ice. Fishermen use chlorine and other cleaning agents in the removal of marine growth from fish gear and boats. Nearly all of these uses dipose of their waste directly into the lower drainages to the bay.

Fertilizer

Chemical fertilizers are used extensively in reforestation.

Controls on Chemical Useage

The handling and application of chemicals is under the control of the state department of agriculture thru the noxious weeds control act (RCW 17.10), the Pesticides Control Act (RCW 15.58), and the Pesticides Application Act (RCW 17.21). Regulations promugated under these acts provide the specific rules for handling and application of chemicals. The Forest Practices Act (RCW 76.09) and Forest Insect and Disease Control Act (RCW 76.06) supply the basis for regulations developed by the Department of Natural Resources governing the handling and application of pesticides in forestry.

Local controls are provided in the Pacific County Shoreline Master Program.

The level of controls varies considerably in the different useages. These levels consist of no control in useage, notification of intent to use, permits, supervision and licenses. Table 6 outlines the controls for the application of pesticides. There are no controls governing the amount of area or total galonage of pesticides applied. The existing controls govern only the manner in which the chemicals are handled and applied. There is no monotoring of effects. Only the application of seven by oystermen has supervision by a regulatory agency during the actual application.

Required Application of Pesticides

The control of pest or weeds may be required under the Forest Insect and Disease Control Act or the Noxious Weed Control Act. The Forest Insect and Disease Control Act is administered by the Department of Natural Resources. The Noxious Weed Control Act is administered by a local board. The members of the board are appointed by the County Commissioners.

TABLE 5

Chemical Useage Controls

User	Owner Application License Required	Commercial Application Licenses Required	Notification to Control Agency	Notification by Publication	Permit Required	Agency Supervision Required
House Holders						
Agricultural	+	x				
Road Right of Ways			*			
Power Line Right of Ways			*			
Forestry		x	x		x	
Oystermen		x	x	x	x	x

\+ License required in 1977

* Only if aerial application

The county noxious weed control board has authority to:

1. Name the noxious weeds (RCW 17.10.090)
2. Adopt rules and regulation (RCW 17.10.060)
3. Require land owners to control noxious weed (RCW 17.10.140)
4. Enter on property to inspect and take specimens without the consent of the owner (RCW 17.10.160)
5. Remove noxious weeds at the expense of the owner (RCW 17.10.170)
6. Place liens on property for the expense of weed removal (RCW 17. 10.170)
7. Quarentine infested lands and deny the owner access or use of the land (RCW 17.10.210)
8. Prosecute the owner if he resists weed board entry or fails to control noxious weeds. (RCW 17.10.230)
9. Use county funds for operation of the program (RCW 17.10.240)

Record of Chemicals in Bay

In the period of 1965-1972 the EPA carried out studies on the occurence of organochlorine compound residues in fish, wildlife and estuaries. The results of these studies were published by Phillip Butler in the Pesticides Monitoring Journal (Vol. 6 No. 4, 1973, pp 238-362). Samples were taken in Willapa Bay at Stackpole, Olson Slough (Tarlatt Slough) the channel of the Bear River, the mouths of Naselle, Nemah and Willapa Rivers and off Stony Point. Each sample consisted of 15 oysters from each site. Butler found in laboratory experiments that:

> "Oysters detect DDT in the ambient water supply at levels as low as 10 parts per trillion. By the process of biomagnification, residues of DDT as high as 25 ppm accumulate in oyster tissues within 96 hours at a level of environmental contamination on only 1.0 ppb. Oysters tolerate tissue residues of DDT at least as high as 150 ppm without apparent ill effect provided residues are accumulated slowly. However, as little as 0.1 ppm of DDT in the oyster's water supply terminates feeding activities and at summer water temperatures (31°C) will cause death."

Butler also found that:

> "Organchlorine residues are flushed rapidly from molluscan tissues when the water supply is no longer contaminated. In one experimental series, for example, DDT residues of about 25 ppb in oysters and soft clams, Mya arenaria, diminished 50-90% after a week of flushing in clean water. Consequently it is possible to learn much about the periodicity of organochlorine pollution in estuaries from samples of sedentary species collected at appropriately brief intervals."

Samples were taken in Willapa Bay from 1965-1968. At that time sampling was terminated because detectable DDT residues were no longer found in most samples. Monthly samples were taken in Willapa Bay and totaled 261 for the period involved Over seven hundred determinations were run on these samples. DDT residues, the metabolites DDE and TDE and Dieldrin were found in Willapa Bay Samples. Butler commented that:

> "The large percentage of the parent compound DDT in residues from Washington mollusks does imply a direct contamination of the esturarine environment, perhaps for insect control. But in general, the percentage distribution of DDT metabolites in these samples revealed little about the

knietics of DDT in the estuary."

Table 5 summarizes the occurences in Willapa Bay.

Site	Percent of total samples	Distribution of Positive results 5ppb or greater (percent)	10ppb or greater (percent)	Both DDT & Metabolites present (percent)
Stackpole	15	19	14	9
Tarlatt	10	23	52	45
Bear River	15	8	5	9
Naselle R.	15	1	5	0
Nemah R.	15	7	10	18
Stony Point	15	24	29	9
Willapa R.	15	18	14	18

Only 9% of the total determinations produced positive results. The highest concentration of DDT (150 ppb) was recorded at Stony Point, August, 1967. A high concentration (120 ppb) of Dieldrin was recorded at the mouth of the Naselle River in July of 1968. No other positive records of Dieldrin were noted. Although positive determinations were made in all months the higher frequencies were in March through July. No samples were taken in the spring of 1966 off Tarlatt Slough. The highest occurences in all categories was at Tarlatt Slough. This coupled with the fact that fewer samples were taken there indicates that the source probably was from the drainages empting into the bay in that area (see drainage maps). Stackpole and the site off Stony Point also show significant occurences. The frequency of positive results dropped off significantly after 1966 when there were 21 samples with one or more of the organochlorine compounds present. In 1967 and 1968 there were 7 and 6 positive samples respectively.

The occurences suggest that the cranberry bogs might be the source of the contamination recorded if the source is from the south bay areas. However the experiment station indicated that their records show no DDT in use after 1966. Ocean Spray Company at Markam believe that all useage had stopped by 1969. Other agricultural uses have not been recorded.

This record indicates the contamination of the bay from an upland use which can be harmful to adult bay organisms and probably is many times more harmful to embryonic stages which would be in the bay in the spring and early summer. There is no current monitoring system which can detect contaminates of this type.

Marine Flow

Tidal action exchanges the bay waters with those of the adjacent ocean. The number of tidal cycles necessary to completely exchange the water from the bay cannot be determined from the information now available. The Army Corps of Engineers has estimated the total volume of the bay to be 56.5×10^9 cubic feet and the amount of water which flows in and out of the bay during a tidal cycle from MHHW to MLLW to be 22.5×10^9 cubic feet. (Corps of Engineers, personal communications)

The incoming tidal waters are made up of marine waters from a variety of sources; some of the water which comes in on the tide is that which flowed out of the bay on the previous ebb, some is ocean water which may be largely surface or be derived from upwellings along the coast, a portion of the incoming water may be from the outflow from the Columbia River carried north by currents or outflow carried south from Grays Harbor. The proportion each of these sources is of the total inflow in any given tide is dependent on local and regional wind and current patterns at the time, the character of the tidal cycle and the runoff conditions in the rivers feeding into the Columbia and Grays Harbor estuaries. The incoming water then may vary considerably in its source and character. Examples of unique materials which enter the bay with the marine inflow are sulfite waste liquor and nuclear by-products.

Standards and Regulations

Man uses the estuary for the production of food, transportation, waste disposal and recreation. He uses the adjacent shoreline and tributary streams for habitations, industrial sites, farming, forestry, etc. His activities have a profound effect on the estuary and can seriously alter the ability of the estuary to serve his needs. The water of the estuary is often measured in terms of its temperature, acidity, disolved oxygen content, bacterial characteristics and clarity. These are simple measurements which do not indicate

the actual character of the system but indicates something of its condition. They are often used to characterize the quality of the water. These measurements do not indicate the nutrient levels of the estuary, the sediment bed load of the streams entering the estuary or circulation patterns within the estuary. They thus serve only to provide an indication of the quality of the waters in terms of those uses to which the waters are to be subjected by man. They are thus useful as a basis for regulation.

Water Quality Standards*

The Washington State Department of Ecology is responsible for maintaining water quality standards which preserve and enhance existing water quality in the State to provide for present and future uses. Standards were first written by a predecessor agency, the Washington Water Pollution Control Commission, and were adopted October 8, 1945.

Although the standards have been amended several times since 1945, the only major revision occurred during 1967-69 in response to the Federal Water Quality Act of 1965, which required the State to substitute numerical values and specific requirements for the broad statements contained in the original standards.

Washington State surface waters are currently classified by a system which identifies present and potential uses and attaches specific water quality criteria to protect those uses. The State has five use classes: Class AA waters, Class A waters, Class B waters, Class C waters, and Lake Class waters.

As shown in Table 2, Class AA waters include uses that demand very high water quality, so these criteria are the most restrictive. At the opposite extreme are Class C waters with uses that require a water of lesser quality. Class C criteria are therefore least restrictive.

Class AA waters generally exist in upper stream reaches where waters are cold, turbulent, and fast. Here a stream's self-purification capacity is at its highest level. It is highly potable water, and fish spawning occurs naturally. The use, quality, and consequently the class change naturally as it proceeds toward lower elevations.

In some cases, low water quality may result primarily from natural occurrences, e.g. stream channel scouring during high runoff periods causes muddy water; warm water is sometimes traced to natural hot springs, etc. Natural conditions are recognized in some criteria by such phrases as "when associated with a fecal source – from human activities – above natural conditions." In addition to specific references to natural conditions, the water quality standards contain a general provision stating, "Whenever the natural conditions are of a lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria."

General Pollution Control Problems

Point Sources

Point source pollution enters receiving waters through a channel, outfall, pipe, or other fixed point of entry. There are approximately 785 municipal and industrial discharges in Washington State, ranging from over 100 million gallons to just a few gallons each day.

* Extract from State of Washington Water Quality Assessment Report
Vol.I 75-8 June 1975

Table 7

Summary of Water Quality Criteria

Class Designation	Typical Uses	(1) Dissolved Oxygen (mg/l)	(2) Temperature (°F)	(2) Total Dissolved Gas (% of Saturation)	pH	(3) Turbidity (JTU)	(2) Total Coliform (median values) (organisms/100 ml)
CLASS AA Exceeds requirements for substantially all uses	Potable Water supply; fishing swimming; fish and shellfish reproduction and rearing						
Fresh Water		9.5	60	110	6.5-8.5	5	50
Marine Water		7.0	55	110	7.0-8.5 (Var. 0.10)	5	70
CLASS A Meets or exceeds requirements for substantially all uses	Potable Water supply; fishing; swimming; fish and shellfish reproduction and rearing						
Fresh Water		8.0	65	110	6.5-8.5	5	240
Marine Water		6.0	61	110	7.0-8.5 (Var. 0.25)	5	70
CLASS B Meets or exceeds requirements for most uses	Industrial and agricultural water supply; fishing; shellfish reproduction and rearing						
Fresh Water		6.5	70	110	6.5-8.5	10	1,000
Marine Water		5.0	66	110	7.0-8.5 (Var. 0.5)	10	1,000
CLASS C Meets or exceeds requirements of selected and essential uses	Cooling water; fish passage; commerce and navigation						
Fresh Water		5.0	75	110	6.5-9.0	10	1,000
Marine Water		4.0	72	110	7.0-9.0 (Var. 0.5)	10	1,000
LAKE CLASS Meets or exceeds requirements for all uses	Potable Water supply; fishing; swimming; fish and shellfish reproduction and rearing	(4)	(4)	110	(4)	5	240

(1) Shall exceed the values shown.
(2) Shall not exceed the values shown.
(3) Shall not exceed the values shown beyond naturally occurring concentrations.
(4) No measureable change from natural conditions.

Municipal Wastes

Municipal wastewater consists of sanitary wastes, household chemicals, and often industrial chemicals, oils, and solids from community businesses. Municipal sewage treatment plant waste usually contains suspended and dissolved solids, chemical nutrients, and bacteria and other microorganisms, although many other pollutants can sometimes be present. Generally, there are three levels of municipal waste treatment. Primary treatment removes most of the suspended solids; secondary treatment removes nearly all suspended and most dissolved solids; while advanced waste treatment (sometimes called tertiary) removes still more suspended and dissolved solids and may in addition remove a substantial portion of one or both of the nutrients found in municipal wastewater, which are the phosphates and nitrogen compounds. All treatment levels use a chemical to kill bacteria and microorganisms — usually chlorine. Initial cost and operating expenses increase substantially between primary, secondary, and advanced waste treatment.

The State still has water quality problems caused by municipal discharges. Sometimes water quality impact may be reduced by better plant operation or a relatively small facility improvement. In cases of antiquated or undersized facilities, new plants must be built. The necessary improvements are required by the waste discharge permit issued to each municipality.

Industrial Wastes

Washington's diversified industries (forest products, food products, aerospace, and many other supporting industries) all generate waste discharges, many of them extremely difficult to treat. Sometimes primary and secondary waste treatment are sufficient to effect the desired quality of effluent, but toxic wastes, colored wastes, etc., must have advanced waste treatment.

The potential for significant ecological damage by industrial discharges far exceeds that for municipal discharges.

Nonpoint Sources

Construction of more and better treatment facilities has reduced the impact of municipal and industrial waste discharges, so that we can more clearly see the importance of nonpoint wastes (wastes which enter streams as runoff, drainage or seepage and not via pipes, drains or channels) in controlling receiving water quality. We now know that even after present waste treatment facility construction programs are completed, over one-half the State's waters will not meet established criteria. How much of this reduced water quality can be attributed to nonpoint source wastes and how much is due to naturally-occurring conditions is generally unknown at this time. To separate natural and nonpoint water quality impacts is usually very difficult. For instance, it is difficult or impossible to determine what percentage of stream sediment is caused by man's activities and how much by natural stream channel scouring or what portion of waterway minerals (including nutrients and metals) results from man's activities and what portion from dissolution of naturally-occurring minerals.

When investigations involve groundwater, distinguishing man-induced constituents from natural constituents is even more complex.

It is imperative to study those waters made substandard by nonpoint and natural sources and to determine which waterways have lowered water quality caused primarily by nonpoint wastes. This knowledge will permit design and implementation of effective waste abatement programs.

Nonpoint wastes originate from human activities, including agriculture, domesticity, forestry, dredging, recreation, and mining. The cause and effect relationships and a general identification of solutions are listed in Table 3.

Table 8
Nonpoint Source Categories

Category	Activity	Waste	Affect	Solution
AGRICULTURE	Tillage, fertilization, irrigation, spraying, animal feedlot operation	Sediments & pesticides transported either by wind or water, excess fertilizer, manure	Inundation of fish spawning beds and smothering aquatic insects by sediments, acceleration of weed and algae growth by fertilizers and manure, killing aquatic life by pesticides, suffocation of fish and other organisms through removal of oxygen by manure, reduction of sanitary quality by manure	Use of sound farm management practices, care in the quality and method of chemical application, technical assistance to farmers through the Dept. of Ecology, US Soil Conservation Service, Soil Conservation Districts, Irrigation Districts, W. State Farm Extension Service & others
DOMESTICITY	General domestic activities, construction, operation of septic tanks, collection and disposal of solid wastes	Litter, household & industrial chemicals (washing compounds, oils, fertilizers, toxicants etc.), sediment due to removal of protective vegetation, sanitary wastes	Reduction of aesthetics due to paper, rags, tires etc. being carried by wind, rain or being dumped into waterways, reduction in potability of groundwater due to contamination by bacteria & chemicals from septic tanks and solid waste sites, other effects similar to the above for sediments, fertilizers, pesticides (toxicants) and manure (domestic animals, sanitary wastes and wastes from solid waste sites	Efficient municipal refuse and street cleaning programs. Adherence to sound septic tank installation practices, careful selection of solid waste sites to reduce or eliminate the possibility of leaching

Table 3

Nonpoint Source Categories (Cont.)

Category	Activity	Waste	Affect	Solution
FORESTRY	Road construction, cutting and handling logs, spraying, fertilization	Sediment, debris from road construction trimming trees and handling logs, insecticides, fertilizers	Debris transported to the streams during storms can produce log jams, change stream channels and eventually reduce the stream's oxygen. Debris from moored log rafts can adversely affect oxygen concentrations and aquatic organisms. Effects from sediment, insecticides and fertilizers are similar to those stated under agriculture.	Use of sound logging practices, care in the quantities and method of chemical application, storing logs on land (cold decking) rather than in waterways, reforesting cut lands immediately
DREDGING	Dredging sediment, depositing dredging spoils	Materials contained in the bottom deposits are brought into solution or suspension	Waterway Oxygen can be depleted, toxicants can be released, and settling of suspended solids can effect bottom dwelling organisms. Effects can occur at the dredging site or deposition site	Sediment samples should be collected before dredging to ascertain oxygen demand and sediment toxicity. Plan work & deposition site to minimize environmental damage
RECREATION	Boating, picnicking, hiking, fishing	Sediment, sanitary wastes, litter, oil	Effects similar to domesticity but generally to a lesser extent	Efficient refuse collection programs. Effective anti-litter campaign, portable sanitary facilities to permit boat waste disposal on land
MINING	Deposition of mine tailings (after ore extraction)	Sediment, toxic metals	Similar to other categories where sediment or toxicants are involved	Selection of site to minimize or eliminate leaching from tailings pile, operate a land reclamation program

Willapa Bay and its tributary streams are all Class A waters. The waters of the state are divided into segments. The segments indicated for Willapa Bay and its tributaries are illustrated in the map which is figure 14. These segments are classified in terms of their relationship to current water quality standards. These classifications are described below:

Effluent Limited Segments - Those in which the present water quality is meeting, and will continue to meet, the applicable water quality standards or can meet water quality standards after the application of secondary and BPT effluent limitations to the segment's point source dischargers.

Water Quality Limited Segments - Those in which the present water quality is below state standards and will continue below the standards even after the application of secondary or BPT levels of discharge to the segment's point discharges. If the violations in the water quality limited (WQ) segment are due to point sources, the segment is designated (WQ-PS), if the violations are due to nonpoint sources, the designation becomes (WQ-NPS) and, if they are due to nitrogen supersaturation, then the segment is designated (WQ-PS-GAS).

Classification of Willapa Bay waters is as follows:

Willapa Bay	EFF
Willapa River-from mouth to extent of tidal influence	WQ-NPS
Willapa River-from tidal influence to headwaters	WQ-NPS
Willapa Bay Tributaries	WQ-NPS

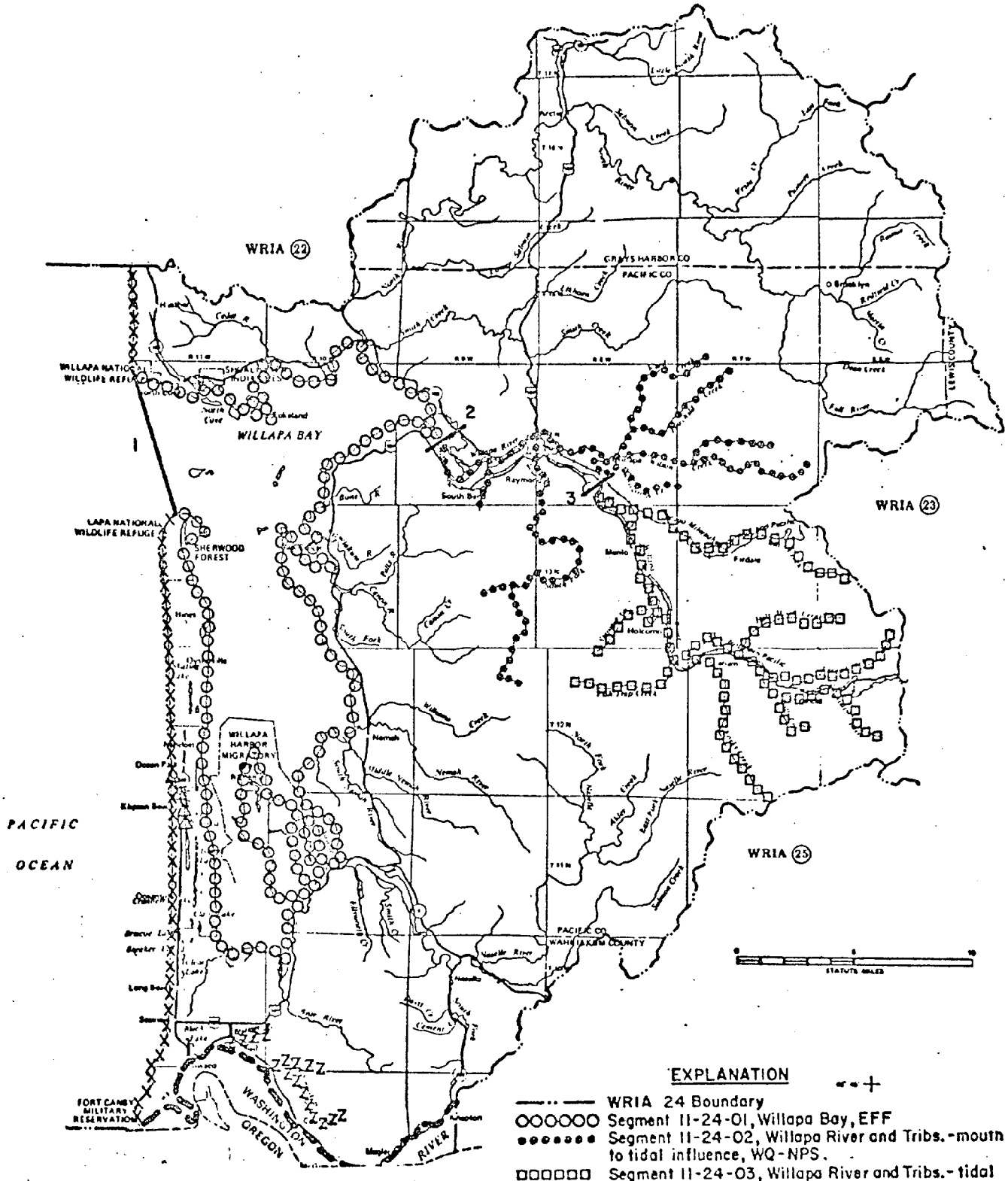

WRIA 22
GRAYS HARBOR CO
PACIFIC CO
WILLAPA BAY
WILLAPA NATIONAL WILDLIFE REFUGE
LAPA NATIONAL WILDLIFE REFUGE
SHERWOOD FOREST
WILLAPA HARBOR MIGRATORY
WRIA 23
WRIA 25
PACIFIC OCEAN
PACIFIC CO
WAHKIAKUM COUNTY
FORT CANBY MILITARY RESERVATION
WASHINGTON
OREGON
RIVER
STATUTE MILES
EXPLANATION
WRIA 24 Boundary
Segment 11-24-01, Willapa Bay, EFF
Segment 11-24-02, Willapa River and Tribs.-mouth to tidal influence, WQ-NPS.
Segment 11-24-03, Willapa River and Tribs.-tidal influence limit to headwaters, WQ-NPS.
Segment 11-24-04, Willapa Bay Tribs., WQ-NPS
Segment 11-24-05, Pacific Ocean, EFF
Segment 11-24-100, Lakes
Segment 26-24-99, Columbia River Tribs.
Segment 26-01-00, Columbia River, WQ-PS-GAS
Dividing Zone -see notes.
Segment 11-24-99, Pacific Ocean Tribs.

Figure 14

Water Quality Planning

In December 1973 the Pacific County Regional Planning Council completed a Water Quality Management Plan for Willapa Bay. This plan was prepared to meet Federal and State requirements for local planning to control and prevent water pollution, paricularly from municipal and industrial wastewaters. The plan was adopted by the Department of Ecology in October of 1974. An addendum was prepared by the Department of Ecology to meet further Federal requirements and adopted at a public meeting August 26, 1975. Table II-I of the WQMP lists the Water Quality Management plan program elements and recommends means of implementation of the plan. The WGMP also contains a Sewage Drainage Basin Plan which indicates the steps necessary to update and provide adequate municipal waste treatment in the planning area. Industrial waste sources are described with emphasis on point sources of pollution. The Forest Practices act was in the legislature at the time the plan was developed so that some aspects of the forest industry effects on water quality were expected to be considered in the pending legislation.

Material presented here will augment data previously presented in the Water Quality Management Plan and not repeat the information unless it is required because of the different context of the present plan. It will also concern itself with non-point sources which were not a primary concern of the WQMP.

Table 9

WATER QUALITY MANAGEMENT PROGRAM
Part I--INSTITUTIONAL AND SEWERAGE WATER POLLUTION PROBLEM AREAS

Section(s)1/	Water Pollution Problem Area	Recommendations for Implementation of the Water Pollution Control and Abatement Plan	Responsible Agencies	Time Schedule	
				Begin	Complete
I-A	Lack of an approved Water Quality Management Plan	Review, revise and formally adopt the Water Quality Management Plan for the Willapa Bay Basin as described in the report to which this table is attached and according to the schedule in Table I-1.	Council, River Basin Coordinating Committee, County, Cities, Towns, SSD, DOE, EPA	1974	1974
		Amend the Plan as necessary to conform to changed conditions and the resulting sewer system proposals and designs.	(same as above)	CTG	CTG
		Revise and update the Plan at 5-year intervals or less.	(same as above)	1978	1978
I-A	Lack of a permanent River Basin Coordinating Committee	Organize a citizen's advisory group to act as a permanent body overseeing implementation of the Plan and other plans, such as the Solid Waste Management Plan and Shoreline Master Program, in order to replace existing ad-hoc committees.	Council	1974	CTG
V-C & V-4	Inadequate or non-existent sewage collection and treatment facilities	Proceed to develop or upgrade sewer systems in conformance with the Plan as outlined in Table V-23 and on Plates V-1 through V-15, including the study of a regional system in the lower Willapa River valley, the development of systems in high construction priority areas, and the upgrading and/or expansion of existing systems to meet federal requirements and population growth.	County, Cities, Towns, SSD, port and water districts	1974	CTG
V-L	Complex problems in providing facilities to lower Willapa River Valley	Carry out complex facilities planning effort (following federal guidelines) to identify the most cost-effective approach to developing and upgrading sewage collection and treatment facilities in Raymond, South Bend, East Raymond, Willapa and other adjacent unincorporated areas.	Raymond, South Bend, County, Willapa Valley Water District	1974	1974
V	Need for sewerage agency in unincorporated areas	Adopt a resolution to develop (or take over responsibility for) and operate sanitary systems in unincorporated areas remote from existing community systems; this is to be done alone or in conjunction with port or water districts	County	1974	1974

Table 9 (cont.)

Part 1--INSTITUTIONAL AND SEWERAGE WATER POLLUTION PROBLEM AREAS (CONTINUED)

Appendix F-13	Immediate need for sewage systems in some areas	Begin implementation of the above resolution by taking the actions outlined in the appendix according to the construction priorities given in Table V-23--i.e., considering Chinook or Ocean Park as first priority.	County	1974	CTG
V-O	Lack of staff for implementation	Employ a staff engineer part-time to begin action on establishing sewer system(s). Establish a sewer division in the County Public Works Department.	County	1973	CTG
V-T and Appendix F-12	Need for control over provision of sewage facilities to land developments.	Adopt regulations limiting the use of on-site sewage disposal systems (septic tanks) to rural areas. Require that minimum lot sizes for on-site disposal systems be determined by soil characteristics and type of water supply, approximately as specified in the Proposed Rules and Regulations of the State Board of Health for such facilities.	Health District	1974	1974
		Amend the zoning and subdivision ordinances to enforce lot size requirements as established by the Health District for proposed developments utilizing on-site disposal systems.	County Planning Commission, County Board of Commissioners	1974	1974
		Require that proposed high density developments be served by a conventional sewage collection system and a permanent treatment facility; except that an interim treatment facility may be allowed if an existing or completely designed regional facility can be connected to within seven years or so.	County Planning Commission County Board of Commissioners, Health District		
V-G, V-T and Appendix F-9	Need for acceptable method of disposing of treatment plant effluent on the Peninsula	On the Peninsula and in similar coastal areas, require that new permanent treatment plants provide an advanced (tertiary) level of treatment adequate to allow long term disposal of the effluent to drain fields or through spray irrigation of vegetated areas. Accept responsibility for operating and maintaining only those systems meeting the preceding requirements.	County or other responsible local government	1974	CTG

Part 1--INSTITUTIONAL AND SEWERAGE WATER POLLUTION PROBLEM AREAS (CONTINUED)

IV-B	Lack of data on effects of on-site disposal systems.	Investigate condition and failure rate of existing on-site disposal systems (septic tanks). Investigate extent of contamination of domestic ground-water supplies by such systems.	Health District	1974	CTG
IV-A	Inadequate sewage treatment plant operating records	Maintain daily treatment plant records of sewage flow, temperature, settleable solids 2/, dissolved oxygen 2/, 5-day BOD 2/, pH 2/, chlorine residual and total coliform.	Cities, SSD	1974	CTG
III-B	Need for water supply exploration and development on the Peninsula	Explore ground and surface water supply sources on and near the Peninsula and set up organizational and financial means for developing and administering a water supply utility to meet future Peninsula water needs.	Council, County, State and Federal Agencies, Private Water Utilities	1974	1977

SOURCE: Delta Engineering

ABBR: Council - Pacific County Regional Planning Council
SSD - Seaview Sewer District
County - Pacific County Board of Commissioners
See last page of Part 2 of table for additional abbreviations.

NOTES: 1/ See the given section in the Summary or the complete text of the Plan for further information.
2/ These substances are to be measured both in the raw sewage and the effluent.

Table 1o

WATER QUALITY MANAGEMENT PLAN (1973-1983)

Part 2--OTHER WATER POLLUTION PROBLEM AREAS

Section[1] (VI-)	Water Pollution Problem Area	Recommendations for Implementation of the Water Pollution Control and Abatement Plan	Responsible Agency(s)[3] DOE	County	City/Town	Other	Time Schedule Begin	Complete	Priority[7]
A	Logging Practices	(1) Analyze the effects of forest management and harvest operations on other forest values, especially water resources, and define forest practices which permit optimum use of timber resources while protecting those values; those practices to serve as county recommendations to the forest practices advisory committee (if the present forest practices bill is passed) or similar body and also to be implemented on shorelines coming under the jurisdiction of the Shoreline Management Act.		X		NOTE[2]	1973	1974	H
		(2) Assist and cooperate in the administration of programs established under (1) above.	X			DNR, Fisheries, Game	1973	CTG	H
		(3) Continue and expand investigations into the effects of Basin logging practices on the quality of both fresh and estuarine water resources.	X			EPA, State Agencies, Wood Industry, Univ.	1974	CTG	H
		(4) Establish an educational program on good logging practices for the small woodlot operator.				Extension Service, DNR	1974	CTG	M
B	Log Storage and Handling	(1) Make the recommendations listed in Log Storage and Rafting in Public Waters, Pacific Northwest Pollution Control Council, conditions of shoreline management permits granted for projects of this nature, UNLESS, the Department of Natural Resources makes those same recommendations (in substance) a condition of all booming and rafting leases.		X	X	-	1973	CTG	H
		(2) Monitor precipitation and sprinkler leachate in runoff from land log storage areas and advise on the need for treatment, . . . and make leachate treatment or recirculation, if needed, a condition of shoreline management permits granted for the establishment or expansion of log storage areas.	X			-	1974	CTG	M
				X	X	-	1974[6]	CTG	
		(3) Prepare recommended practices on land log storage, . . and implement those practices through shoreline management permit conditions.	X	X		NOTE[2]	1973	1974	H
				X	X	-	1974	CTG	
C	Agricultural Wastes	(1) Provide matching funds for assisting farmers to carry out environmentally protective practices, as was formerly done under the REAP program.				Federal & State Gov'ts.	1974	CTG	H
		(2) Recommend guidelines on the management of livestock wastes in Western Washington.	X			-	1973	1974	L
		(3) Develop an animal waste element as part of the SWCD long-range program; county government to participate in the process of doing so.		X		SWCD	1974	CTG	H
		(4) Determine the reasons for the relatively high nitrate levels in the Willapa and Naselle Rivers.	X			-	1974	1977	L
D	Chemicals Usage	(1) Provide a suitable place for the disposal of common pesticides and other containers through implementing proper disposal procedures at the proposed central sanitary landfill site, those procedures to meet the minimum criteria described in the Washington Pest Control Handbook, W.S.U. and Department of Agriculture, November 1971, pp. 75-76. and applicable state regulations, OR, if local conditions are not suitable for disposal of such wastes, provide collection facilities and shipment to an approved disposal site.		X		-	1974	CTG	M
		(2) Investigate and assess the magnitude, character and water quality effects of existing chemicals usage on forest lands and of future changes associated with intensive forest management practices.	X			DNR, Fisheries, Game	1974	CTG	H
		(3) Continue research on the side effects of the use of Sevin on oyster beds and on non-chemical or biological means for controlling ghost shrimp.				Fisheries	CTG	CTG	H
		(4) Stop routine herbicide spraying on portions of rights-of-way within buffer zones established along streams and estuarine waters and preferably use mechanical means of weed control instead; any spraying within buffer zones to be allowed only on a case-by-case approval basis and to be done selectively using hand equipment. The spraying agencies to decide upon buffer widths in conjunction with the Departments of Agriculture and Ecology. If possible, the same agencies to discontinue spraying altogether.	X	X		State & County Highway Dept's. DNR, BPA, AGRIC.	1974	CTG	H

SOURCE, ABBR. AND NOTES SEE LAST PAGE OF TABLE

Section 1/ (VI-)	Water Pollution Problem Area	Recommendations for Implementation of the Water Pollution Control and Abatement Plan	Responsible Agency(s) 3/			Time Schedule		Priority 7/
			BOE	County	City/Town / Other	Begin	Complete	
		(5) Investigate the effects on water quality of surface drainage from agricultural lands, including hay cropland and cranberry bogs, after pesticide applications.	X		-	1974	CTG	L
		(6) Establish an educational program on proper chemicals usage for farmers, small forest land owners and home owners, including education on non-chemical alternatives.			Extension Service	1974	CTG	M
(E)	Dredging	(1) Apply conditions protective of water quality to shoreline management permits granted for dredge spoil disposal sites; those conditions to require, if necessary, complete dike enclosure, adequate outlet structures, data on the characteristics of the material dredged, and so on.		X	X -	1974	CTG	H
		(2) Advise the local governments on the necessary conditions to be applied in (1) and help inspect the dredging operations for compliance with those conditions.	X		Corps	1974	CTG	H
		(3) Continue monitoring water quality in the vicinity of dredging activities and disposal site outlet structures and publish the results.	X		Corps	1974	CTG	H
(F)	Solid Waste and Waste Oil	(1) Implement a version of the comprehensive solid waste management plan which calls for a central sanitary landfill site with leachate treatment meeting federal and state standards.		X	X -	1974	NA	H
		(2) Issue water pollution control guidelines relating to the location and management of industrial wood-waste disposal sites; those guidelines to be implemented through the disposal site permit required by the health department, or through the shoreline management permit system for those proposed sites coming under the jurisdiction of the Act.	X	X	NOTE 2/	1973	NA	N
				X	X PHD	1974	CTG	
		(3) Develop methods for disposing of or utilizing industrial wood-wastes which do not result in the discharge of leachate to ground or surface waters in sufficient amounts to cause violations of state water quality criteria.			Wood Industry	CTG	1977 6/	H
		(4) Implement the solid waste management plan on schedule.		X	X	1974	CTG	H
(G)	Wastes from Watercraft	(1) Provide sewage pump-out and treatment facilities within two years of the establishment of the USCG regulation on marine sanitation devices.			X Port Districts	1976 5/	1976 5/	H
		(2) Make the provision of sewage pump-out and treatment facilities as scheduled in (1) a condition of shoreline management permits granted for the construction or expansion of moorage facilities.		X	X -	1974	CTG	H
		(3) Require houseboats to meet the local sewage treatment standards applied to new residential units, enforcement being through shoreline management permit conditions and/or public health regulations.		X	X PHD	1974	CTG	H
(H)	Erosion and Siltation	(1) Continue to inventory roadside erosion sites and establish priorities for stabilization treatment.		X	State Hwy. Dept.	1973	CTG	H
		(2) Cooperate in carrying out treatment measures for areas identified in (1).		X	SCS	1974	CTG	H
		(3) Carry out treatment measures for areas identified in (1).			State Hwy. Dept.	1973	CTG	H
		(4) Continue to inventory logging roadside erosion sites, establish priorities for stabilization treatment, and carry out treatment measures.			Wood Industry, DNR	1973	CTG	H
		(5) Carry out stream bank protection measures, provided they do not conflict with the Shoreline Management Act Guidelines on shoreline protection.			Corps, SWCD, Private Entities	1974	CTG	H
(I)	Urban Runoff	(1) Investigate the relative effects of urban and non-urban runoff in areas similar to the Basin and prepare guidelines for the control of any significant quantities of pollutants in urban runoff.	X		EPA	1973 4/	NA	H
		(2) Continue and expand street cleaning programs with efforts being directed toward more frequent cleaning during the dry months.			X -	1974	CTG	
		(3) Investigate the need for and feasibility of a street cleaning program during the dry months for selected unincorporated communities.		X	-	1974	1974	
		(4) Include in subdivision regulations performance standards designed to reduce the amount of sediment transported from soils exposed as a result of urban development activities.		X	-	1974	1974	

SOURCE, ABBR. AND NOTES SEE LAST PAGE OF TABLE

tion[1]	Water Pollution Problem Area	Recommendations for Implementation of the Water Pollution Control and Abatement Plan	Responsible Agency(s)[2] DOE	County City/Town	Other	Time Schedule Begin	Complete	Priority[7]
J	Reservoirs	(1) If the Willapa and/or A'Chote Project should go ahead, carry out a thorough investigation of the effects on downstream and estuarine water quality of reservoir construction and operation; the investigation to include both an analysis of the effects of flow augmentation and an estuarine study detailed enough to allow an assessment of the potential effects of waste discharges from any new industry attracted to the area by the reservoir's assured water supply.			Bureau of Reclamation or Other Implementing Agency	NA	NA	L
K	Water Resources Data	(1) Increase the sampling frequency and the number of locations sampled for the water quality sampling programs carried out in both stream and estuarine waters.	X		EPA, USGS, Fisheries	1974	CTG	H
		(2) Assess the extent of contamination due to subsurface sewage disposal of ground-water used for domestic supplies in coastal and other disposal proulem areas.			PHD	1974	1975	H
		(3) Investigate and determine the causes of water quality problems in the lower Willapa River.	X	X	EPA, Wood Industry Oyster Industry	1973	CTG	H
		(4) Carry out a comprehensive physical and biological study of Willapa Bay and the watershed draining into it, including the effects of non-point and point sources of pollution on Bay water quality and productivity.	X	X	State and Federal Natural Resource Agencies, Private Industry, Universities	1974	CTG	H

SOURCE: Complete text of Plan.

ABBR:
- CTG - Continuing action on the recommendation
- NA - Not applicable
- AGRIC - State Department of Agriculture
- BNR - Burlington Northern Railroad
- BPA - Bonneville Power Administration
- Corps - U. S. Army Corps of Engineers
- DNR - Department of Natural Resources
- DOE - Department of Ecology
- EPA - Environmental Protection Agency
- Fisheries - Department of Fisheries
- Game - Department of Game
- PHD - Grays Harbor-Pacific Public Health District
- REAP - Rural Environmental Assistance Program
- SCS - Soil Conservation Service
- SWCD - Soil and Water Conservation District
- USCG - U. S. Coast Guard
- USGS - U. S. Geological Survey
- UNIV - Universities

NOTES:
1/ For the present status of and future trends in a given water pollution problem area, see the given section in either the Summary or the complete text of the Plan.
2/ To be done with the assistance of the U. S. Forest Service staff member on loan to the Pacific County and Grays Harbor County regional planning bodies.
3/ Agency(s) suggested as having major responsibility for implementation.
4/ Date set to meet 1972 Federal water quality legislation requirements.
5/ Assuming USCG regulations are issued in 1974; otherwise, two years after issuance.
6/ Treatment may be required by 1977 to meet Federal requirements.
7/ Priority based on importance to protecting water quality and on ease of implementation: H=High; M=Medium; L=Low.

Current Evaluation of Water Quality

Municipal and industrial wastes in the Willapa River provide the major water quality problem recognized in Willapa Bay. Failure of the sewage collection systems in Raymond and South Bend during periods of high rainfall along with discharges from the mills and processing plants results in high bacterial counts in the lower river and adjacent bay.

Areas for growing oysters for market are certified as to their sanitary condition by the Department of Social and Health Services. At present a health line exists at the mouth of the Willapa River east of which no oyster beds are certified. In the winter of 1975 the Department of Social and Health Services decertified beds, temporarily westward from the health line to Bruceport, because of expected high bacterial counts resulting from flooding in the South Bend-Raymond area. Social and Health Services predicts that if additional outfalls are established in the bay the result will be further reduction in oyster growing areas.

Sulfite waste liquor concentrations in the bay run rather consistently between 5 and 10 mg/1. However, when deeper samples are taken the concentrations are over three times that level.

The level of chemical polluntants and radiological products in Willapa Bay is not regularly monitored. Short term sampling in the past has revealed the presence of both sources of pollution.

An oyster hatchery in the Nahcotta Basin reports frequent occurences of high concentration of microscopic fibers in bay waters. These have been identified as manufactured rather than natural fibers.

Oystermen probably have the most intimate day to day contact with bay waters and report much slower growth rates in oysters, slower recovery of fatness after spawning and less frequent successful oyster sets in recent years. These, in part, reflect a reduced productivity in Willapa Bay, which in turn indicates conditions which inhibit nutrient generation low in the food chain. This also reflects both salt marsh reduction and conditions of water quality unfavorable to full development of waste utilitzation organizms.

RECREATION

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RECREATION

INTRODUCTION

At high tide Willapa Bay has one hundred twenty two square miles of surface area. As the tide receeds fifty square miles of tidelands are exposed. The shoreline around the bay and its major island, Long Island, is one hundred twenty seven miles long. Ten large streams or rivers enter the bay, primarily on its east and north shores. Willapa Bay is oriented north-south in its longest dimension of twenty five and one half miles. It is slightly over six miles in width. Summer winds, which are generally from northwesterly direction, and winter winds, generally from southeasterly to southwesterly, have long fetches due to the orientation and configuration of the bay. Easterly winds develop in very warm summer weather and very cold winter weather.

Rainfall in the bay varies from 70 to 90 inches per year, most of which falls between October and June. Tidal ranges are from seven to ten feet. Runoff to the bay from its freshwater tributaries reaches approximately three million acre feet per year. Summer winds are usually strong steady winds developing through the morning hours and slacking after sunset. Winter storms often reach gale force and may come up suddenly. In clear weather fog may build up in the morning and late afternoon. The coldest weather occurs in January, February and early March. The freshwater streams may freeze over and usually the borders of the bay have a buildup of ice during very cold winters. In the summer the incoming ocean water is cooler than the freshwater from the tributary streams while in the winter the opposite condition is often the case with the ocean water being warmer than that from the rivers and streams. Water temperature of seventy degrees may be reached in the summer in Willapa Bay dropping to thrity five to forty in the colder months.

Deepwater shorelines are available only in the tributary areas where river channels are found close to the banks. Access to the bay water from dry land is available only at higher tides around the perimeter of the bay itself except where artificial basins or docks have been developed. Such facilities are found at Nahcotta on the west shore of the bay and at Tokeland on the north shore of the bay. Public deep water access to the bay by way of the tributary streams is developed along the Willapa River, and at Bay Center on the Palix River on the east side of the bay.

Shoreline profiles are low along the west side of the bay but are abrupt on the east side due to the nearly continuous terraces developed there with elevations of about twenty feet. Highway 101 borders the bay in the southeastern portion from Bear River to Naselle River and from Bone River to Bruceport. From North River

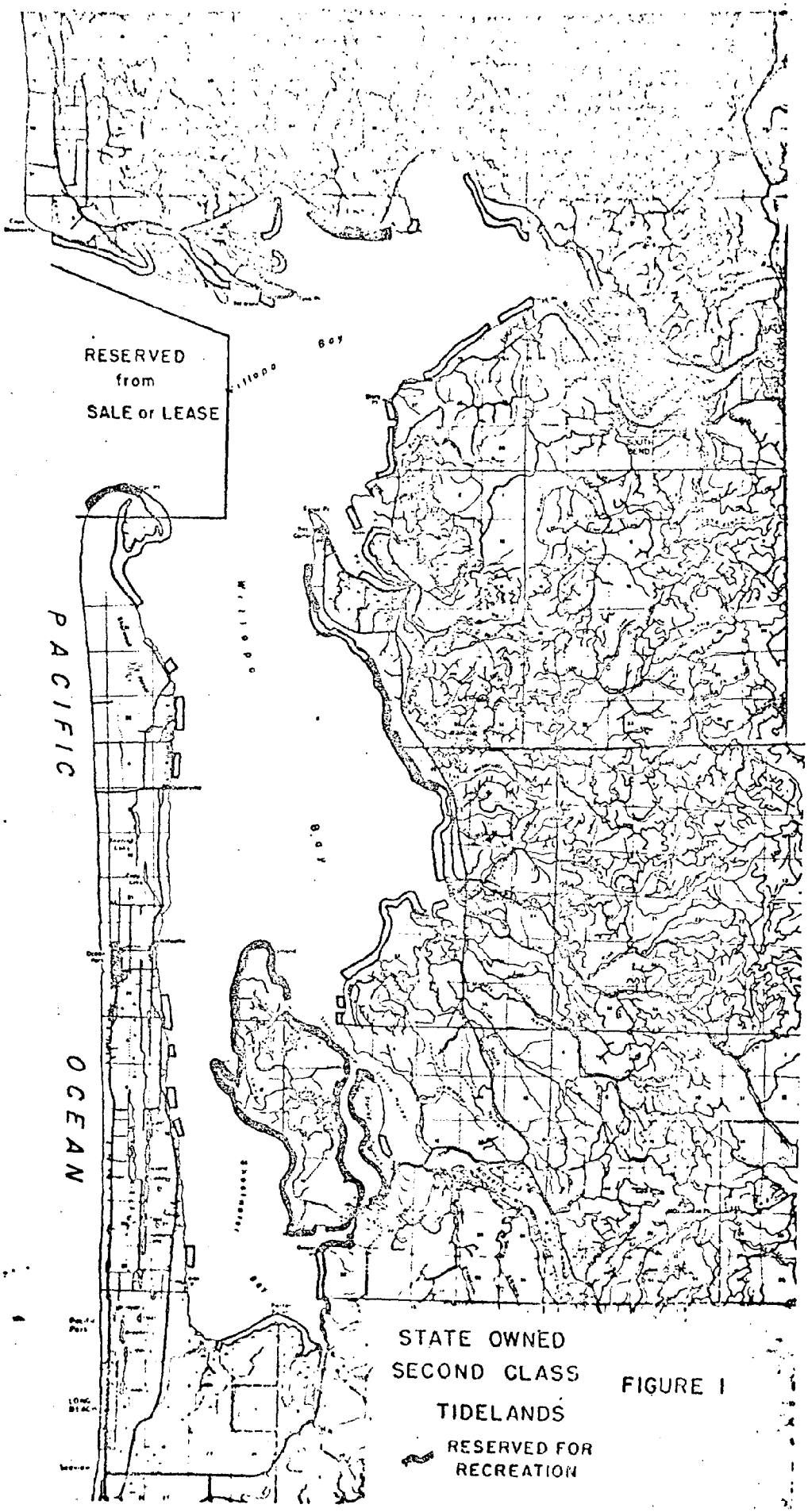
RESERVED
from
SALE or LEASE
PACIFIC
OCEAN
STATE OWNED
SECOND CLASS
TIDELANDS
RESERVED FOR
RECREATION

FIGURE 1

to Cedar River, along the north side of the bay, access is possible from Highway 105. A total of approximately ten miles of shoreline of the bay is directly accessable from public highways. A few additional miles provide vistas of the bay but not access. Very few areas are developed for parking off the highway at points where the bay is visible or accessible.

OWNERSHIP OF SHORELINE

Thirty three miles of the upland bordering Willapa Bay is in public ownership. Of this public upland only one and one half miles does not have abuting publicly owned second class tidelands. In addition about the same amount of second class tidelands is in public ownership but with private upland ownership. Of the total seventy six miles of public tidelands along the shores of Willapa Bay thirty miles has been withdrawn from sale or lease and reserved for recreation. Table 1 indicates the mileages in various types of private ownership of both abuting second class tidelands and upland shoreline. Figure 1 illustrates the location of publically owned second class tidelands bordering the shoreline and also identifies those reserved for recreation. Second class tidelands extend to extreme low tide after 1911 or to deeded oysterland boundaries or Oyster Reserve boundaries. Because of the highly variable distance from the shoreline to the waterward boundaries it is simpler, for comparative purposes, to refer to the linear shoreline extent of ownership rather than to use acreage.

TABLE 1

Shorelines Ownership - Willapa Bay
in Miles

Ownership	2nd Class Tidelands	Upland Shoreline	Ownership
Public	76	33	Public
Oystermen	29	--	----------
Individuals	18	69	Small Private
Lumber Co.s	4	25	Large Private
TOTALS	127	127	

The 1927 legislature withdrew a large area at the mouth of the bay from sale or lease, this includes the northern tip of the Long Beach Peninsula. In 1933 the legislature reserved second class tidelands on the west side of the Bay Center Peninsula for recreational park purposes. A large area north of the mouth of the Nemah River was withdrawn from sale or lease by the 1955 legislature and reserved as public areas for recreational use and for the taking of fish and shellfish for personal use. The Hawks Point area appearing in Figure 1 was reserved from sale or lease by order of the Land Commissioner in 1961. A use deed to the U. S. Fish and Wildlife Service reserves the second class tidelands around Long Island and along the easterly side of Long Island Slough for recreation.

The recreational tidelands of Long Island and the Long Island

Slough are only readily accessable by boat. The tidelands along the Bay Center Peninsula are accessable by county road. The beach area at the north end of the bay west of Hawks Point is accessable from the State Highway (105).

CURRENT RECREATIONAL USES

FISHING

Marina Facilities near the mouth of the bay serve sport fishermen bound for ocean fishing. The Tokeland small boat harbor is the best situated for this purpose and has been recently expanded. Ocean fishing is primarily directed toward salmon, Chinook and Silvers, but does include some bottom fish.

Salmon are also fished in the tributary streams. Access to these streams is by boat landings which are situated on most of the larger rivers. Steelhead are probably the most sought after fish in the tributaries. Cutthroat are usually trolled for low in the drainages in the brackish water areas.

Perch, flounder and cutthroat are caught from docks in the salt water areas. This attracts many people but space and access to docks is very limited.

A number of quiet freshwater areas have been created through diking or small dams. These have been planted with bass and provide another element in the sport fishery of the area.

Fishing in the bay itself is limited to early season vagrant chinook which move into the bay following food but will not spawn in the Willapa Bay tributaries since their home is in the Columbia River drainage or other coastal areas.

CLAMING

Razor clams occur primarily outside the bay on the ocean fronts but are found on some of the spits in the mouth of the bay. Bay clams consist of the gapper and littleneck clams native to the area and the Eastern or softshell and Japanese Littleneck which have been introduced with oyster transfers or oyster seed imports.

CRABS

Crabs are abundant in Willapa Bay. Personal use crabs are usually taken by the short term visitor with crab rings from docks or boats. Crab pots are also used for catching crabs for personal use but require a larger boat because of their greater size and weight. Pots are usually fished continually rather than on a short term, part of a tide, basis.

OYSTERS

Both the native and the introduced Pacific Oyster occur in

Willapa Bay. Their abundance on public tidelands is very low.

BEACH ACTIVITIES

Few areas along the shoreline of Willapa Bay provide a typical recreational beach situation. Before the ocean beaches were readily accessable Rhoadesia Beach on the Bay Center Peninsula and the beaches at Cape Shoalwater were used as bathing beaches. These areas are still used for this purpose. Most beach areas along the shoreline of the bay do not provide walking or bathing conditions because of their soft character or lack of access.

HUNTING

Willapa Bay is a major stopover area for migratory ducks and geese. The Fish and Wildlife Service has established a major refuge for migratory birds in the bay and have established public hunting areas. These areas are indicated on Figure 2. Other areas are also available around the bay.

CAMPING

A number of public and private campgrounds have been developed, many of which are located adjacent to the bay. Figure 2 indicates the location of these areas which vary considerably in the facilities available.

The bay and its fauna and flora provides an attraction to those who wish to enjoy viewing the area. This includes those who come to the area for this purpose and those who pause on their way through to some other destination.

BOATING

With its large area and varied shoreline Willapa Bay would appear to be highly attractive to boaters. However much of the bay is very shallow with over half the areas exposed at low tide. Unless a boater is familiar with the position of the deeper channels and the action of the tide there is a considerable risk that he will be stranded on tidelands by the receeding tide. Since many of these tidal areas are isolated from the mainland by sloughs or soft ground a boater stranded by the tide will often have no alternative but to wait for the returning tide. If he has had the bad luck of going aground in a high area or on the higher of the two daily high tides he may have to wait at least twelve hours to get off. In the extreme if he goes aground during the higher tides of the month his boat could be there for a month or longer, although he and his passengers would probably be noticed and removed long before then. The tide presents a real risk to the casual boater in Willapa Bay.

Because of the long fetches present in the configuration of the bay and its exposure to strong summer and winter winds the surface can become very rough, even for commercial vessels, and

may do so in a relatively short time. There is little in the way of protected areas other than the various tributaries and the two protected boat basins at Nahcotta and Tokeland. A boater may well find himself several miles from a protected area when a sudden storm hits.

Sailboats and motor boats do use the bay for pleasure and those that are well prepared can do so in reasonable safety. Recreational boaters should be aware of the risks involved. At least one is lost each year on the Bay.

Boat landings are located at a number of sites around the bay and in the tributaries. Figure 2 illustrates the location of these facilities.

CONFLICTS OF RECREATION AND COMMERCIAL FISHERY USE OF THE BAY

Willapa Bay supports a major commercial fishery. Salmon and Sturgeon are caught by gillnet from June through November, Crabs from January through April or May and to a lesser extent to September, and Oysters which are worked all months of the year with harvesting concentrated from October through May. At all times of the year there is a considerable amount of commercial activity on the bay and various fishing gear in the bay. Conflicts with recreational use of the bay may develop just for use of the surface area.

Twenty five thousand acres of the tidelands in the bay are privately owned and set aside for the commercial culture of shellfish. These areas are not identified other than by the presence of oyster stakes. Oysters are the primary crop raised on these beds with a much smaller areas used for the culture of clams. The oysters are the introduced Japanese Oyster referred to as the Pacific Oyster and are planted by the oystermen. Some natural set occurs in the bay and may occur on suitable substrate in the public tidelands, however these sets are rather rare so that few oysters are to be found on the public lands. Conflicts occur when oysters are removed from private land in the mistaken belief that they are public. Many of the public tidelands are adjacent to private oysterlands. Visitors to the area thus are encouraged to take private oysters when they find none on the public lands. Some private oyster beds are also easily accessable from public roads. As a result of these two factors a considerable amount of oysters and clams are taken from private shellfish beds by recreationists unaware of the difference and by those who come prepared to "gunnysack" considerable amounts of private shellfish. Several areas are particularly susceptable to these problems. They include, Stackpole Harbor, Stony Point, West side of Long Island, Nemah Flats, Goose Point and Hawks Point. In some areas oystermen have had to cease culturing oysters because of the losses encurred from pilfering from the beds.

The Department of Natural Resources and the Department of Fisheries control most of the state owned public tidelands in Willapa Bay. In Puget Sound they have instituted a program for the designation of these areas by signs and planting clams and oysters for the removal by tourists. This program is usually referred to as "Put and Take". Oystermen have discouraged this type of program in Willapa Bay because of the losses from their beds which have resulted without any encouragement.

Any shellfish recreation program will have to take into account the problems and concerns which are involved in the past without a program.

Recreational opportunities related to the fishery have histroically been developed at the expense of the existing commercial fishery. This has been particularly true in the case of salmon and razor clams. Two types of resource are involved; one which is public including salmon and shellfish on public tidelands while the other is private consisting of shellfish on private tidelands. It is in the public resource area that competition for the use of the resource has developed.

Moorage facilities for commercial boats generally require larger slips and must be available year round wheras recreational boats require small slips and short term storage. Facilities designed for one use are not likely to be sutiable for the other. There is then some competition for shore based facilities between recreational and commercial boat owners.

Conflicts between recreational use of the bay and the commercial fishery are likely to develop or have devloped concerning the use of the surface area of the bay, losss of shellfish from private beds, competition for species in the public resource and the development of adequate shore-based facilities.

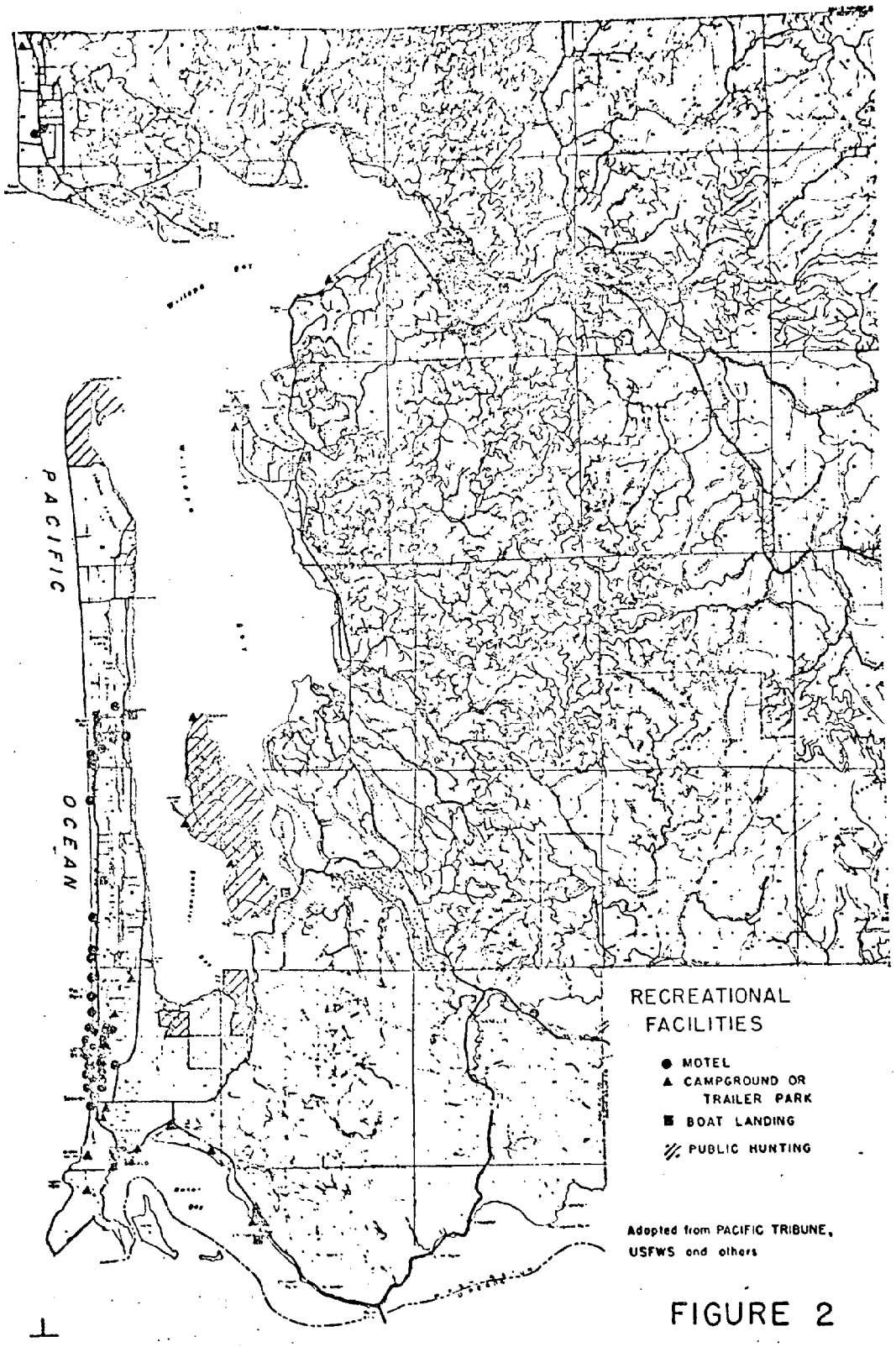
PACIFIC
OCEAN
RECREATIONAL
FACILITIES
MOTEL
CAMPGROUND OR
TRAILER PARK
BOAT LANDING
PUBLIC HUNTING
Adopted from PACIFIC TRIBUNE,
USFWS and others

FIGURE 2

AGENCIES INVOLVED

PUBLIC FACILTIES

Federal agencies involved in recreation and recreational developments in Willapa Bay include the Fish and Wildlife Service. In addition to the migratory bird refuge and public hunting areas previously referred to the Fish and Wildlife service maintains campgrounds on their portion of Long Island in the southern portion of the bay. A recent contract of the service with the owners of the remaining private property on Long Island will lead to ownership of most of the remainder of the Island in the future. Additional recreational facilities will be developed there.

The State Parks and Recreation Commission, State Game Department, State Department of Fisheries and the Department of Natural Resources all administer state lands related to Willapa Bay and all have recreational interests. Plans for the development of these interests have not been available.

Pacific County operates three parks. Two of these are situated on the bay, one at Bruceport and one at Bay Center. These are day use parks with limited overnight camping facilities.

PRIVATE FACILITIES

Campgrounds, motels, trailer parks, and resturants have been built by private interests either adjacent to the bay or in areas which may serve recreationists with interests in Willapa Bay. Figure 2 shows the general distribution of these facilities.

NATURAL DISASTERS

NATURAL DISASTERS

INTRODUCTION

In recent years three natural disasters have struck in the Willapa Bay area. Each of these has had significant effect on the bay. Other natural events have been less spectacular but cannot be overlooked as contributors to some of the present problems. Since the oyster industry works privately owned tidelands and always has crops at some stage of development on these beds they are most likely to suffer from such events. Damage is described in terms of the losses to the oyster industry but it should be recognized that other activities depending on the public resource also suffered losses but these are difficult to access.

1933-34 FLOOD

High runoff following heavy rains in December of 1933 compounded by the failure of a large splash dam on North River resulted in extensive flooding. Most of the recorded damage was to agricultural lands, improvements and crops. Failure of dikes allowed the inundation of fields by salt water which caused much of the damage.

OCTOBER 12, 1962 STORM

High southerly winds reaching 120 miles per hour hit Willapa Bay late in the day at low tide. Waves in Willapa Bay generated by the wind caused a great deal of turbulence on the oyster beds. As a result a high proportion of the 1962 seed planting in the bay south of Bay Center was carried away or buried. Older oysters on growing beds were also lost. Published accounts at the time estimated the loss between $200,000 and $300,000 largely represented by direct seed loss. The accounts also indicated that there was severe scouring in the tidelands by the waves generated by the high winds. Available accounts indicate that the damage was largely limited to the bay south of Bay Center.

MARCH 28, 1964 SUNAMI

A sunami generated by an earthquake in Alaska hit at Willapa Bay at about 12:30 A.M. March 28, 1964. The initial wave was high enough to dislodge the Moore Oyster Cannery at the mouth of Bone River and drive it into the nearby highway bridge. Succeeding waves were observed at 6:00 A.M., 9:00 A.M., 10:30 A.M. and 1:00 P.M. Draw-downs in the bay preceeding each of these waves and magnified their effects. The resulting turbulence scoured much of the bay bottom, particularly in the north end of the Bay.

Oysters were transported or buried by the waves, many ending up in windrows on the beaches. Many oysterlands were scoured clean while others were sanded in. Losses to the oyster industry were estimated to be between $400,000 and $900,000. Subsequent production drops in the Tokeland area and Nemah correlate with this event. (See figure 15 and Table 9 of the oyster section, Vol. I)

The long term losses were probably several times the estimates made at the time of the event.