TN
872
.W2
N67
1979

"NORTHERN TIER PROPOSAL WITHIN JEFFERSON COUNTY: ANALYSIS OF FACILITIES AND EFFECTS"

"NORTHERN TIER PROPOSAL WITHIN JEFFERSON COUNTY: ANALYSIS OF FACILITIES AND EFFECTS"

Prepared by:

Jefferson County Planning Department

May 1979

TN872.W2N67 1979

The preparation of this report was financially aided through a grant from the Washington State Department of Ecology (DOE) with funds obtained from the National Oceanic and Atmospheric Administration (NOAA) and appropriated from Section 308C of the Coastal Zone Management Act of 1972.

In addition Jefferson County wishes to thank James Williams, Washington State Association of Counties, for obtaining and coordinating the grant that enabled the preparation of this study. Also, special thanks to Northwest Environmental Consultants for their outstanding contribution to this assessment.

TABLE OF CONTENTS

	PAGE
INTRODUCTION	
AFFECTED AGENCIES AND PARTIES	
JEFFERSON COUNTY AND IT'S CHARACTERISTICS	1
Features	1
Geomorphology	1
Demography	4
PIPELINE ROUTE	7
Environmentally Sensitive Areas	7
ANTICIPATED CONSTRUCTION IMPACTS	9
Staging/Storage Areas	9
Housing	9
Transportation	10
Pipe Testing/Discharge	10
Residential Intrusion	11
Erosion/Sedimentation	11
Debris Disposal	11
Borrow Sites	11
Blasting	12
Sensitive Areas (Non-River and Estuaries)	12
Sensitive Areas (Streams, Rivers, Drainage Basins, and Estuaries)	12
ANTICIPATED OPERATIONAL IMPACTS	14
Oil Spill/Pipeline Rupture	14
Supervision/Enforcement	14
Safety/Inspection/Security	15
Taxation	15
Emergency Contingency Plans	16
Use Alteration/Abandonment	16
Vegetation Control	16
CONFORMANCE WITH LOCAL SHORELINE PROGRAM	17
Applicable Elements of Local Shoreline Program	17
RESOLUTION NO. 55-79	
REFERENCES	
APPENDIX A	
APPENDIX B	

Introduction

Jefferson County lies in the heart of the Olympic Peninsula. The County stretches from the Pacific Ocean on the west to Puget Sound and Hood Canal on the east. The marine waters framing the eastern boundary of the County are among the most productive found anywhere in the Puget Sound basin. For instance, Dabob Bay in the waters of Hood Canal is one of the few areas in the world containing the proper balance of environmental conditions for the commercial production of oyster seed. The streams and rivers emptying into the waters surrounding East Jefferson County are an equally important resource as they are the rearing areas for many anadromous fish species.

The landscape of East Jefferson County was carved out through a number of periods of glaciation. As the last glacier receeding, rivers began to work on the landscape. Today East Jefferson County is characterized by undulating lowlands and sharply rising foothills and mountains. Many of the stream and river beds that radiate away from the Olympic Mountains tend to be "V" shaped rather than "U" shaped, accounting for their steep and unstable sides.

The Northern Tier pipeline project proposed to bisect Jefferson County, generally follows the base of the Olympic foothills and crosses nine streams and four rivers, all of which empty into the eastern side of the County.

It is the combimation of existing environmental conditions and resource base, coupled with the proposed pipeline project, which raised a number of concerns for Jefferson County. Basically these concerns fall into four major categories: (1) physical and biological impacts from construction (the crossing of nine streams and four rivers); (2) physical and biological impacts from operation (pipeline leak or rupture, oil spill at transhipment point, erosion, and weed and brush control); (3) socio-economic impacts of construction (housing, transportation, etc.); and (4) socio-economic impacts of operation (oil spill contingency, etc.).

The review and assessment that follows evaluates the identified and potential impacts from the Northern Tier project as they may affect Jefferson County. It is meant to be an objective and detailed review of the proposed project. While it is quite certain that not all the impacts associated with the project are documented here, major areas of concern are carefully illustrated. Of particular importance to this review is Appendix A. Appendix A is an in-depth field analysis of the streams, rivers, lakes, estuaries and marine waters that will or may be impacted by the proposed pipeline project.

The review of the anticipated impacts are broken into three areas: (1) construction impacts, (2) operation impacts, and (3) graphic representation of the pipeline corridor and major areas of environmental concern. For mitigative impacts, mitigative measures are proposed. Project elements that require more information or further study before an assessment can accurately be made, have been identified.

Affected Agencies and Parties

City of Port Townsend
Joseph B. Steve, Mayor
City Hall
Port Townsend, Washington 98368
telephone 385-3000

Clallam-Jefferson Community Action Council
Gael R. Stuart, Director
802 Sheridan Street
Port Townsend, Washington 98368
telephone 385-0776

Jefferson County Department of Emergency Services
John Doubek, Director
607 Water Street
Port Townsend, Washington 98368
telephone 385-1512

Jefferson County Fire Protection District No. 2 (Quilcene)
Robert Minty, Chief
P.O. Box 276
Quilcene, Washington 98376
telephone 765-3320

Jefferson County Fire Protection District No. 4 (Brinnon)
Donald Buchmann, Chief
Olympic Canal Tracts
Brinnon, Washington 98320
telephone 796-4756

Jefferson County Fire Protection District No. 5 (Discovery Bay)
George Brown, Chief
Route 3, Box 427
Port Townsend, Washington 98368
telephone 385-1298

Hood Canal Advisory Commission
Robert M. Hays, Jefferson County Member
802 Taft Street
Port Townsend, Washington 98368
telephone 385-2396

Jefferson County Hospital District No. 2
Anthony F. DeLeo, Commissioner
1926 Haines Street
Port Townsend, Washington 98368
telephone 385-0415

Jefferson County Public Utility District No. 1
Ralph P. Anderson, Manager
Route 3, Box 67
Port Townsend, Washington 98368
telephone 385-1966

Jefferson County Educational School District No. 114
Kenneth Howerton, Superintendent
Federal Building
Port Townsend, Washington 98368
telephone 385-2055

Port of Port Townsend
George Randolph, Manager
2539 Washington Street
Port Townsend, Washington 98368
telephone 385-2355

Brinnon School District No. 46
Don Marley, Superintendent
Route 2, Box 147
Brinnon, Washington 98320
telephone 796-4646

Quilcene School District No. 48
Dr. C.W. Campbell, Superintendent
P.O. Box 40
Quilcene, Washington 98320
telephone 765-3364

Port Townsend School District No. 50
Margaret Berry, Superintendent
1610 Blaine Street
Port Townsend, Washington 98368
telephone 385-3614

Jefferson County Water District No. 2 (Brinnon)
E.L. Bowdish, Commissioner
Star Route 1, Box 161
Lilliwaup, Washington 98555
telephone 796-3575

Jefferson County Water District No. 3 (Quilcene)
Herbert Covert, Commissioner
Route 2, Box 783A
Quilcene, Washington 98376
telephone 765-3956

Earth Care Organization
Thelma Moser, President
Route 3, Cape George Colony
Port Townsend, Washington 98368
telephone 385-3467

Jefferson County Citizens for Sound Development
Merle Meacham, Director
Route 1, Box 672
Port Ludlow, Washington 98365
telephone 385-4334

Protect the Peninsula's Future
Robert Haugland, Member
Route 2, Box 138
Port Townsend, Washington 98368
telephone 385-0109

Jefferson County Audobon Society
Mrs. F.G. Stopps
Route 1, Box 525C
Port Ludlow, Washington 98365
telephone 437-2359

Jefferson County Board of Commissioners
County Courthouse
Port Townsend, Washington 98368
telephone 385-2016

Jefferson-Port Townsend Shoreline Management Advisory Commission
David Goldsmith, Staff Director
County Courthouse
Port Townsend, Washington 98368
telephone 385-1427

Jefferson County Planning Commission
David Goldsmith, Staff Director
County Courthouse
Port Townsend, Washington 98368
telephone 385-1427

Jefferson-Port Townsend Regional Council
David Goldsmith, Staff Director
County Courthouse
Port Townsend, Washington 98368
telephone 385-1427

Jefferson County
and its Characteristics

FEATURES

LOCATION, BOUNDARIES AND SIZE: Jefferson County is located on the northern portion of Washington's Olympic Peninsula. The County is bounded on the west by the Pacific Ocean and on the east by the waters of Admiralty Inlet, Hood Canal, and Kitsap County. On the north it adjoins Clallam County and on the south it is adjacent to Mason and Grays Harbor Counties. The County is 1,305 square miles in size, which is the 18th largest of the State's 39 counties, and has approximately 170 miles of marine shoreline and 31 separate river/stream systems.

GEOMORPHOLOGY

TOPOGRAPHY: The topography of Jefferson County varies from sea level beaches to the alpine peaks of the Olympic Mountains. The County consists of three distinct geographic areas: the Pacific Ocean, the Olympic Mountain areas, and the Puget Lowland areas.

The Olympic Mountains, located in the center of the County, are by far the dominant landform, occupying more then three-quarters of the total County land area. The Olympic National Forest and the Olympic National Park occupy the majority of the land in the range, providing many recreational resources. Mount Olympus, at 7,965 feet, is the highest point on the Peninsula. Vast timber resources are located in this central portion of the County.

To the west lies the Pacific Ocean area, ranging from the foothills of the Olympics to the rough and broken coastline along the Pacific Ocean. The majority of the coastline is located in the Olympic National Park, with the remainder occupied by the Hoh and the Queets Indian Reservations.

Terrain in the eastern portion of the County ranges from the mountain heights to the sandy beaches along the straits of Juan de Fuca, Admiralty Inlet, and Hood Canal. The low-lying agricultural lands in the County are located primarily in the Chimacum Valleys, Leland Valley and in the plains of the Big Quilcene, Little Quilcene, Dosewallips and Duckabush Rivers.

Steep slopes present both construction and accessibility problems. The steepness of slopes in some areas of the County has precluded economic development. Approximately half of the land profile in East Jefferson County is of slopes fifteen percent or greater. The greatest portion of these steeper slopes lies on the foothills of the Olympic Mountain Range from Discovery Bay south to the Mason-Jefferson County line. Included in this excessive slope category are the ridges forming the West and Chimacum Valleys, and the east and west edges of the Toandos Peninsula. Less steep areas are generally found east of the Snow Creek basin, including the inland valleys, hilly beaches or plateaus, and the Quimper Peninsula.

LANDFORMS AND GEOLOGY: Physically the County consists of three distinct geographic areas: the West End on the Pacific Ocean, the Olympic Mountains in the center, and the Puget Lowlands in the east section. The Olympic Mountains are by far the dominant landform of the County, occupying more than three-quarters of its total land mass. The range includes Mount Olympus at 7,965 feet, the highest point on the Peninsula. The Olympic National Foest and the Olympic National Park occupy the majority of the land area in the range.

Because these mountains were uplifted as a dome, rather than as a ridge, the river systems which developed radiated out in all directions from the center. The major river systems draining into the Pacific Ocean on the West End are the Hoh, the Clearwater, and the Queets. Draining north into the Strait of Juan de Fuca are the Elwha and the Dungeness, both originating in Jefferson County, but pass through Clallam County. The major rivers emptying into admiralty Inlet and Hood Canal in East Jefferson County are the Duckabush, Dosewallips, Big Quilcene, and Little Quilcene. Snow Creek, Salmon Creek, and Eagle Creek drain into Discovery Bay.

Glaciers, both mountain and continental, have been the primary sculptors of the highlands and lowlands of Jefferson County. While their influence on the topography is readily apparent, their less obvious impact on soils, geology, and ground water conditions is equally important. At least 4 separate glaciers have invaded the Puget Lowland, leaving behind a complex series of sediments up to 2,000 feet thick.

The two primary types of glacial deposits are "outwash" and "till." Outwash consists of unconsolidated sand, gravel and rocks which results from the run-off of melting glaciers. Outwash is usually quite loose and highly permeable. Glacial till or "hardpan" consists of unsorted clay, sand, gravel, and rock which has been compacted by the weight of the glacier into a highly impervious concrete-like material. Due to the advance and decline of several glaciers, these layers of outwash and till may overlap one another, and may run in different directions.

In the West End, the foothills of the Olympics consists primarily of both glacial till and outwash. Glaciation in this area was limited to mountain types since the rugged mountains kept the lower level continental glaciers well away from the coast. In addition to the outwash and till, the valley floors of the three major river basins in the West End consist largely of alluvial deposits.

The Olympics themselves, in the center of the Peninsula, are composed of ancient sedimentary and meta-sedimentary rock. The eastern portion of the range, from near the Little Quilcene River south to the County line, consists of more recent basaltic rock, a volcanic formation.

The geology of the northeast portion of the County, a part of the Puget Lowlands, is somewhat more complex. The substrata is again primarily sedimentary or basaltic bedrock, but is frequently overlain with various types of glacial deposits at differing depths.

Basaltic rock outcroppings are evident from Mats Mats to Chimacum, and also occuring in a strip just west of the southerly tip of Discovery Bay. The area west of a line between Irondale and Quilcene Bay consists primarily of a sedimentary rock. Also in this category is a strip running from about the middle of Discovery Bay west to the Clallam County line.

The remaining half of the Puget Lowland area, or northeast portion of the County, is composed primarily of glacial till and outwash. This includes most of the major peninsulas, and Indian and Marrowstone Islands. Also included is the central portion of East Jefferson County, roughly from Chimacum Ridge and Port Ludlow south to Dabob Bay and Hood Canal.

The geology, or parent material, which underlies the soils of Jefferson County can play a vital role in the planning of both private and public developments. Geologic characteristics which are important include slope stability and landslide potential, compressiblity, liquid waste disposal, ground water sources, and deposits of minerals. Maps and information relating to these characteristics are available in the office of the Jefferson County Planning Department. The data is useful for land planning either on a site-by-site basis or for areawide analysis.

FLOODPLAINS: Jefferson County has seven major river systems which are subject to seasonal flooding. Four of these are located in the eastern section of the County: the Duckabush, Dosewallips, Big Quilcene, and Little Quilcene. Three are located in the West End: the Hoh, Clearwater, and Queets.

Detailed engineering studies are currently being conducted for all streams and coastal areas in the County which are subject to periodic flooding. Once the studies are completed, precise knowledge of flood potential will be available.

Jefferson County is a participant in the National Flood Insurance Program which makes federally-subsidized flood damage insurance available to property owners at reasonably low rates.

SHORELINES: The Jefferson County coastal area, which includes the Straits of Juan de Fuca and Hood Canal, is a complex interrelated system of inlets, bays and deep water channels, with tidal seawater entering from the west and north. Approximately thirty-one freshwater rivers, streams, and creeks enter at many points throughout the system.

The Olympic Mountains combine with prevailing ocean weather systems to prolong seasonal river discharge into the coastal zone. This abundant freshwater discharge plays a significant role in the great productivity of Hood Canal. The importance of the Jefferson County shoreline is derived from the valuable physical and biological resources it contains as well as its strategic location for national and international trade. Many interests compete for the coastal resources. Jefferson County's major industries, and a large share of its population, reside in the coastal zone.

The shoreline resources of East Jefferson County include few beach areas which are not covered at high tide. Bluffs ranging from ten to three hundred feet in height rim nearly the entire extent of the Canal, making access to beach and inter-tidal areas difficult. For this reason, the relatively few accreted beaches which are not inundated at high tide are extremely valuable for public recreation purposes. The ubiquitous bluffs are also a serious topographic constraint to development. The estuaries that remain largely unaltered are highly valued, in part because of their increasing rarity, but more so for their role in the marine bio-resource system.

Flooding within the coastal zone includes coastal type flooding which results from the high spring tides combined with strong winds from winter storms, riverine overbank flooding and the conbimation of the two. Storms that produce the surges also bring heavy rains and, therefore, the high river flows are held back by tides producing flooding at river mouths. Major damages occur within the floodplains which have experienced the greatest growth and development, and these are the streams draining easterly into Hood Canal.

Hood Canal: Hood Canal is a deep body of water with depths of one hundred to six hundred feet found in less than one mile offshore. Shoaling is minimal in the north and central portions of the Canal. Shoal areas are restricted to the mouths of major rivers and streams; Fulton Creek, the Duckabush, Dosewallips, Big Quilcene, and Little Quilcene are the most notable. Large tidal flats and marshes are found frequently in numerous inlets and bays.

Because of their glacial-till composition, the Hood Canal bluffs are susceptible to fluvial and marine erosion and can be serious slide hazards. Although the Canal is protected from the direct influence of Pacific Ocean weather, storm conditions can create very turbulent and occasionally destructive wave action. Without an awareness of the tremendous energy contained in storm waves, the development of shoreline resources can be hazardous and deleterious to the resource characteristics which make Hood Canal beaches attractive. Miles of physically unsuitable shorelines are committed to residential and recreational subdivisions. Some areas have already experienced slide loss and others are known to be hazardous to future development.

Because of the north-south axis of the Canal there is a difference between the north and the south end in terms of the flow of tides. A tide change, on the southern portion of the Canal will occur approximately one hour after a similar change at Port Townsend, at the north end of Puget Sound. Tidal amplitude also varies, being greatest in the southern portion of the Canal and decreasing generally toward the north.

Sills at the Canal entrance, at the entrance of Dabob Bay, and near South Point greatly reduce water exchange and deep water circulation. Deep water exchange is normally limited to late summer when cold, nutrient-rich upwelling water from the ocean flows into the Strait and over the entrance sill into Hood Canal. Average flushing time (theoretical time to completely exchange all water in the Canal with water from the outer Sound) calculated for Hood Canal is 177 days.

Tidal current speeds and the transport of water in the Canal are influenced by geographic location, distance from the Canal's entrance, and channel bathymetry. Strongest currents occur when the tide is either falling or rising. Tidal currents in the main section of the Canal are generally directed either up or down channel; but in Dabob Bay and seaward, eddies form at slack tide and cross-channel transport occurs. In general, strongest tidal flows and greatest mixing occurs in the northern Canal. Tidal flows into the southern Canal and Dabob Bay are considerably weaker and less turbulent, becoming extremely weak in the eastern arm.

Near-surface (top twenty-five meters) stratification of waters in Hood Canal commonly occurs because of large freshwater input into the Canal, extreme depth in many sections of the Canal, and existence of weak tidal mixing force. Stratification is greatest in the southern Canal and in the eastern arm that forms the Canal's terminus, areas where tidal mixing forces are weakest. Oxygen saturation below the this stratified layer often is thirty percent or less, again with lowest values occuring in the southern section of the Canal and in Dabob Bay.

Washington has designated Hood Canal as Class AA (extraordinary). Basic water quality (temperature, salinity, dissolved oxygen, and nutrients) is similar in both sections of the Canal. Salinities are generally low (twenty-seven to thirty parts per thousand) and reflect the large volume of freshwater that flows into this deep Canal. As observed in the Strait of Juan de Fuca, historical dissolved oxygen values were often below the present water quality standard of 7.5 mg/l. Dissovled oxygen values in the Canal have increased in recent years (post 1965), probably because organic loading is lower since sewage treatment systems have been installed in communities in the Hood Canal watershed.

Discovery Bay: Discovery Bay's flushing capabilities are believed to be limited, due to bathemetry and the shelving caused at the Bay's entrance by Protection Island.

Discovery Bay has limited water quality data available, however, water quality violations in dissolved oxygen concentrations and temperature levels during the warm months have been found. The degree to which these violations may be attributed to man-related pollution sources is not readily answered. Most likely, these violations result from the variability of natural water conditions. Despite these instances, Discovery Bay has been classified in the Class AA water quality standard.

MARINE RESOURCES: Discovery Bay and Hood Canal waters are rich in nutrients and support a wide variety of marine fish and shellfish species. An estimated two hundred-fifty miles of stream are utilized by anadromous fish for spawning and rearing throughout the area, including chinook, coho, sockeye, pink and chum salmon, steelhead, searun cutthroat and Dolly Varden trout. All these species use Discovery Bay and Hood Canal as a migration and nursery area. Their offspring spend varying amounts of time in the shore waters of the area before moving to sea to grow to maturity, while others remain as "resident" resources.

Major species of marine fish inhabiting Discovery Bay and Hood Canal are Pacific Cod, dogfish, skate, lingcod, sablefish, Pacific hake, starry flounder, Pacific halibut, ratfish, Pacific bait and forage fish include Pacific herring, smelt, and anchovies. Herring use the shallow end of many inlets and bays of the Canal for spawning purposes. All of these species are important food sources for other fish.

The beaches and estuaries contain Pacific and native oysters; Dungeness crab, littleneck, horse, jackknife, butter, Japanese littleneck, goeduck, softshell, cockle clams, rock and Puget Sound pink scallops; kamchka or pinto abalone; and several species of shrimp.

In 1976 a marine resource inventory was performed throughout Jefferson County. As a result of this study, the distribution of marine organisms and their habitats were mapped and are available for review in the Jefferson County Planing Department. One element mapped, the Bi-Valve Molluscs, includes subtidal hardshell clams, intertidal clams, and goeducks; potential Pacific oyster clutching areas; Pacific oyster optimal spawn areas; and oyster infestation areas. Another element, the Crustacean, includes the distribution of crab and shrimp. Surf smelt, true cod, English sole spawn areas, and herring spawn areas, are depicted on an additional map.

Discovery Bay and Hood Canal have historically supported substantial fish populations. However, with the development of the surrounding areas, some of these fisheries, particularly in the Southern Canal, have declined. The principal causes of the decline have been habitat degradation brought about by domestic wastes and unfavorable land use practices, direct habitat destruction through diking and landfills, construction of upstream water development projects, and poor timber harvesting practices. The effect of dikes and fills on fish populations is not clearly understood, but a loss of nursery and rearing habitat has occured, or is currently threatened.

The decline in fisheries is partially balanced by the fact that aquaculture or sea farming is beginning to come into its own in the complex. The mass production of oysters, clams, geoducks, shrimp, salmon, and other marine biota looms as an important international industry. Effective shoreline management is particularly crucial to the success of sea farming.

Hood Canal and Discovery Bay are also noted as wintering areas for waterfowl, as small bays, inlets, and estuaries provide a discrete habitat for these migrating bird species. Harbor seals and even some porpoise are found in Hood Canal and Discovery Bay. Mamals inhabiting adjacent freshwater areas include beaver, muskrat, weasel, otter, and raccoon.

GEOMORPHOLOGICAL SUMMARY: There is an intricate balance of, and interdependence between, all elements of the aforestated systems. The human population is dependent upon the system not only for livelihood and recreation, but for food production for both national and international markets. Potential intrusions or degradations of these systems will require critical review of the risks involved, and whether the risks merit any associated loss to the environmental system of Hood Canal or Discovery Bay.

DEMOGRAPHY

POPULATION, GROWTH, AND DISTRIBUTION: Th history of Jefferson County has been characterized by sharp increases and decreases in population, resulting from rapid fluctuations in employment opportunities. In an area with a relatively small population such as Jefferson County, changes in the local economy can cause major changes in population. For example, the closure of Fort Worden in 1951 resulted in dramatic declines in the population level and business activity of the County.

In the last decade of 1960 and 1970, Jefferson County's population increased by eleven percent. This was moderate in comparison to neighboring counties, such as Clallam and Kitsap, with increases at sixteen and twenty-one percent respectively. The State population increase for that decade was roughly twenty percent.

Jefferson County has experienced one of the fastest growth rates of the Peninsula counties since 1970. This has resulted from both local economic changes and the influx of people who have been attracted to the County by its semi-rural, small town atmosphere, and the significan architectural, historical and cultural heritage.

In 1977 the County's population was 12,600, a 4 percent increase from the 1976 figure of 12,100. During that year, Jefferson County experienced the greatest population growth of the Peninsula counties. Clallam County increased by two percent, Grays Harbor increased by one percent, and Mason County increased by less than three percent. Jefferson County's location adjacent to the major urban center of Puget Sound, is an important factor affecting the accelerated growth rate.

The County's population density is approximately seven persons per square mile, ranking thirty-second among Washington's thirty-nine counties. Although Jefferson County is the least densely population of the Peninsula counties, it is adjacent to the two most densely populated counties of the State, King and Kitsap, a short distance away across the waters of Hood Canal and Puget Sound. King and Kitsap Counties have densities of 547 and 321 persons per square mile respectively.

Approximately ninety-three percent of the County's population is concentrated in the eastern portion of Jefferson County, which includes the City of Port Townsend. The remaining seven percent of the County's population lives in the western portion, which borders the Pacific Ocean. The central portion, within the bounds of the Olympic National Park and the Olympic National Forest, is virtually uninhabited.

Population in Jefferson County tends to be concentrated in areas having waterfront property or water views. The most heavily populated areas are the Quimper Peninsula (the location of Port Townsend and the County seat, with a 1977 resident population of 5,655); Discovery Bay; the Tri-Cities area of Irondale, Hadlock and Chimacum; Port Ludlow; Quilcene; and Brinnon. The unincorporated areas of the County, particularly waterfront areas, have recently experienced an increase in population growth and an escalation on the housing construction industry.

MINORITY GROUP POPULATION: In 1977 the largest minority group in Jefferson County was the American Indian/Native American group, with 420 persons, or about 3 percent of the total population. Of this population, approximately eighty--six percent live in the western portion of the County on the Queets and Hoh Indian Reservations.

The next largest minority group is the Spanish Surname/Mexican American group with 80 persons, or about 1.6 percent of the total. The Oriental/Asian American group consists of 65 persons, or about 0.5 percent of the total, and the Black Afro American group consists of 40 persons or about 0.3 percent of the total.

The minority population in Jefferson County in 1977 was approximately five percent of the total population. The white population accounted for the remaining ninety-five percent.

AGE AND SEX CHARACTERISTICS: Jefferson County's population profile indentifies the median age group as the forty-five through sixty-five year old group. This group represents approximately one-quarter of the total Jefferson County population. The County's median age is somewhat older than the State of Washington's and can be attributed to the influx of the retiree population, and a steady decline of population in the younger age brackets.

In 1975 the male population represented fifty-one percent of the total County population, whereas the female population represented forty-nine percent. This ratio has remained stable in recent years. The twenty-four through twenty-nine year old age group contains a slightly higher number of males than females. Although the County has been experiencing an outmigration of males in this age group, an equal or even greater number of males and females are migrating into the County for a host of reasons, including employment opportunities in lumber, construction, fishing and related industries, as well as those attracted to the area's climate, physiography, and cultural characteristics.

POPULATION TRENDS: The following section identifies specific population trends which are characteristic of the particular time period in Jefferson County.

Population Trends, 1960-1970:

1. An outmigration of both males and females occured, primarily in the eighteen through thirty-five age group. This trend may be attributed to the limited number of local employment opportunities, as well as other personal reasons.
2. The number of children in the birth through five age group declined steadily between 1960 and 1970. Several factors are responsible for the pattern, including the outmigration of the child-bearing age group, the trend toward marrying at an older age, the trend toward postponing child rearing, and other personal reasons related to limiting family sizes.
3. The number of people age sixty-five and older rapidly increased in the County. The elderly population increased by approximately fifty percent between 1960 and 1970, due in part to growing longevity, but more importantly to the influx of retirees into the County.

Population Trends, 1970-1977:

1. The outmigration of local residents in the eighteen through thirty-five age group was offset by the immigration of people in the same age group who came to the County because of the attraction of physiography, climate, culture and history. Many of the newcomers in this age group are self-employed writers, artists or crafts-persons. In addition, many are employed in local home and boat construction.
2. The number of children in the birth through five age group continued to decline.
3. The influx of retirees into the County continued, and accounted for a majority of the total immigration population. The number of people age sixty-five and older increased by thirty-eight percent between 1970 and 1977. Jefferson County's elderly population has been consistently greater than the State average. In 1977 that proportion of the County's population for the State came to ten percent of the total population.

Population Trends, 1978 and Beyond:

1. As a result of the Navy facilities at Trident and Indian Island, the population level is expected to increase much more rapidly than it would have under normal growth conditions.
2. Population growth will be primarily a resultof immigration, rather than a natural increase. Population will continue to increase because of increased mobility, higher incomes, and more leisure time. Some of the visitors may eventually become full-time residents.

The Pipeline Route

The proposed pipeline system originates at the onshore storage facilities near Port Angeles, approximately fifteen miles west of Jefferson County, generally traverses the County in a north-south axis over a lineal distance of approximately thirty-one miles. A "utilities corridor" concept has been proposed inasmuch as the pipeline corridor will use or parallel the Bonneville Power Administration's (BPA) existing power transmission line route in Jefferson County.

The width of this "utility corridor" in the EFSEC application is two miles. Generally the width of the permanent right-of-way required will be seventy-five feet. However, temporary additional widths of ninety feet will be required during construction to provide adequate working space for equipment.

The proposed "utility corridor" traverses nine watersheds or "drainage basins" which contain twenty-five rivers, streams, and creeks and their respective tributaries. Two of these crossings are over major streams which drain into Discovery Bay. All others drain into Hood Canal.

The corridor also crosses a major municipal water supply line, fifty-eight private water sources (surface), twenty-seven private water wells (ground source areas), two fish propagation plant surface water sources, one food production plant water source, and one fish plan propagation ground water source (well).

The corridor crosses eight constructed County road right-of-ways, three unfinished County road right-of-ways, and three crossings of two State highway routes.

Major construction other than layment of pipeline includes the placement of block and check valves within the pipeline system, and new road construction necessary for efficient access to the pipeline both during construction and for emergency and inspection services after construction.

Block and check valve proposed locations include a mainline block valve at MP.22.7, on both sides of three major rivers, and on one side of another major river. Therefore, of the twenty-three river and creek crossings, four crossings will contain block and check valve provisions.

WATER SHEDS/DRAINAGE BASINS: Water sheds and drainage basins the pipeline will cross include Salmon Creek, Snow Creek, Little Quilcene River, Big Quilcene River, Devil's Lake, Marble Creek, Duckabush River, Dosewallips River, and Fulton Creek.

RIVER AND CREEK: Rivers the proposed pipeline will cross include Big Quilcene, Little Quilcene, Dosewallips, and Duckabush and one tributary. Creeks the proposed pipeline will cross include Salmon and three tributaries, Snow and one tributary, Donovan and two tributaries, unnamed creek south of the Big Quilcene, unnamed creek from Mount Walker, Spencer and one tributary, Marble Turner, McDonal, and Fulton.

MUNICIPAL WATER SUPPLY LINE: The proposed pipeline will cross a water supply line just north of Petersen Lake in Section 26, Township 28 North, Range 1 West, W.M.

ROADS: Roads the proposed pipeline will cross, in order of crossings north to south, include three unfinished right-of-ways, West Uncus, Lind, Quilcene-Chimacum, Linger Longer, Mount Walker, Dosewallips River, Duckabush, and one maintenance facility. The pipeline will cross State Highway 101 and 104.

ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas the pipeline will cross are described below and shown on the attached maps.

DISCOVERY BAY (A): The pipeline will pass through excessive slopes of fifteen percent or greater to reach the first major sensitive area of Discovery Bay. It will also cross Snow Creeks and their respective watersheds. Discovery Bay is exceedingly rich in marine resources. It is considered a major area for commercial shellfish and salmon production. Salmon and Snow Creeks are important salmon spawning areas. The Discovery Bay area is also characterized by a seasonal water table depth to five feet, high aquifer recharge, potential flooding, high soil compressiblity, and agricultural soil suitability.

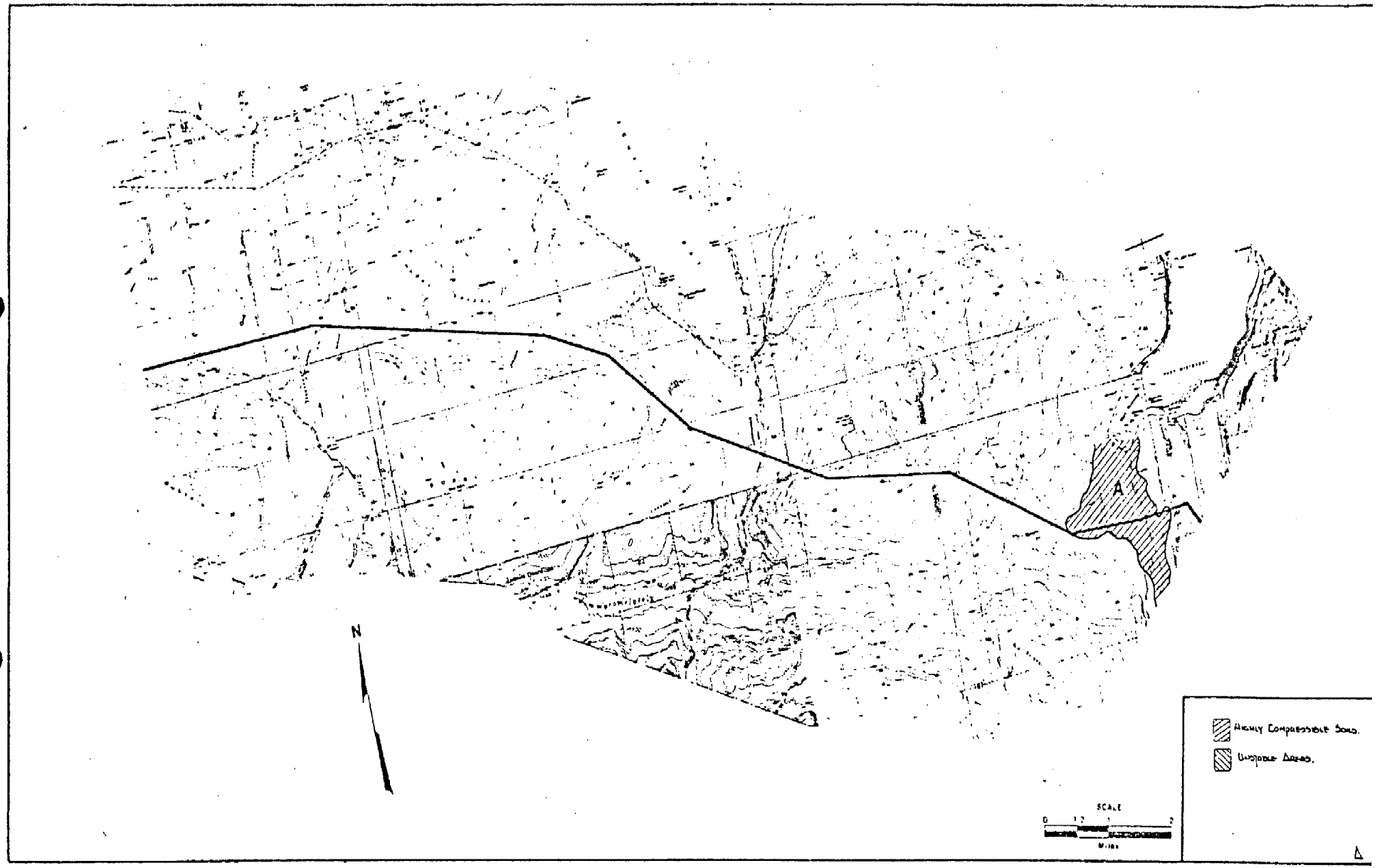
QUILCENE RIVER (B): In route to the second environmental sensitive area of Quilcene, the pipeline will cross excessive slope areas to the north near Lake Leland and Rice Lake. This area is the watershed for Crocker, Leland, Peterson and Tarboo Lakes. It will also cross the Big and Little Quilcene Rivers, and respective watersheds, which feeds eastward into Quilcene Bay. This is a substantial marine resource area which includes many species of salmon, cut-throat trout, crab, shrimp, herring and oysters. It also contains large eel-grass beds that are essential for sustenance and support of marine resources. Major salt water tidal marshes are located here, which also support marine resouces and waterfowl. Other characteristics of the Quilcene area include a seasonal water table depth to five feet, a large aquifer from which all domestic water for the area is drawn, flooding susceptibility, high soils compressiblity, and high agricultural soil suitability. The Quilcene district is the beginning of an extensive geologically unstable area which extends southward.

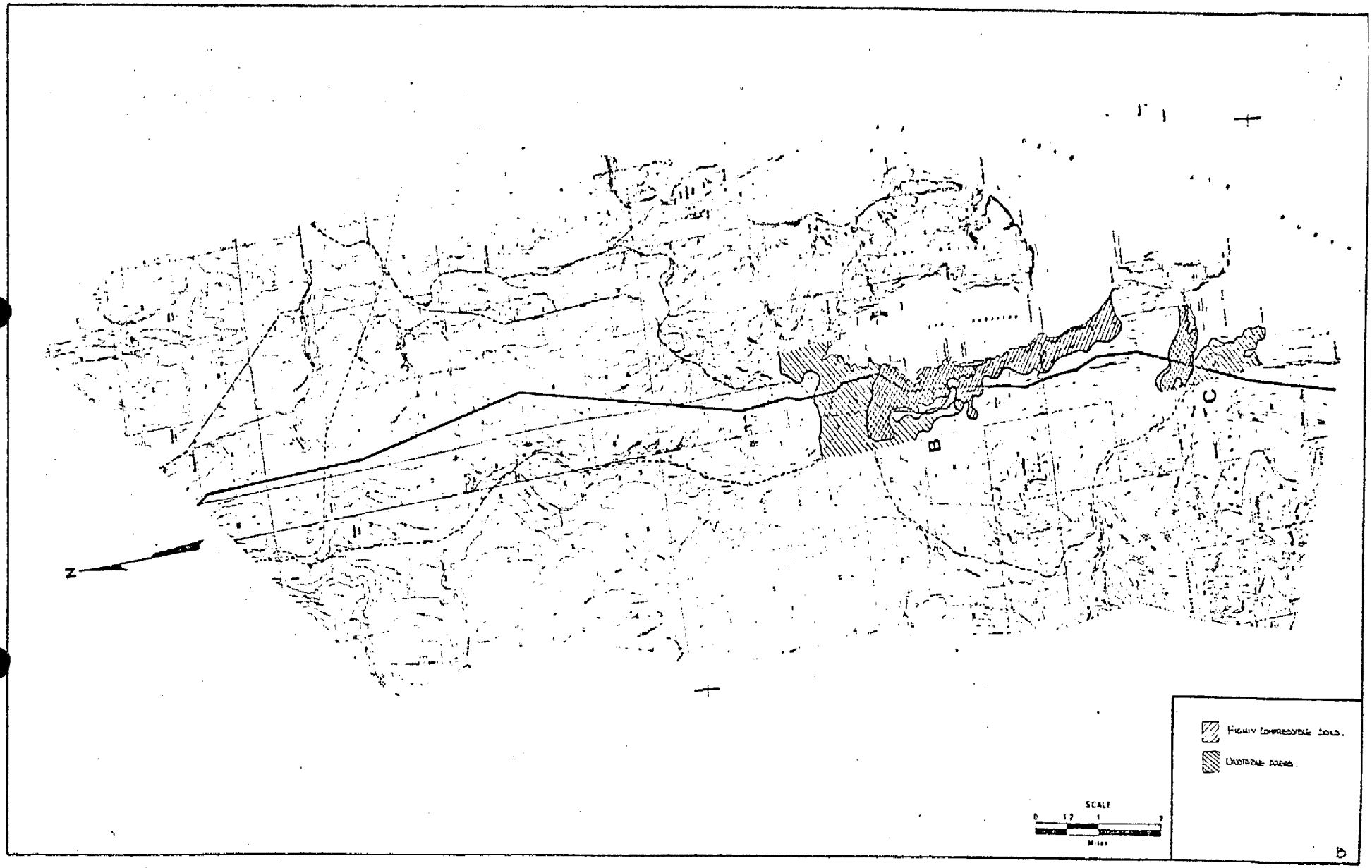
JACKSON CREEK (C): In reaching the Jackson Creek area, the third environmentally sensitive area, the pipeline will pass one mile west of the Washington State Shellfish Laboratory at Point Whitney. In route it will cross variable slopes, some being fifteen percent or greater. It will cross Jackson and Spencer Creeks which flow into Dabob Bay. The Creeks are important for salmon spawning. The Bay contains substantial marine resources such as shellfish, shrimp, herring, surf smelt, salmon, and oyster seed. The pipeline also comes within the proximity of an important tidal marsh at Right Smart Cove. The Jackson Creek area has a seasonal water table depth to three feet, large aquifer recharge, potential floodplans, and highly compressible soils. The north side of Jackson Creek is a geologically unstable area.

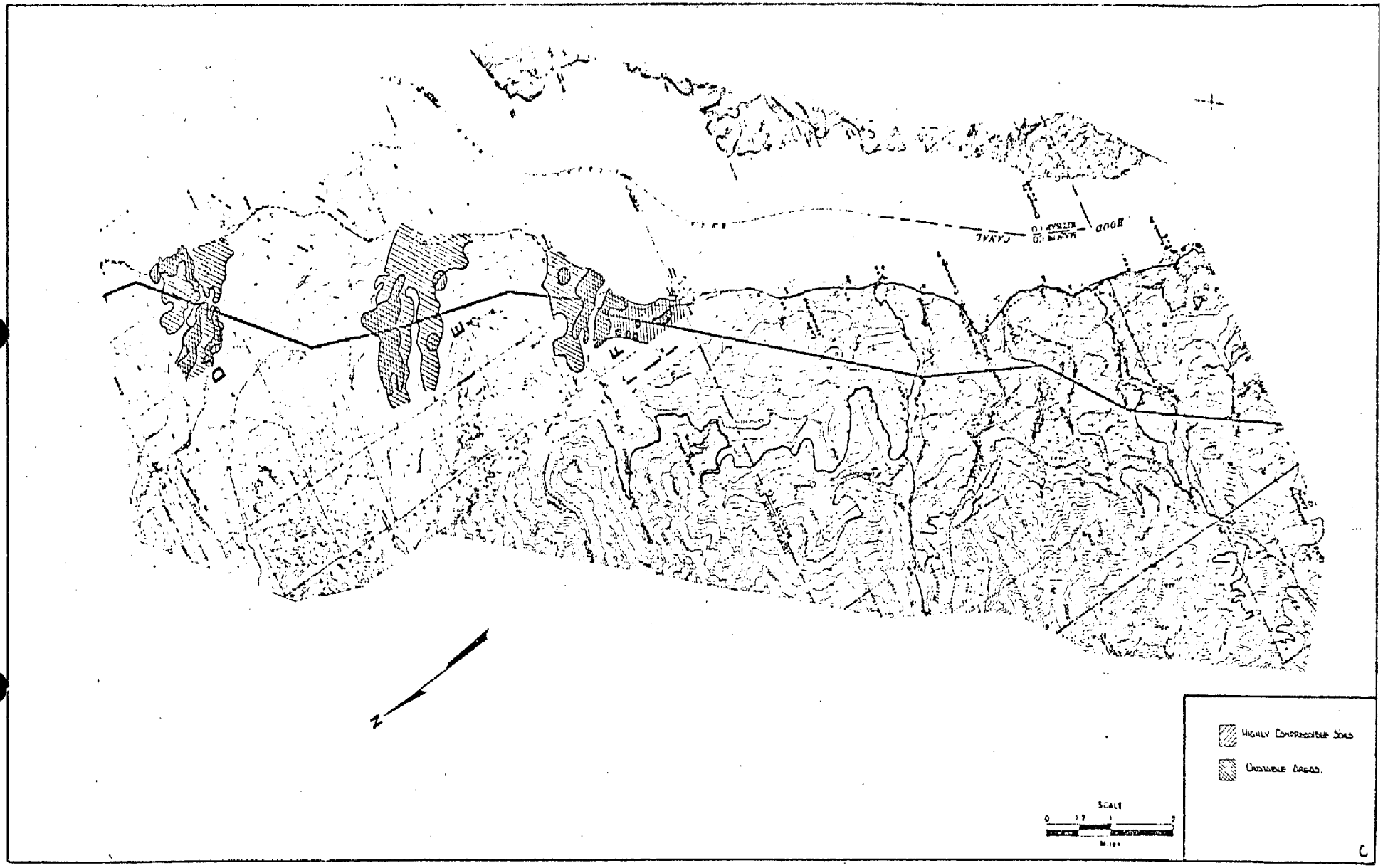
BRINNON AREA (D): The pipeline will pass over the Brinnon area, which is also environmentally sensitive. The terrain the pipeline passes over in route to this area contains excessive slopes of fifteen percent or greater. The pipeline will come within a mile of a Federal fish hatchery situated on the Dosewallips River. The waters from the Dosewallips and off the Brinnon area are used extensively for marine research. The area is rich in marine resouces such as goeduck, cut-throat trout, salmon, crab, shrimp, herring spawn, surf smelt, and oysters. The area is characterized by substantial flooding, aquifer recharge, agricultural suitability, and high compressiblity. The River is bounded on both sides by geologically unstable ground.

DUCKABUSH RIVER (E): The pipeline will cross over more excessive slope areas of fifteen percent or greater in getting to the fifth environmentally sensitive area. The Duckabush River area is an important marine resource center. Substantial shellfish, crab, shrimp, herring, surf smelt, cut-throat, steelhead, salmon, and oysters are located here. Waterfowl also inhabits the area. At the mouth of the River large eel-grass beds are found. The area is characterized by aquifer recharge and substantial flooding. The soils are highly compressible and are suitable for agriculture. Within a half-mile of the Duckabush, the pipeline will pass through a large area of land considered geologically unstable.

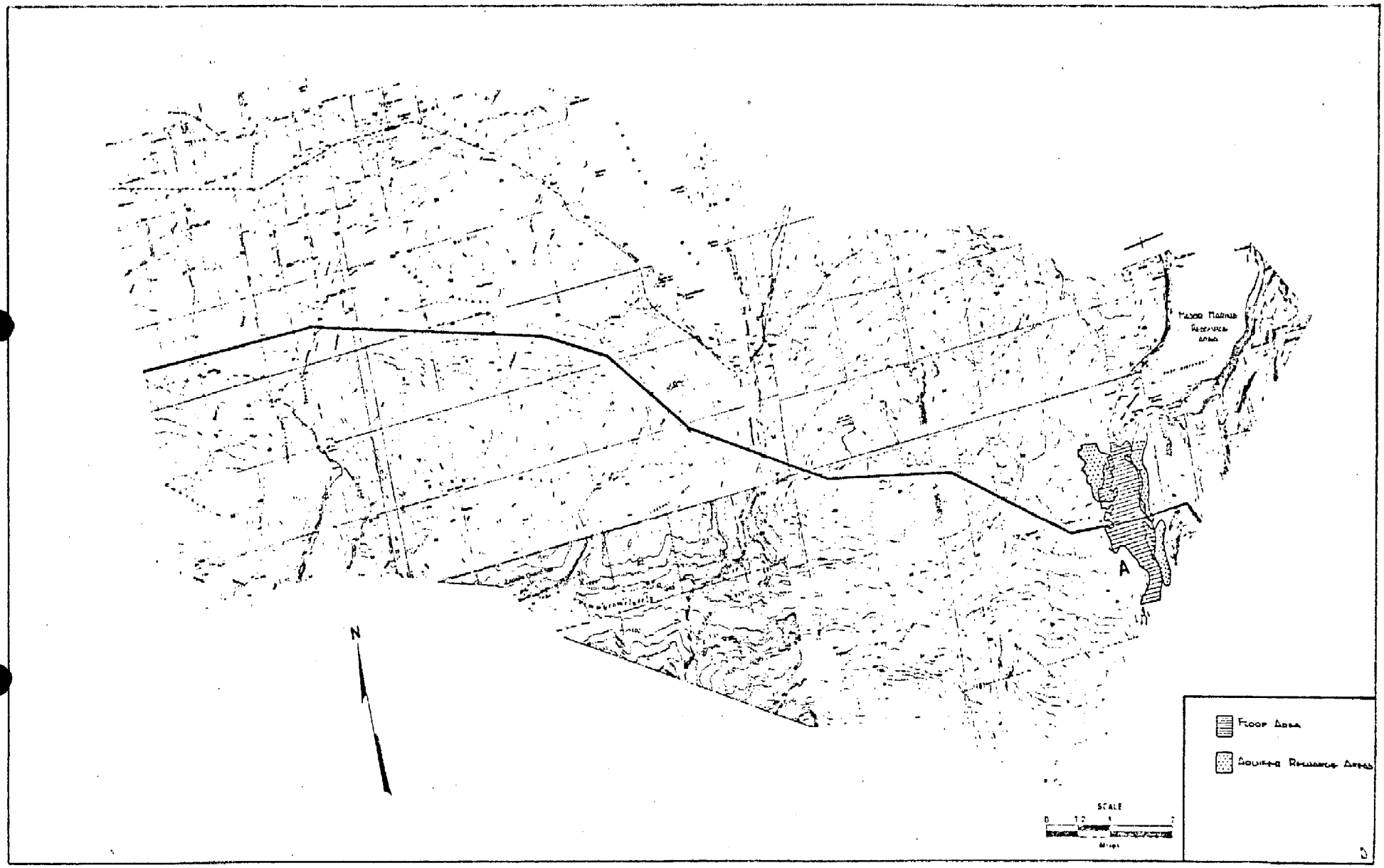
McDONALD COVE (F): The McDonald Cove area is another environmentally sensitive area that the pipeline will cross. This area includes McDonald Creek, which leads to McDaniel Cove, and Fulton Creek, all having excessive slopes. Important marine resources located here are crab, shrimp, salmon, shellfish, herring, and oysters. The area contains a large aquifer recharge area and floodplain. The soils are highly compresible. The pipeline will cross geologically unstable areas from Fulton Creek south to the County line.

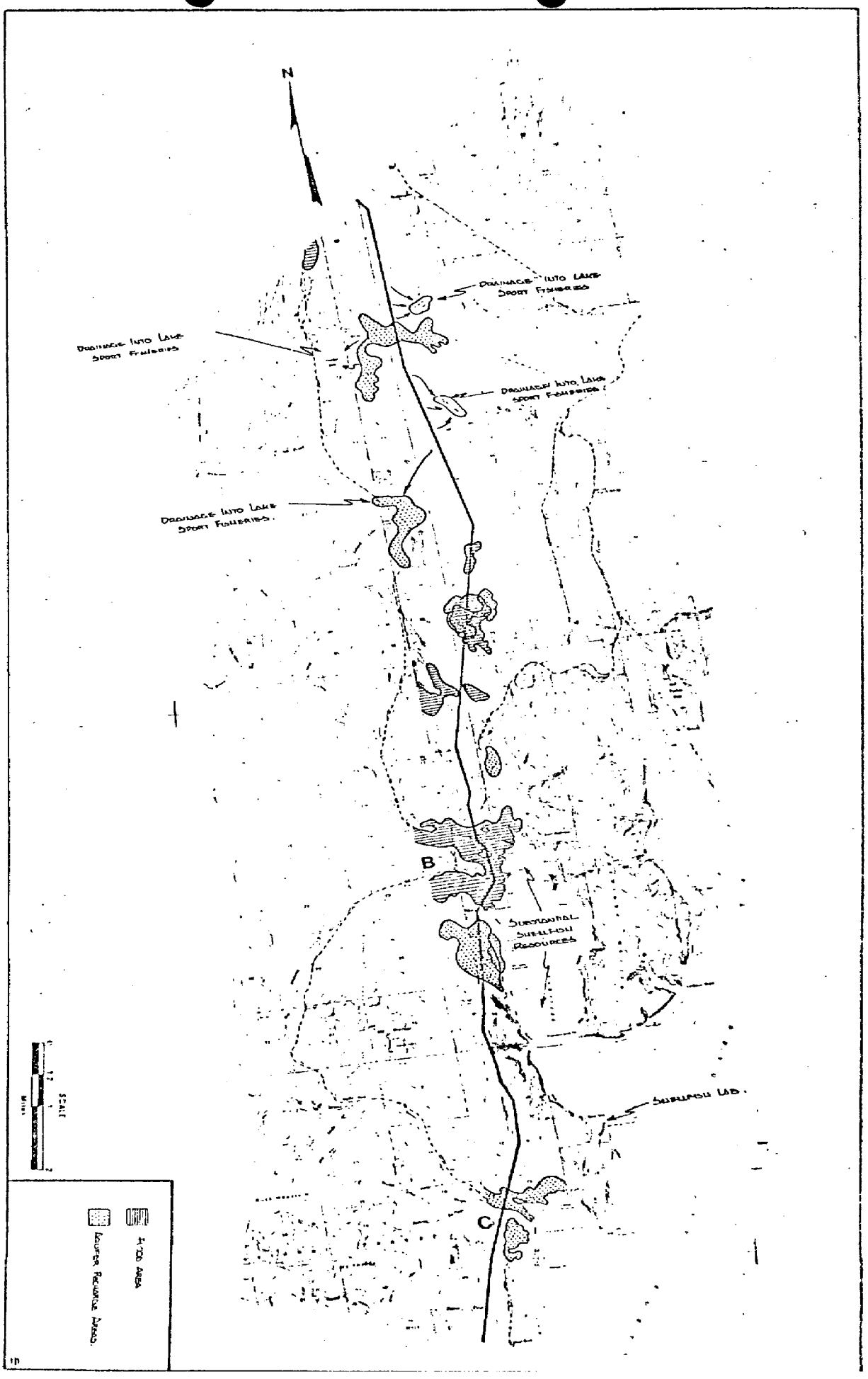

A
N
Highly Compressible Soils.
Unstable Areas.
SCALE
0
1/2
1
2
Miles

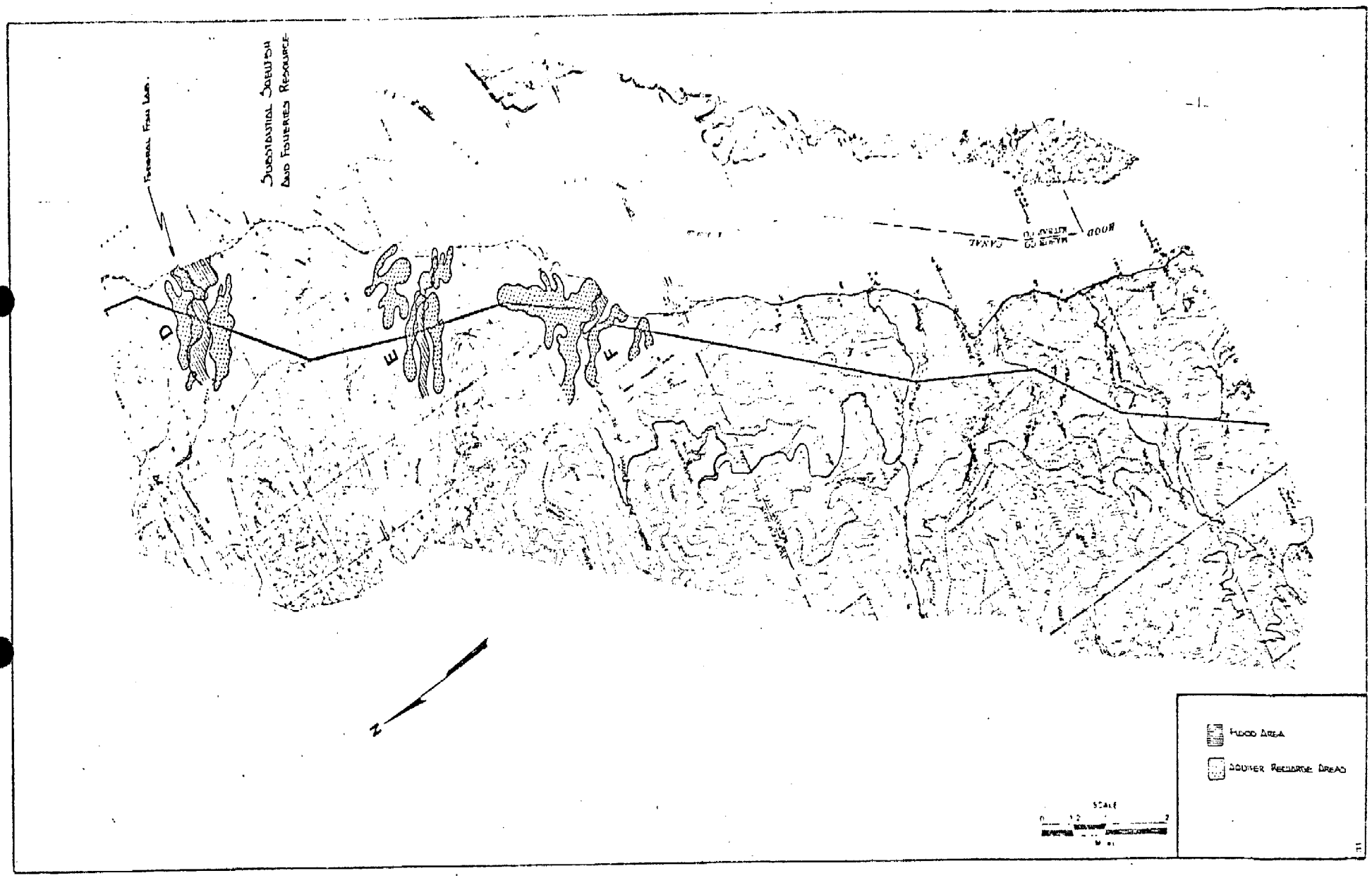

B
C
N
Highly Compressible Soils.
Unstable areas.
SCALE
0
1/2
1
2
Miles
B



D
E
F
HOOD
CANAL
N
SCALE
0
1/2
1
2
Miles
Highly Compressible Soils
Unstable Areas.
C


A
N
SCALE
Floor Area
Aquifer Recharge Area


N
Drainage into Lake Sport Fisheries
Drainage into Lake Sport Fisheries
Drainage into Lake Sport Fisheries
Drainage into Lake Sport Fisheries.
B
Subnormal Shellfish Resources
Shellfish Lab.
C
Scale
Miles
1:100 Area
Aquifer Recharge Areas.


Federal Fish Lab.
Substantial Depletion and Fisheries Resource
D
E
F
N
Flood Area
Aquifer Recharge Area
SCALE

Anticipated Construction Impacts

STAGING/STORAGE AREAS

DESCRIPTION: Materials for pipeline construction must be received from outside the County. Due to lack of adequate land transport soures to the Peninsula, it is probable that water transport will be used. Port Angeles currently has adequate shore facilities, however, Port Townsend does not. Rail transport from these two cities is feasible whereby Discovery Bay Junction becomes the focal point for transfer of materials from rail to truck. It is possible that materials can be trucked from a shore facility in either of the two above-mentioned cities. Materials received before actual installation would require temporary stockpiling or warehousing of strategic location close to worksites or transport corridors.

ANTICIPATED IMPACTS: Rail line conditions between Port Angeles and Port Townsend may need to be repaired and/or updated. Abandonment procedures by the rail owners have been undertaken. Port Townsend has inadequate facilities for water/land transport facility. To update this facility substantial construction would be necessary. The Port of Port Townsend has substantial land for storage and warehousing of construction materials and equipment.

The southeast shore of Discovery Bay has adequate area for a transfer site from rail to truck. Limited storage area is also available at this site. Truck transport from Port Angeles or from Port Townsend would create traffic congestion impacts. (See also Transportation/Circulation.)

MITIGATIVE MEASURES: Not enough information is known at this time to access the impacts of a materials storage area at Discovery Bay Junction. It appears that a water/rail connection between Port Angeles and Discovery Bay would be the most feasible alternative for the movement of construction equipment and materials. Prior to any certification of this project, complete details as to the proposed storage facility at Discovery Bay Junction and associated impacts should be developed and mitigative measures employed.

HOUSING

DESCRIPTION: The stated demand for housing accommodations for the Northern Tier workforce will be forty-seven units during the peak summer months, and twelve units during non-summer periods. The stated peak workforce is 440 to 480. Thus there is high probability that the greater number of the workforce will seek transient accommodations in the County. Projected number of available units is stated to be 205. The availability of campsites is considered. However, the anticipated construction months coincide with the tourist season, therefore ... campsites are virtually not available. Also, National Forest campsites have a ten--day maximum stay rule.

ANTICIPATED IMPACTS: Factors not taken into consideration by Northern Tier in their application is the competition for any and all accommodations by tourists during the summer months. Also, the initiation of the Indian Island Naval Ordnance Depot in 1979 will create demand for housing accommodations for workforce personnel on overnight liberty for 186 days of a year. The pipeline worker's families who join the workers during construction further increase demand.

If the pipeline corridor is anticpated to be used as a temporary construction camp to accommodate those workers with recreation vehicles, then the following on-site impacts are anticipated: waste disposal, fire protection, and police protection.

MITIGATIVE MEASURES: In order not to impact the limited supply of transient facilities and public campgrounds, Northern Tier should consider the development of temporary construction workforce camps as the best alternative to handle housing needs. Such facilities will require provisions for water, sanitation, solid waste disposal, security, and fire protection.

Prior to certification of this project a complete, detailed study of anticipated workforce accommodations should be completed. This study should indicate availability of transient facilities, location of temporary workforce camps, etc.

TRANSPORTATION

DESCRIPTION: The EFSEC application states that the primary access routes in Jefferson County will be the State highway routes. Secondary access to the pipeline is to be accomplished over existing County right-of-ways, with possible use of private roads. Traffic volume estimates state that 960 one-way trips per day could occur in the vicinity of the moving construction base. Adding material and equipment trips, a maximum of about 1,040 trips per day will impact the road network near the pipeline at any given point.

ANTICIPATED IMPACTS: Damage to County right-of-ways resulting from overweight trucking may result. Many access roads are not improved or completed and therefore are not at County standards. Without improvement, these roads would incur substantial damage, and may require major reconstruction. Lack of sufficient access to the pipeline corridor will necessitate new road construction which increases the chances of environmental degradation through erosion, landfill, and excavation.

MITIGATIVE MEASURES: Truck load weights should be kept within the tolerances of the respective County right-of-ways. When County road designated haul routes are identified, a before and after condition inspection will be made. A road damage and repair agreement should be required between the project sponsor and Jefferson County. Due to seasonal rains, dirt and gravel roads will require additional grading and rock surfacing to keep them passable for local traffic. The project sponsor will be responsible for keeping these access County roads suitable for local traffic. Any new road construction will be required to meet County specifications. The County reserves the right to specify haul routes on County right-of-ways based upon truck load weights, anticipated usage, and other factors deemed relivent by the County Engineer.

PIPE TESTING/DISCHARGE

DESCRIPTION: Hydrostatic testing of the pipeline will be conducted in fifteen mile segments of the pipeline. The County has three such "spreads." The water source for testing is to be the Big Quilcene, Dosewallips, and Duckabush Rivers. Linefill total is approximately fourteen million gallons of water from these sources. Discharge areas of this water includes the Big Quilcene, Duckabush and Dosewallips Rivers, and Marble and Fulton Creeks. To combat any resultant corrosion in the pipe, soda ash will be added to increase ph to nine. A bactericide would become a necessary additive if the water is not removed from the line in less than two months. Discharge of water treated with bacteriacide requires it to be diluted before ultimate disposal. This would be accomplished with holding ponds or direct discharge into large, deep water bodies for dilution purposes. All discharge water will meet State and Federal water quality standards.

ANTICIPATED IMPACTS: The rivers, as sources of water, will sustain significant flow changes and effect the downstream ecology. Jefferson County is particulary concerned with discharge of this test water back into the stream ways due to the increase in flow rates, the affect on stream chemistry and temperature, as well as changes in turbitity.

MITIGATIVE MEASURES: The withdrawal of test waters from rivers and springs may create major changes in stream hydrology and ecology. Likewise, the discharge of test waters will have negative effects on streams and rivers, particularly in those instances where chemicals are added to test waters.

Test waters should be taken from municipal supplies whenever feasible. Orly as a last resort should test waters be taken from streams and rivers. In those cases, withdrawals should be carefully monitored to insure that aquatic and marine resources are not adversely affected.

The discharge of test waters should not take place directly into streams and rivers, or marine waters. Holding ponds or other means should be utilized for the discharge of all test waters and these methods should be carefully monitored to insure that contaminants will not reach ground water sources.

RESIDENTIAL INTRUSION

DESCRIPTION: The pipeline route will pass through the unincorporated town of Quilcene. No description of impact of lights, noise, and glare from construction or the measures of mitigation are addressed.

ANTICIPATED IMPACTS: Pipeline construction will cause noise levels in excess of the ambient noise levels of the residential areas adjacent to the pipeline route. Further possible night operations would thus be particularly disruptive of normal sleeping habits of residents due to lights and noise.

MITIGATIVE MEASURES: Construction activities should be restricted to normal daytime "work hours" when located within half a mile of concentrated residential areas (densities exceeding four homes per acre). Further, extraordinary measures for noise control of construction machinery including transportation devices should be required to maintain noise levels below EPA standards for "complaint levels."

EROSION/SEDIMENTATION

DESCRIPTION: The EFSEC application states that conventional methods of controlling erosion will minimize erosion. However, it does not specify quantities of material from excavation for land clearing, grading, pipeline trenching and backfill, etc. Further, acknowledgement is made of short term turbidity during storm crossings.

ANTICIPATED IMPACTS: Erosion and turbidity in streams will impact important fisheries resources and downstream water sources for domestic use. General erosion from any road construction and land scarification should not be of significant impact provided that rivers, streams, and creeks are not involved.

MITIGATIVE MEASURES: All land changes exposing the soil should be immediately attended to by seeding or mulching. Further, land berms to contain erosion or settling ponds should be designed to minimize erosion.

DEBRIS DISPOSAL

DESCRIPTION: Land preparation for the pipeline proposal includes land clearing, earth removal and erosion control. The resulting accummulation of debris thus creates need for disposal of same.

ANTICIPATED IMPACTS: Accummulation of debris would not only hinder construction operation, but also creates potential hazards of fire and accident. Debris may also become an aesthetic problem along the corridor.

MITIGATIVE MEASURES: Debris disposal should be accomplished on-site as much as possible through regulated burning and burying. Said deposition should be conducted to coordinate with site rehabilitiation, road construction, or by sale to private companies. In no instance should debris be disposed of in or near stream or river corridors or in environmentally sensitive areas such as wetlands. All debris disposal sites should prevent erosion. Debris disposal at County solid waste sites shall be coordinated with the Jefferson County Director of Public Works.

BORROW SITES

DESCRIPTION: Select backfill is likely needed for the pipeline foundation and overburden. This will necessitate the trucking of select materials from site sources within Jefferson County.

ANTICIPATED IMPACTS: Due to the variable amounts that may be needed it is anticipated the new site sources will be required.

MITIGATIVE MEASURES: Any new site sources of select materials should be subject to the State mining and relcamation standards.

BLASTING

DESCRIPTION: Pipeline excavation in Jefferson County will require blasting of bedrock in preparation for layment of the pipeline.

ANTICIPATED IMPACTS: Blasting near residential areas or residences may cause damage to residences in the form of glass breakage, etc. Blasting should not be harmful to the environment.

MITIGATIVE MEASURES: Blasting near residences should have a prerequisite of notifying residents of the use of explosives and the time expectations. Damages directly attributable to Northern Tier blasting and subsequent reparations should be the responsibility of Northern Tier.

SENSITIVE AREAS (Non-River or Estuaries)

DESCRIPTION: The proposed pipeline corridor contains environmentally sensitive lands in which extraordinary construction methods will be required, or changes in the pipeline route will be necessary. The types of sensitive areas include aquifer recharge areas, high soil compressiblity factors (low bearing capacity), freshwater marshes, and geologically unstable hillsides. (See maps of Element I.)

ANTICIPATED IMPACTS: Geologically unstable areas increase the risk of pipeline rupture and require extraordinary measures for pipeline construction. Highly compressible land also becomes threatened due to additional construction requirements necessary for pipeline construction. Aquifer recharge areas are extremely sensitive to contamination from oil spills.

MITIGATIVE MEASURES: Prior to certification, all construction methods, extraordinary precautions, route realignments, etc. should be completed and submitted to Jefferson County.

SENSITIVE AREAS (Streams, Rivers, Drainage Basins, and Estuaries)*

DESCRIPTION: The proposed project anticipates burying a forty-two inch diameter pipeline under the beds of nine streams and four rivers in East Jefferson County. The method of construction entails the dredging of a trench below the source depth of an one hundred year flood for these streams and rivers. These trenches will be backfilled and compacted as necessary. Some blasting may occur where the trenching operation meets bedrock materials.

ANTICPATED IMPACTS:

1. Water diversion or blockage may occur during construction by the presence of construction equipment, portions of the pipeline, or the accummulation of dredge materials within stream and river beds. Water diversion may also occur by the construction of diversion dams or by dewatering into point wells. Any blockage or diverging of stream and river waters will adversely affect flora and fauna downstream. Dewatering will expose sensitive spawning beds of anadromous fish, kill downstream aquatic plants, fish, shellfish, and impact animals which are dependent on stream bed habitats. Dewatering may also raise the salinity in downstream estuaries beyond the tolerance limits of organisms. Diversion of waters will increase the velocity of streams and rivers which in turn will increase sensitive spawning beds of anadromous fish species by siltation or removal.
2. Stream bed siltacion by erosion will severely impact streams, rivers, and estuaries, and associated habitats along the pipeline route. Erosion and siltation will be exceptionally critical in "V" shaped stream and river valleys due to construction activities anticipated, and topographical and geological conditions found in these valleys. Impacts include covering or distruction of anadromous fish species spawning beds, particularly during the egg incubation period. Sediment accummulation in estuaries and associated wetlands are critical to juvenile salmon and oyster spat.

*A complete analysis of the construction effects on the proposed project is found in Appendix A: An Analysis of Streams, Rivers, Lakes, and Estuaries Along the Proposed Northern Tier Pipeline Route in Jefferson County, Washington, by Northwest Environmental Consultants, Inc., February 1979.

3. Oil and gasoline leakage may occur from machinery operating in and around streams and rivers. While minor, any degradation of stream and rivers due to oil and gasoline pollution will adversely impact the ecology of these sensitive areas.
4. The timing of construction activities is most critical. The construction "window" in which time in the life cycles of fish and shellfish species, particularly salmon and oysters, construction may proceed is in most cases very short. All of the adverse impacts associated with the crossing of streams and rivers will be enhanced if construction timing does not coincide with non-critical periods of fish and shellfish lifecycles.

MITIGATIVE MEASURES: Mitigative measures are broken into two categories, which are crossing alignment and construction options.

Crossing Alignment: Salmon Creek; realign corridor approximately one half mile south and east of proposed route. Big Quilcene River; realign to avoid unstable, steep, slope areas above Quilcene Bay. Spencer, Jackson, and Marble Creeks; realign toward the west beginning north of Spencer Creek and re-enter proposed corridor south of Jackson Creek. Dosewallips River; realign corridor 0.1 to 0.2 miles upstream of proposed route. Duckabush River; realign 0.2 to 0.3 miles to the west of proposed route. McDonald Creek; realign 0.2 to 0.3 miles west of proposed route.

Construction Options: Many of the stream and rivers crossed are contained in "V" shaped valleys that are geologically unstable, and very steep. To reduce impacts along with realignment alternatives, trestling of the pipeline over many of the streams and rivers is considered a positive and practical mitigative measure. Trestling, along with route realignments as described above, is the preferred mitigative measure for the Duckabush and Dosewallips Rivers, and for Salmon, Spencer, Jackson, Marble, McDonald and Fulton Creeks. In areas where trestles are employed, an interceptor pipe surrounding the main pipe should be constructed to contain and divert any oil leakage and guard against rupture or sabatage.

There are other mitigative measures for pipeline construction in or around streams and rivers. The avoidance of diverting or dewatering stream and rivers should be paramount in the construction procedures. Erosion and siltation may be minimized by the depositing of dredge material above the one hundred year flood levels of streams and rivers, and beginning revegatation upon backfill. Construction equipment should not enter streams and rivers without being throughly cleaned to prevent the possibility of oil or gasoline from the equipment from entering the water. Construction in and around stream or river beds should only occur during late May, June and July to minimize impacts on fish and shellfish species.

Anticipated Operational Impacts

OIL SPILL/PIPELINE RUPTURE

DESCRIPTION: The proposedproject will not reduce oil transport in the Strait of Juan de Fuca or Puget Sound, but rather adds to the current traffic. Oil spill risk discussion is based upon the statistical analysis for the proposed project and not on the total traffic system risks including non-oil transport traffic. Current statistical analysis of oil spill does not address itself to the extreme geomorphological constraints of the State of Washington coastline. Further, should spills occur, the Strait's tidal currents and wind factors combine to make spills virtually impossible to contain.

Large scale pipeline spills are not expected by the Northern Tier Corporation within the nominal life of the project. The proposed pipeline automatic warning system as described by Northern Tier is put into effect by a leak or rupture with a discharge rate exceeding 6.4 barrels per minute. Smaller discharges are therefore undetectable by such a system.

ANTICIPATED IMPACTS: Oil spilled from vessels in the Strait of Juan de Fuca may well be trajected into Canadian waters as well as to Puget Sound. Marine plants and animals, water quality, shorelines, waterfowl, fish and shellfish species, etc. will sustain immediate and direct impact. Economic impacts would include loss of income for fishermen and the related costs of clean-up. Pipeline oil leaks are reported to be less serious. However, oil in soil degrades slowly, if at all. The lighter fractions of the oil has viscosity near that of water, therefore, transport is facilitated. The pipeline itself is placed on select material which is more permeable than the surrounding sides of the pipeline trench. Underground leakage and severe topographic variations combine to transport oil impacts. Land spills pose problems of separation of the oil from impregnated soils, which increases costs and efforts for clean-up, and the affected soil must be disposed of. Oil lost under such circumstances generally cannot be refined.

MITIGATIVE MEASURES: Oil transport vessels should be double-hulled. Ship docking and departures should be conducted under the same system as the Puget Sound ship-pilot program. The proposed clean-up equipment should be supplied and strategically located to facilitate clean-up procedures. Oil vessels should have mandatory inspections by the U.S. Coast Guard to insure proper operation of equipment, fittings and vessel control and communication systems. A clear responsiblity of liability must be established for possible oil spills. Pipeline spill detection equipment should be technologically advanced to detect, as close as possible, any size of leak or rupture. Oil spill clean-up equipment should be placed in the areas of critical concern. In Jefferson County, Discovery Bay, Quilcene and the Duckabush and Dosewallips, estuaries should all be equipped with oil spill clean-up equipment along with training for personnel to man such equipment. Additionally, the crossing of the Little Quilcene, Big Quilcene, Dosewallips and Duckabush Rivers should be accompanied with block valves located on either side of the river bank.

SUPERVISION/ENFORCEMENT

DESCRIPTION: Pipeline operation, including construction will require accountability to a governmental body vested with the authority and responsiblity to supervise construction and operation, and enforce the approval criteria established with project certification. Included in the authority is the enforcement powers to bring project violations, or allegations thereof, to expedient resolution when and if they occur.

ANTICIPATED IMPACTS: Lack of supervision and enforcement will increase risks of mechanical failure or human error. Supervision and enforcement lacking during construction will result in construction insensitivity to environmentally sensitive areas in and around the pipeline corridor. Lack of total enforcement results in costs which will be incurred by the general taxpaying public through their governmental agencies.

MITIGATIVE MEASURES: Herbicide use should not duplicate the current program conducted by BPA. Herbicide use should be prohibited from drainage areas, rivers, and stream basins, and from agricultural areas. Herbicide use should be prohibited from use near residential domestic water supplies.

SAFETY / INSPECTION / SECURITY

DESCRIPTION: Devices which detect unacceptable deformation of the pipe due to external forces will be used following construction and periodically during operation. A "Supervisory Control and Data Aquisition" system will be installed which will provide continuous monitoring and control of system activities. Ground and aerial reconnaissance every two weeks as required by the Washington State Department of Transportation regulations. Routine ground inspection and maintenance of facilities will also be conducted. It is stated that minor leaks, below the threshold of the leak detection system, will also be identified by these operations. Right-of-way access control is not presented.

ANTICIPATED IMPACTS: Human error in pipeline system construction and operation, as well as mechanical failure, increases the risk potential during pipeline operation. Third party damage to the pipeline would cause lengthy economic and environmental restoration procedures (see "Emergency Contingency Plans"). Third party potential damages may arise from use of the corridor by all-terrain vehicles.

MITIGATIVE MEASURES: Safety equipment should be designed for protection from damages from third party causes and should receive routine maintenance at regular intervals to assure proper operation. Operational inspection should at all times be conducted by trained and qualified personnel accountable not only to Northern Tier Company but also to a State office responsible for project supervision. Specific legal ramifications should be posted at strategic locations depicting results of tampering trespass or vandalism. A justice system plan should be coordinated for proper investigation and prosecution of violations related to the pipeline.

TAXATION

DESCRIPTION: The installation of the Northern Tier Company pipeline in Jefferson County will result in a "use tax" under the personal property assessment process. The project will also generate sales tax revenues derived from material sales, cost of construction, merchandise, and other good sales to the workforce.

ANTICIPATED IMPACTS: The tax revenue from the pipeline use would broaden the County's tax base and generally reduce the burden of taxes borne by each taxpayer, provided, government budgeting does not increase beyond the limits of the new revenue. This revenue can be used to offset the impacts local units of government will experience in terms of specialized equipment and training, however, these revenues are not available when the initial expenditures by local units of government will be made.

Land values would not directly increase as a result of the pipeline construction due to a lack of the lands derived benefit or speculative value. Land values can directly increase however due to new road construction providing access to areas previously roadless.

Land values may decrease as a result of land degradation resulting from pipeline construction and operation (i.e. erosion, domestic water supply degradation, oil spill contamination, etc.).

MITIGATIVE MEASURES: To offset initial expenditures by local units of government for such things as specialized equipment or training, or capital improvements, etc., an advance tax should be made by the proponents to the local governments which will allow existing budgets to not sustain unpredicated capital expenditures.

Land value degradation as a result from pipeline construction should allow for immediate tax relief for affected owners, or for direct cash relief, or Federal income tax loss deductions.

MITIGATIVE MEASURES: Establishment of a commission or agency with overall supervisory and enforcement capabilities with accountability to the govenor together with the financial powers to account for and release indemnity fund monies. This strict accountability to such a governmental entity will assure that the performance of contractors is in proper manner, and to also certify any damage to public or private properties arising from project construction or operation.

EMERGENCY CONTINGENCY PLANS

DESCRIPTION: Vessel transport of oil, it's storage, as well as pipeline transport, would be subject to natural disaster, sabotage, and vandalism necessitating a program of emergency plans to assure public safety and environmental protection. In this context, existing public safety agencies are presently ill-equipped and have lack of proper training for specialized problems associated with oil vessel transport, storage, and pipeline transport.

ANTICIPATED IMPACTS: Construction accidents, oil spills, fire, and natural disasters will necessitate immediate response. The shut down procedures of the pipeline alone will not preclude oil from reaching the environment. Significant damage may occur within the County, unless a coordinated, planned effort can be effectuated at a moments notice. The above-stated deficiencies in local government equipment and training would contribute to a less than comprehensive emergency preparedness program. Training of local agencies for specialized efforts associated with a project of this nature, combined with associated equipment costs, would cost the general taxpaying public.

MITIGATIVE MEASURES: Specialized training and equipment, and the costs associated, should be born by the project proponents. Contingency plans shall be devised to include local units of government, specifically planning procedures and locations for equipment, together with manpower mobilization procedures.

USE ALTERATION / ABANDONMENT

DESCRIPTION: Use alteration of the pipeline was not adequately described. Use alteration would consist of converting the pipeline from oil transport to that of liquified natural gas, etc. Abandonment procedures should include removal of the pipeline in some areas for salvage, as well as the block and check valve equipment. It is stated that river and/or road crossings may not be removed in the event of abandonment.

ANTICIPATED IMPACTS: Use alterations of the pipeline could result in economic and potential industrial impacts on the County by acting as a magnet for industrial growth and secondary economic impacts. Abandonment procedures and line recovery impacts will closely parallel construction impacts.

MITIGATIVE MEASURES: Use alteration of the pipeline should be subject to either R.C.W. 80.50 for energy facilities, or subject to all local and Federal regulatory programs in order to provide proper impact assessment procedures. Abandonment and line recovery procedures should be subject to the same impact mitigation conditions as pipeline construction.

VEGETATION CONTROL

DESCRIPTION: Control of undesirable vegetation is described to be accomplished through the application of herbicides, revegetation with preferred species, and mechanical cutting. The seventy foot wide operation right-of-way is within or adjacent to the Bonneville Power Administration's right-of-way which now exists in the County. This pipeline corridor will cover approximately 335 acres (based on 90 foot construction corridor over 31 miles) of land in Jefferson County.

ANTICIPATED IMPACTS: The primary impact from vegetation control results from the use of herbicides. Generally the potential impacts will not occur within the existing BPA corridor since vegetation control has been taking place for years. However, the concern is that any additional herbicide use will increase the potential for off-site contamination.

Conformance with Local Shoreline Program

The Northern Tier pipeline proposal is subject to the statutory provisions of Chapter 90.58 R.C.W., the Washington State Shoreline Management Act, until certification of the project is made by the Govenor under Chapter 80.50 R.C.W. Said certification effectively over-rides the statutory provisions of the Shoreline Management Act.

The scope of the project is reviewed not only as the construction of a pipeline facility through Jefferson County, but also the inherent risks associated with oil spills. Combining risk factors with the environmental conditions of the County, oil spills from ruptures should be considered within the context of project review.

The Jefferson-Port Townsend Shoreline Management Master Program was adopted and incorporated by reference in the Washington State Master Program on December 20, 1974, and is codified under Chapter 173-10-240, Washington State Administrative Code.

The Master Program enunciates the legislative findings, policies and goals of the Shoreline Management Act, R.C.W. 90.58. Chapter 90.58.020, R.C.W., provides in part: "It is the policy of the State to provide for the management of the shorelines of the State by planning for and fostering all reasonable and appropriate uses. This policy is designed to insure the development of these shorelines in a manner which, while allowing for limited reduction of rights of the public in the navigable waters, will promote and enhance the public interest. This policy contemplates protecting against adverse effects to the public health, the land and its vegetation and wildlife, and the waters of the State and their aquatic life, while protecting generally public rights of navigation and corollary rights incidental thereto. . ."

"In the implementation of this policy the public's opportunity to enjoy the physical and aesthetic qualities of natural shorelines of the State shall be preserved to the greatest extent feasible consistent with the overall best interest of the State and the people generally. To this end uses shall be preferred which are consistent with control of pollution and prevention of damage to the natural environment, or are unique to or dependent upon the use of the State's shoreline. Alterations of the natural condition of the shorelines of the State, in those limited instances when authorized, shall be given priority for single family residences . . . and . . . industrial and commerical developments which are particularly dependent on their location of or use of the shorelines of the State . . . "

"Permitted uses in the shorelines of the State shall be designed and conducted in a manner to minimize, insofar as practical, any resultant damage to the ecology and environment of the shoreline area and any interference with the public's use of the water." (Emphasis added.)

The transport of crude oil to refineries for processing may be considered a "reasonable and appropriate" use under certain circumstances. However, to be consistent with the statutory policy of the Act and Master Program, this use must protect against adverse effects (inherent or potential) to the public health, the land and its vegetation and wildlife, and the water and its aquatic life.

In the implementation of the Act and Master Program, the physical and aesthetic quality of Jefferson County's rivers and shorelines must be preserved subservient only to the greater interest of the people of the State. This preservation is accomplished by permitting only those uses which control pollution and prevent damage to the natural environment, or which are dependent upon the use of the shorelines.

The Northern Tier pipeline project constitutes a variance from a number of use regulations within the Jefferson-Port Townsend Shoreline Management Master Program. ram. In exercising judgements on a variance request for a proposal, the County is subject to the variance standards established by the Shoreline Management Act and the local Master Program. Variance procedures are established to insure that strict implementation of the program will not present an undue hardship to the proponent, provided that in granting variances the goals and policies of the Master Program and the Act are preserved. Any such variance would have to be based upon the existence of extraordinary circumstances not addressed by the Master Program and the Act, and also show that the public interest can be secured by the granting of the variance.

The proposed pipeline project, to be consistent with the Shoreline Management Act and the local Shoreline Management Master Program, must provide evidence that the project, from construction through operation, will: (1) control pollution and prevent damage to the natural environment; (2) be in harmony with the general intent,

goals, and policies of the Master Program and the Act; and (3) preserve the public welfare and interest.

A number of issues concerning the proposed project, as reflected in the EFSEC application and this analysis, remain unresolved. In order for the proposed project and variance requests to be judged consistent with the local Master Program and the Act, the following items need to be resolved: (1) stream crossings -- erosion and sedimentation during and after construction; (2) pipeline flushing -- protection of land degradation and streams from contamination; (3) risk of oil spill or pipeline rupture -- liability and restoration responsibilities in streams and down stream marine habitats; and (4) staging areas -- location, construction, and operation.

APPLICABLE ELEMENTS OF LOCAL SHORELINE PROGRAM

Following are applicable goals, policies, and performance standards of the Jefferson-Port Townsend Shoreline Management Master Program. Those performance standards that will be varying from the proposal are noted with an asterisk.

UTILITIES, 5,140: Defined as services or facilities which produce, transmit, carry, store, process or dispose of electric power, gas, water, sewage, communications, oil, and the like.

Policies:

a. Whenever utilities must be placed in a shoreline area, the location should be chosen so as not to obstruct or destroy scenic views. Whenever feasible, these facilities should be placed underground or designed to do minimal damage to the aesthetic qualities of the shoreline area.
b. To the extent feasible, Jefferson County and the City of Port Townsend should incorporate major utility corridors on shorelines into their programs and plans for public access to and along water bodies.
c. Utilities should be located to meet the needs of future populations in areas planned to accommodate this growth.
d. Upon completion of installation/maintenance projects on shorelines, banks should be restored to pre-project configuration, replanted with native species and provided maintenance care until the newly planted vegetation is established.

Performance Standards:

a. Utilities shall be installed adjacent to or within existing utility or circulation easements or right-of-ways whenever feasible.
b. Utilities shall be installed underground whenever feasible.
c. Utilities shall be designed and installed to meet future needs when possible.
d. When feasible, utility corridors shall serve multiple uses such as shoreline access or recreational trails or pathways.
e.* Utilities installed in the water, or the beach, or upon tidal areas shall assure that water quality and marine life will not suffer degradation.
f. Installation of utilities shall assure the prevention of siltation or beach erosion.
g. Upon completion of installation projects, or maintenance projects, banks shall be restored to a suitable configuration and stability, and shall be replanted with native species and provided with maintenance care until the newly-planted vegetation is established.
h.* Utility discharges and outfalls shall be located, designed, constructed and operated such that degradation to water quality, marine life, and general shoreline ecosystems is kept to an absolute minimum.
i. Both during and after installation, utilities shall assure that geohydraulic shore processes and marine life are basically maintained in their natural condition.
j. Utilities located in flood-prone areas shall be provided adequate flood protection, and shall not be so intalled so as to increase flood hazard or other damage to life or property.
k. Flamable or toxic materials shall not be stored in areas subject to flooding.
l. Utilities shall not be installed in areas subject to geologic hazards unless it can clearly be demonstrated that such hazards can be overcome.

ROAD AND RAILROAD ROUTES AND DEVICES,** 5.160: Defined as a linear passageway for motor vehicles or trains, together with appurtenant devices such as bridges.

Policies:

a. Whenever feasible, major highways, freeways and railroads should be located away from shorelands, except in port and heavy industrial areas, so that shoreland roads may be reserved for slow-moving recreational or residential traffic.
b. Roads located in wetland areas should be desigred and maintained to prevent erosion and to permit a natural movement of ground water.

**No road construction is identified, however, new access or emergency access construction may be required.

c. All debris, overburden, and other waste materials from construction should be disposed of in such a way as to prevent their entry by erosion from drainage, high water, or other means into any water body.
d. Road locations should be planned to fit the topography so that minimum alterations of natural conditions will be necessary.
e. Scenic corridors with public roadways should have provision for safe pedestrian and other nonmotorized travel. Also, provision should be made for sufficient view points, rest areas and picnic areas in public shorelines.
f. Extensive loops or spurs of old highways with high aesthetic quality should be kept in service as pleasure by-pass routes, especially where main highways, paralleling the old highway, must carry large traffic volumes at high speeds.
g. Since land use and transportation facilities are so highly interrelated, the plans for each should be coordinated.

Performance Standards:

a. When feasible, major highways and railroads shall be located away from the shoreline.
b. Whenever possible, roads shall be located on natural benches, ridge tops or other areas where alteration of natural features, such as soils, will be minimal.
c. Roads shall be located so as to avoid steep, narrow canyons, slide areas, slumps, swamps, marshes, wet meadows and the like.
d. Roads and railroads shall be located so as to provide buffer areas along streamways and other shorelines.
e. The nubmer of waterway crossings shall be minimized.
f. Unnecessary duplication of roads shall be avoided by making use of existing roads where practicable.
g. Road drainage shall be designed so as to provide waste and borrow areas that will produce a minimum of erosion, water turbidity, and aesthetic damage.
h. Cut and fill slopes shall be designed at the normal angle of repose or less.
j. Cut and fill areas shall be protected from erosion by mulching, seeding, use of headwalls or other suitable means.
k. Roads and waterway crossings shall not be wider than to accommodate the anticipated use.
l. Waterway crossings shall be designed so that the integrity of the naturally-occuring geohydraulic process is maintained.
m. Waterway crossings shall be designed so as to provide minimal distrubance to banks.
n. Culverts and similar devices shall be designed with regard to fifty-year storm frequencies.
p. Roads, bridges, culverts and similar devices shall afford maximum protection for fisheries resources.
q. Excess material shall be desposited in stable locations and not into streamway corridors where such materials degrade water quality, impeded flood waters, or alter naturally-occurring geohydraulic processes.
r. No machinery shall operate within a stream bed except in compliance with a hydraulics permit issued by the Department of Fisheries and Game.
s. All material associated with road construction which is potentially unstable or erodable shall be stabilized by compacting, seeding, mulching, or other suitable means.
5. All roads and drainage systems shall be maintained so as to prevent erosion and/or water quality degradation.
u. Excess material accummulated during maintenance of roads and drainage systems shall be deposited in stable locations and not into streamway corridors where such materials would degrade water quality, impede flood waters, or alter naturally-occurring geohydraulic processes.
v. Mechanical apparatus, rather than chemicals, shall be used for brush clearing maintenance wherever practicable.
w. Herbicides used for maintenance along roads and drainage systems shall follow the performance standards under Section 5.803(d).
x. Road routes shall make provisions for pedestrian, equestrian, bicycle and other modes of travel whenever feasible.
y. In compliance with R.C.W. 36.87.130, Jefferson County shall not "vacate a County road or part thereof which abuts on a body of salt or fresh water, unless the purpose of the vacation is to enable any public authority to acquire the vacated property for port purposes, boat moorage or launching sites, or for park, viewpoint, recreational, education, or other public purposes, or unless the property is zoned for industrial purposes."

Further, such vacation shall not be accomplished for any purpose that is not consistent with this Master Program, and then only when all appropriate Federal, State, and local permits have been issued for the intended use.

PORTS AND INDUSTRY, 5.180: Defined as centers for waterborne traffic associated manufacturing firms.

Policies:

a. Water dependent industries which require frontage on navigable water should be given priority over other industrial uses.
b. Port facilities should be designed to permit viewing of harbor areas from viewpoints, waterfront restaurants and similar public facilities which would not interfere with port operations or endanger public health and safety.
c. Sewage treatment, water reclamation, desalinization and power plants should be located where they do not interfere with and are compatible with recreational, residential or other public uses of the water and shorelands. Waste treatment ponds for water related industry should occupy as little shoreline as possible.
d. The cooperative use of docking, parking, cargo handling and storage facilities should be strongly encouraged in waterfront industrial areas.
e. Land transportation and utility corridors serving ports and water related industry should follow the guidelines provided under the sections dealing with utilities and road and railroad design and construction. Where feasible, transportation design and utility corridors should be located upland to reduce pressures for the use of waterfront sites.
f. Since industrial docks and piers are often longer and greater in bulk than recreational or residential piers, careful planning must be undertaken to reduce the adverse impact of such facilities on other water dependent uses and shoreline resources.
g. Because heavy industrial activities are associated with industrial piers and docks, the location of these facilities must be considered a major factor in determining the environmental copatibility of such facilities.

Performance Standards:

a.* Only shoreline dependent industry shall be permitted shoreline locations. The only exception to this rule shall be when other shoreline-oriented industry can clearly demonstrate that no other site location is practicable.
b.* Industrial development shall be located, designed, constructed, and operated in such a manner as to minimize adverse effects on aquatic life.
c.* Industiral developments shall comply with all Federal, State, regional and local requirements regarding air and water quality. No pollution of air by fly-ash, dust, vapors, odors, smoke, or other substances shall be permitted which are harmful to health, animals vegetation, or other property, or which can cause excessive soiling.
d.* Industrial and port facilities shall be located, designed, constructed, and operated so as to minimize unnecessary interference with the rights of adjacent property owners, as well as adjacent shoreline or water uses.
e. Industiral and port facilities shall not duplicate, but share overwater structures such as docks and piers whenever practicable. Any activity involving the use or storage of flamable or explosive materials shall be protected by adequate fire-fighting and fire-prevention equipment and by such safety devices as are normally used in the handling of any such material. Such hazards shall be kept removed from adjacent activities to a distance which is compatible with the potential danger involved.
f.* Industrial and port facilities shall make adequate provisions to minimize the probability of spills of fuel or other toxic substances. Provisions shall be made to handle accidental spills that do occur.
g. No activity shall emit dangerous radioactivity at any point, or electrial disturbance adversely affecting the operation of any equipment at any other than that of the creator of such disturbance.
h.* Objectionable noise which is due to volume, frequency, or beat shall be muffled or otherwise controlled. Air-raid sirens and related apparatus used solely for public purposes are exempt from this requirement.
i. No vibration shall be permitted which is discernible without instruments on any adjoining lot or property.
j. Industrial facilities shall assure that no direct or reflected glare is visable from adjacent properties, streets, or water areas.
k. Industrial facilities shall be so located, designed, and operated to eliminate all unnecessary noxious odors.
l. Port and industrial facilities shall provide public access to shoreline areas when feasible, taking into consideration public safety, public health, and security.
m. Waste treatment ponds shall be located as far inland as practicable.
n. Port and industrial facilities shall be located, designed, and constructed to permit viewing of harbor areas or other recognized or officially delineated vistas.

DREDGING, 5.200: Defined as the removal of earth, sand, gravel, silt or debris from the bottom of a stream, river, lake, bay, or other water body.

Policies:

a. Dredging should be controlled so as to minimize damage to existing ecological values and natural resources of both the area to be dredged and the area for deposit of dredged materials.
b. Long range plans should be developed for the deposit and use of spoils on land. Spoil deposit sites in water areas should also be identified by local government in coorperation with the State Departments of Natural Resources, Game and Fisheries.
c. Depositing of dredge material in water areas should be allowed only for habitat improvement to correct problems of material distribution adversely affecting fish and shellfish resources, or where the alternatives of depositing material on land is more detrimental to shoreline resources than depositing it in water areas.
f. Dredging of bottom materials for the single purpose of obtaining fill material should be discouraged.

Performance Standards:

a.* Dredging shall cause no more than minimal damage to water quality, fish, shellfish, essential marine-biological elements, and other natural resources.
b.* Dredging shall cause no more than minimal disruption of natural geohydraulic processes along shores and streams.
c.* Dredging operations shall be scheduled so as not to materially interfere with the migratory movements of anadromous fish.
d.* Dredging shall not cause unnecessary interference with navigation or unnecessary infringement upon adjacent shoreline uses, properties, or values.
e.* Dredge material shall be deposited on upland sites wherever possible, and only on those sites authorized by the shoreline management substantial development permit.
f.* Dredged mateirials deposited on upland sites shall constitute landfill, and when deposited within the geographical jurisdiction of this Master Program, shall comply with Subsection 5.210.
g.* Depositing of dredged materials in water areas shall be allowed only (1) for wildlife habitat improvement or, (2) to correct problems of material distribution adversely affecting fish and shellfish resources, or (3) when the alternatives of depositing material on land is more detrimental to shoreline resources than depositing it in water areas, or (4) in dredge spoil disposal areas authorized by the State of Washington or Jefferson County, or (5) for the enhancement of geohydraulic shore processes by beach feeding.
h.* Depositing of dredged materials in water areas shall be onle in a manner which does not unnecessarily disrupt natural geohydraulic processes or interfere with the use or value of adjacent property.

LANDFILLS, 5.210: Defined as the creation of dry upland area by depositing material into water, or onto shoreline or wetland areas.

Policies:

a. Shoreline fills or cuts should be designed and located so that significant damage to existing ecological values or natural resources, or alteration of local currents will not occur, creating a hazard to adjacent life, property, and natural resource systems.
b. All perimeters of fills should be provided with vegetation, retaining walls, or other mechanisms for erosion prevention.
c. Fill materials should be of such quality that it will not cause problems of water quality. Shoreline areas are not to be considered for sanitary landfills or for the disposal of solid waste.
d. Priority should be given to landfills for water dependent uses and for public uses. In evaluating fill projects and in designating areas appropriate for fill, such factors as total water surface reduction, navigation restriction, impediment to water flow and circulation, reduction of water quality and destruction of habitat should be considered.

Performance Standards:

a.* Landfill shall only be permitted to serve shoreline dependent uses.
b.* Landfill is not permittted in estuaries, tidelands, marshes, ponds, swamps, or similar water-retention areas.
c.* Landfills are not permitted in floodplains unless it can clearly be demonstrated that the geohydraulics and floodplain storage capacity will not be altered so as to increase flood hazard or other damage to life or property.
d.* Landfills shall not disrupt streamway geohydraulics which may lead to damage of adjacent properties.
e.* Landfills shall rot disrupt normal surface water drainageways.
f.* Landfill shall be deposited so as not to sever the normal recharge of ground

water supplies, and in a manner that does not degrade quantity and quality of ground water.

g.* Fill material shall be of a quality, and so placed and contained, that it does not cause water quality degradation. Junk, garbage, and other potentially hazardous sewage and rubbish is not permitted to be used as fill material. Normally, fill material shall be restricted to soil, sand, rock, or gravel.

h.* Permitted fills shall be appropriately sloped and planted with vegetation to prevent erosion.

RESOLUTION NO. 55-79

WHEREAS, the Board of Commissioners of Jefferson County are charged with the responsibility of protecting the health, safety, and general welfare of the citizens of the County; and

WHEREAS, this responsibility includes protecting and enhancing the resources of the County from which many of the citizenery derives their livelihood; and

WHEREAS, Jefferson County has analyzed and evaluated the probable and potential impacts associated with the proposed Northern Tier pipeline project; and

WHEREAS, this analysis has illustrated a number of concerns and impacts associated with the project which have not been adequately addressed by the Northern Tier Pipeline Company; and

WHEREAS, these probable and potential impacts represent a threat to the long term productivity of the resources of Jefferson County; and

WHEREAS, the mitigative measures presented herein provide further protection to the resources of the County, but do not mitigate all impacts or concerns.

NOW, THEREFORE, BE IT RESOLVED, that until the Northern Tier Pipeline Company can thoroughly and quantitatively mitigate the concerns and impacts contained in this assessment report, the Jefferson County Board of Commissioners cannot support the Northern Tier pipeline project as proposed.

Approved and adopted this 29th day of May, 1979.

SEAL

JEFFERSON COUNTY BOARD OF COMMISSIONERS

A.M. O'Meara, Chairman

B.G. Brown, Commissioner

Carroll M. Mercer, Commissioner

ATTEST: Betty Anderson
Betty Anderson,
County Auditor and Ex-Officio
Clerk of the Board

References

Bureau of Land Management, 1978, Draft Environmental Statement, Crude Oil Transportation System, U.S. Department of the Interior, Washington, D.C.

Calambokidis, J., et al., 1978, Chlorinated Hydrocarbon Concentrations and the Ecology and Behavior of Harbor Seals in Washington State Waters, The Evergreen State College, Olympia, Washington.

Division of Marine Land Management, 1977, Washington Marine Atlas, Volume 2: South Inland Waters, Washington Department of Natural Resources, Olympia, Washington.

Econ Corporation, 1975, North Olympic Coastal Basin - Water Quality Management Plan, Vancouver, Washington.

Egan, R., 1977, Salmon Spawning Ground Data Report (Progress Report Number 17), Washington State Deparmtent of Fisheries, Olympia, Washington.

_____, 1979, Salmon Spawning Ground Data Report (Progress Report Number 51), Washington Department of Fisheries, Olympia, Washington.

Goodwin, L., 1978, Puget Sound Subtidal Geoduck Survey Data (Progress Report Number 36), Washington Department of Fisheries, Olympia, Washington.

Goodwin, L. and Shul, W., 1978, Puget Sound Subtidal Hardshell Clam Survey Data (Progress Report Number 44), Washington Department of Fisheries, Olympia, Washington.

Hood Canal Advisory Commission, 1977, Hood Canal Handbook, Kitsap County Central Reproductions, Port Orchard, Washington.

Jefferson County Planning Department, 1978, Unpublished maps and data pertaining to soils and other physical features, Port Townsend, Washington.

_____, 1979, Jefferson County Comprehensive Plan (draft), Port Townsend, Washington.

Jefferson-Port Townsend Shoreline Management Advisory Commission, 1974, Shoreline Management Master Program for Jefferson County and Port Townsend, Port Townsend, Washington.

Jennings, M., et al., 1977, Snow Creek Research Project and Facilities: A Draft Environmental Impact Statement, Washington Department of Game, Olympia, Washington.

Little, Arthur D., Inc., 1977, The Onshore Impacts of Alaskan Oil and Gas Development in the State of Washington, Washington Department of Ecology, Olympia, Washington.

McCreary, F.R., 1975, Soil Survey of Jefferson County Area, Washington, U.S. Soil Conservation Services, Washington, D.C.

Nautilus Bio-Resource Advisors, 1976, Jefferson County Shoreline Bio-Resource Inventory - Phase One, Jefferson County Planning Department, Port Townsend, Washington.

New England River Basins Commission, 1976, Estimates for New England Onshore Facilities Related to Offshore Oil and Gas Development, Boston, Massachusetts.

_____, 1976, Factbook - Onshore Facilities Related to Offshore Oil and Gas Development, Boston, Massachusetts.

Northwest Environmental Consultants, 1975, The Tidal Marshes of Jefferson County, Washington, Jefferson County Planning Department, Port Townsend, Washington.

Oceanographic Commission of Washington, 1975, Submarine Pipeline Crossings at Admiralty Inlet, Puget Sound, Washington Legislature, Olympia, Washington.

Poole, M.G. and Associates, 1969, Jefferson County Comprehensive Plan, Dash Point, Washington.

Sandison, G., 1978, Letter and Attachments to Allen Zink, April 4, 1978, Washington Department of Fisheries, Olympia, Washington.

Scott, W.B. and Crossman, E.J., 1973, Freshwater Fishes of Canada, Bulletin 184, Fisheries Research Board of Canada, Ottawa, Canada.

U.S. Geological Survey (USGS), 1953 (1973 photorevised), Topographic 1:24,000 Scale Map for Holly, Brinnon, Seabeck, Mount Walker, Quilcene, Center, and Uncas, Washington.

Washington Department of Fisheries, Whitney Point Shellfish Laboratory, Assorted Data and Publiscations Related to Fish and Shellfish Resources in Discovery Bay, Quilcene Bay, Dabob Bay, Hood Canal, and Brinnon, Washington.

Williams, R.W., Laramie, R.M., and Ames, J.J., 1975, A Catalog of Washington Streams and Salmon Utilization: Volume 1, Puget Sound Region, Washington Department of Fisheries, Olympia, Washington.

Yoshinaka, M.S. and Ellifrit, N.J., 1974, Hood Canal - Priorities for Tomarrow U.S. Fish and Wildlife Service, Portland, Oregon.

Appendix A

"AN ANALYSIS OF STREAMS, RIVERS, LAKES AND ESTUARIES ALONG THE PROPOSED NORTHERN TIER PIPELINE ROUTE IN JEFFERSON COUNTY, WASHINGTON"

Northwest Environmental Consultants, Inc.

February 1979

AN ANALYSIS OF STREAMS, RIVERS, LAKES AND ESTUARIES ALONG THE PROPOSED NORTHERN TIER PIPELINE ROUTE IN JEFFERSON COUNTY, WASHINGTON

G. Bradford Shea
and
Douglas J. Canning

February 1979

Submitted to:

JEFFERSON COUNTY PLANNING DEPARTMENT
Jefferson County Courthouse
Port Townsend, Washington 98368

By:

NORTHWEST ENVIRONMENTAL CONSULTANTS, INC.
158 Thomas Street, Suite 35
Seattle, Washington 98109

ACKNOWLEDGEMENTS

The preparation of this report was financially aided through a grant from the Washington State Department of Ecology (DOC) with funds obtained from the National Oceanic and Atmospheric Administration (NOAA) and appropriated from Section 308(c) of the Coastal Zone Management Act of 1972.

In addition to the Washington Association of Counties, DOE and NOAA, whose funds made these studies possible, Northwest Environmental Consultants, Inc.(NEC), wishes to thank Mr. David Goldsmith and Tom Aumock of the Jefferson County Planning Department for their continued support throughout the project. We also wish to thank Mary Lou Mills of the Washington Department of Fisheries and Joe La Tourette of the Washington Department of Game for discussions of potential pipeline impacts and the interests of their respective agencies. We especially want to thank Ms. Ruth Pittman who put in many extra hours to complete the report production by the deadline.

CONTENTS

	Page
I. INTRODUCTION	1
Hood Canal	3
II. EXISTING CONDITIONS	13
Salmon Creek	15
Snow Creek	22
Salmon-Snow Creek Estuary	25
Lakes	28
Peterson Lake	29
Crocker Lake	30
Tarboo Lake	31
Leland Lake	32
Little Quilcene River	37
Big Quilcene River	41
Quilcene Estaury	44
Spencer Creek	48
Spencer Estuary	49
Jackson - Marple Creeks	53
Turner Creek	56
Dosewallips River	58
Dosewallips Estuary	63
Duckabush River	66
Duckabush Estuary	70
McDonald Creek	73
McDaniel Cove	74
Fulton Creek	77
Fulton Creek Delta	79
III. POTENTIAL IMPACTS	81
Contruction Effects	81
Operational Effects	86
IV. POSSIBLE MITIGATIVE CONSTRUCTION OR ALIGNMENT MEASURES	88
V. EVALUATION AND RECOMMENDATIONS	92
REFERENCES	95

FIGURES

1. Salmon Creek, Snow Creek and Salmon - Snow Creek Estuary 20
2. Peterson, Crocker and Tarboo Lakes 34
3. Leland Lake 35
4. Big and Little Quilcene Rivers and Quilcene Estuary 40
5. Spencer, Marple, Jackson and Turner Creeks. 51
6. Dosewallips River 62
7. Duckabush River and Estuary 69
8. McDonald and Fulton Creeks 76

TABLES

1. Stream Crossing Survey Summary 2
2. Dollar Values of Present Production of Fisheries Resources in Selected Areas of Puget Sound and Puget Sound as a Whole. 5
3. Dollar Values of Potential Fishery Production of Selected Areas of Puget Sound and Puget Sound as a Whole 6
4. Hood Canal River of Origin Salmon Production Value 9
5. Estimated Commercial Landings of Bottomfish on Puget Sound during 1976 10
6. Annual Harvest and Potential Annual Harvest of Various Species of Shellfish 11
7. Intertidal Clam and Otster Farm Licenses Issued by Washington Department of Fisheries, Hood Canal . . . 12
8. Timing of Salmon Fresh-water Life Phases in the Quilcene and Nearby Olympic Basins 85
9. Stream Sensitivity Matrix 93

I. INTRODUCTION

This report enumerates the results of field studies, data compilations and the review of relevant literature pertaining to potential impacts of the proposed Northern Tier Pipeline on rivers, estuaries, streams and lakes in Jefferson County, Washington. The first section gives existing physical conditions in each waterway. This includes all rivers and streams which will be crossed (as defined by existing plans) as well as lakes or estuaries which lie in drainage basins of the proposed corridor.

Field studies were carried out by Mr. Douglas Canning, Dr. G. Bradford Shea and Ms. Kathy Pazera of Northwest Environmental Consultants, Inc., during November, December and January (1978 - 1979) on rivers, streams and lakes along the proposed pipeline corridor. The field studies were carried out for the Jefferson County Planning Department in order to evaluate existing conditions, potential impacts and mitigative measures associated with the Nortern Tier Proposal. The study was initiated due to a lack of detailed information on the lakes, estuaries and smaller streams in the EFSEC Application and Corps Permit Applications.

Northern Tier has proposed a preliminary route within a two mile wide pipeline corridor. Theoretically, the pipeline might be located anywhere within this corridor, if problems arise with the proposed crossing locations. NEC personnel therefore attempted to survey several points within the corridor for each river, stream, lake or estuary within or downstream of the corridor. In much of the County, the pipeline will probably parallel the existing Bonneville Power Administration (BPA) powerline. The waterways investigated during this study are shown in Table 1, together with their respective receiving waters and survey dates. The existing physical and biological conditions of these areas and potential effects of the proposed pipeline will constitute the remainder of this report.

Table 1

STREAM CROSSING SURVEY SUMMARY

River, Stream, Estuary or Lake	Receiving Waters	Survey Dates
Salmon Creek	Port Discovery Bay	Nov 15, Dec 22
Snow Creek	Port Discovery Bay	Nov 15, Dec 22
Salmon-Snow Creek Estuary	Port Discovery Bay	Dec 22
Peterson Lake	Chimacum Creek	Dec 22
Crocker Lake	Little Quilcene River	Dec 22
Tarboo Lake	--	Dec 13
Leland Lake	Little Quilcene River	Dec 22
Little Quilcene River	Quilcene Bay	Dec 13
Big Quilcene River	Quilcene Bay	Dec 13
Quilcene Estuary	Dabob Bay - Hood Canal	Dec 13
Spencer Creek	Dabob Bay	Jan 21
Marple Creek	Dabob Bay	Jan 21
Jackson Creek	Dabob Bay	Jan 21
Turner Creek	Dabob Bay	Jan 21
Dosewallips River	Dabob Bay	Nov 25
Dosewallips Estuary	Dabob Bay	Nov 25
Duckabush River	Dabob Bay	Nov 25
Duckabush Estuary	Dabob Bay	Nov 25
McDonald Creek	Hood Canal	Jan 21
Fulton Creek	Hood Canal	Jan 21
Donovan Creek	Quilcene Bay	*

*not surveyed separately; see Quilcene Bay

At this time, the Northern Tier Pipeline Company has proposed a preliminary route and has applied for U.S. Army Corps of Engineers dredging permits for four major river crossings:

Little Quilcene River

Big Quilcene River

Dosewallips River

Duckabush River

The Corps of Engineers has not considered requiring full permits on other streams at this time, although many streams on the route could be considered as under Corps' jurisdiction.

Northern Tier Company has also submitted a multi-volume site application to the Washington State Energy Facilities Siting and Evaluation Council (EFSEC). Two environmental impact statements have been prepared on the project:

- A federal NEPA impact statement by the Bureau of Land Management (BLM)
- A Washington State SEPA impact statement being prepared by CH_2M Hill Corporation for EFSEC

As of the time of this writing, only the BLM document has been issued.

In order to set the individual stream analyses in context, this introduction concludeswith a general discussion of Hood Canal dynamics, resources and, to a limited extent, economics. The remainder of the report will deal with resources on an area-specific basis.

HOOD CANAL

Oceanography

Hood Canal, as a sub-system of Puget Sound, is very sensitive to contamination of any type due to its flushing and water exchange characteristics. In general, the Canal has a constant but *limited*

water exchange with the main Puget Sound system. Deep water excange of Hood Canal waters with Puget Sound waters generally only occurs during late summer. As might be expected in a 64 mile long, dead-end embayment, tidal flow and mixing are strongest in the extreme lower reach, with progressively weaker tidal flow and mixing towards the upper head of the bay.

Two factors inhibit complete, constant mixing, and rapid flushing. Two sets of sills, one near the mouth of the Canal, and another approximately 9 miles inside the Canal at South Point, reduce exchange and deep water circulation. The Dabob-Quilcene Bay inlet of the Canal also has sills at its mouth, further reducing exchange and flushing in that area.

The weak tidal action results in a salinity stratification which also inhibits complete flushing and exchange. When fresh riverwater enters the Canal, it floats on the more dense saline water with minimal mixing. This lower salinity waters forms a surface layer approximately 10 feet deep. The surface layer mixes readily with Puget Sound waters; the deeper, more saline layer generally is able to exchange only during one brief period a year in late summer (Yoshinaka & Ellifrit 1974).

At best, then, flushing of Hood Canal takes at least one year, with flushing times for southern Hood Canal likely greater. Throughout most of Puget Sound, flushing times on the order of a few tidal cycles (days) are common.

Fisheries

The Hood Canal commercial and sports fisheries forms a substantial portion of the general Puget Sound fisheries. The data in Table 2 show that the existing Hood Canal fisheries resource catch is 16.8% of the Puget Sound catch. Shellfisheries are more important yet, comprising 26.5% of the Puget Sound harvest. With full implementation of all existing management and enhancement programs (Table 3), Hood Canal fisheries would increase to 23.1% of the

Table 2

DOLLAR VALUES OF PRESENT PRODUCTION OF FISHERIES RESOURCES IN SELECTED AREAS OF PUGET SOUND AND IN PUGET SOUND AS A WHOLE

	Straits[1]	Central Sound	South Sound	Hood Canal	All of Puget Sound[2]
Shellfish	$1,264,000	$3,003,000	$4,177,000	$5,798,000	$21,917,000
Commercial groundfish	260,000	263,000	17,000	140,000	1,187,000
Recreational bottomfish	51,000	511,000	281,000	10,000	976,000
Salmon production[4]	1,958,000	8,833,000	5,545,000	4,163,000	35,380,0
Herring[5]	--	--	224,000	146,000	1,600,000
Total	3,533,000	12,610,000	10,244,000	10,257,000	61,060,000
Salmon harvest[3]	$9,588,433	$6,585,721	$3,492,547	$1,672,435	48,958,541

1/ Straits include only Port Angeles to Port Townsend for shellfish.

2/ Represents total of all selected areas listed plus Puget Sound areas not specifically designated.

3/ Salmon production and harvest figures are additive in special circumstances.

4/ 718,300 lbs. of production in Puget Sound tribal and co-operative projects is not included. Estimated dollar value of these releases is $5,387,250 annually.

5/ 1976 herring harvest used. 1975 harvest was approximately double the 1976 harvest in South Sound and Hood Canal.

Source: Sandison 1978

Table 3

DOLLAR VALUES OF POTENTIAL ANNUAL FISHERY PRODUCTION OF SELECTED AREAS OF PUGET SOUND AND OF PUGET SOUND AS A WHOLE

	Straits[1]	Central Sound	South Sound	Hood Canal	All of Puget Sound[2]
Shellfish	$4,248,000	$5,394,000	$10,103,000	$10,721,000	$49,200,000
Commercial groundfish	757,000	1,274,000	360,000	213,000	3,719,000
Recreational bottomfish[3]	51,000	511,000	281,000	10,000	976,000
Salmon production[4]	7,684,000	18,298,000	24,665,000	30,030,000	123,387,000
Herring	--	--	408,000	264,000	2,800,000
Total	$12,739,000	$25,477,000	$35,817,000	$41,638,000	$180,082,000

1/ Straits include only Port Angeles to Port Townsend for shellfish.

2/ Represents total of all selected areas plus other geographic areas in Puget Sound.

3/ No projections made on harvest increases. Present harvest used.

4/ Present production plus unconstructed Washington Department of Fisheries projects and proposed projects.

Source: Sandison 1978

Puget Sound catch. The dollar values of catches and harvests shown are based on prices paid to fishermen, and thus represent an absolute minimum value of the resource. The processed value of the resource is approximately two times the catch value. Retail sales values are three to four times the catch values. The total economic value of the resource is, or course, much greater to the Washington economy, taking into account support industries.

River of origin production values are shown in Table 4. These data indicate the total salmon production value of each stream regardless of where the fish were harvested. Production values of the Skokomish and Quilcene rivers and Finch Creek are greatly enhanced by the presence of salmon hatcheries on those streams. Hood Canal salmon production is 11.8% the production of all Puget Sound streams.

Bottomfish landings in Hood Canal are relatively small in comparison to other Puget Sound sub-areas (Table 5), with the exception of dogfish. Hood Canal dogfish harvest comprises 35.1% of the Puget Sound catch. All bottomfish caught in the Canal comprise 13.6% of the Puget Sound catch.

The absolute and comparitive harvests of a variety of shellfish in Hood Canal and Puget Sound are shown in Table 6. Species which form a particularly substantial portion of the Puget Sound harvest are shrimp (70.5%), recreational intertidal clams (27.7%), recreational intertidal rock crabs (19.3%), and geoducks (26.5%). Of greater interest are commercial harvests of Pacific oyster seed and recreational harvests of intertidal oysters, both of which occur only in the Puget Sound system at Hood Canal.

The Washington Department of Fisheries licenses the intertidal farming of clams and oysters for commercial and personal harvest in excess of sports harvest limits. Information from the Department of Fisheries Licensing Division is available to describe the general location of intertidal clam and oyster farming. Areas of

intense intertidal farming in Hood Canal and South Puget Sound are Dabob and Quilcene Bays, Seal Rock, Brinnon, Hoodsport, Union and Tahuya, and the Skookum - Oyster Bays system (Table 7).

Summary

Hood Canal as a water body and shorelines system is unusually vulnerable to contamination due to its extremely slow flushing rate and poor tidal mixing characteristics. The Canal contributes a significant portion of the state's Puget Sound fishery.

Table 4

HOOD CANAL RIVER OF ORIGIN SALMON
PRODUCTION VALUES *

Rivers	Value, $
Quilcene	679,000
Dosewallips	464,000
Duckabush	311,000
Hamma Hamma	116,000
Skokomish	1,204,000
Misc. Steams	545,000
Finch Creek	750,000
Dewatto	38,000
Tuhuya	56,000
TOTAL	$4,163,000

(Puget Sound Grand Total $35,380,000)

* Does not include cooperative, tribal or federal production other than Quilcene.

Source: Sandison 1978

Table 5

ESTIMATED [1/] COMMERCIAL (ALL GEARS) LANDINGS OF BOTTOMFISH IN PUGET SOUND DURING 1976

Species	Straits	Hood Canal	Central Sound	South Sound	North Sound	Total
English Sole	117,563	29,986	592,324	4,361	710,776	1,455,010
Dover Sole	----	----	177,044	----	17,310	194,354
Rock Sole	61,515	4,457	9,487	479	167,465	243,403
Sand Sole	5,800	25	5,950	15,305	74,099	101,179
Flounder	14,446	794	68,071	32,035	491,438	606,784
Other Sole	155	100	800	100	400	1,555
Lingcod	77,049	8,505	11,266	24	53,376	150,220
Pacific Cod	1,237,019	17,933	109,979	4,885	1,598,777	2,968,593
Pacific hake	----	----	3,691,684	----	46,417	3,738,101
Rockfish	25,879	5,229	31,947	11,455	62,627	137,137
Dogfish	1,052,805	2,009,631	943,751	36,572	1,676,673	5,719,432
Perch	----	119,636	105,910	37,452	----	262,998
Halibut	5,730	20	----	----	39	5,789
Misc. food	7,916	398	17,324	1,804	97,937	125,379
Misc. indust.	----	----	81,339	283,911	129,527	494,777
Total	2,605,877	2,196,714	5,846,876	428,383	5,126,861	16,204,711

1/ Data Sources: Trawl-Pattie, B. and W. Gormley. The 1976 Washington Trawl Landings by PMFC and State Bottomfish Statistical Areas. Washington Department of Fisheries, Prog. Rept. J. Press
Other gears - D. Ward, WDF State Rept. ROIFT for 1976.

Source: Sandison 1978

Table 6

ANNUAL HARVEST
AND POTENTIAL ANNUAL HARVEST (IN PARENTHESIS)
VARIOUS SPECIES OF SHELLFISH

(IN 1000's OF POUNDS)

Species	Hood Canal	Puget Sound	Hood Canal as % of Puget Sound
Pacific oyster (commercial)	185 (550)	2,500 (10,000)	7.4 (5.5)
Pacific oyster seed (commercial)	50 (150)	50 (150)	100.0 (100.0)
Octopus	0.5 (50)	60 (500)	0.8 (10.0)
Dungeness crabs	158	2,882	5.5
Shrimp	201	285	70.5
Intertidal clams (sport)	714	2,520	27.7
Intertidal oysters (sport)	115	115	100.0
Intertidal crab (sport)			
Dungeness	17	134	12.7
Rock	11	57	19.3
Geoduck	2,235 (5,167)	8,443 (27,400)	26.5 (18.9)
Subtidal hardshell clam (commercial dredge)			
Butter	5.6 (3,169)	319 (22,706)	1.8 (14.0)
Littleneck	0.4 (280)	53 (5,534)	0.8 (5.1)
Horse	0.1 (420)	484 (5,760)	<0.1 (7.2)

Source: Sandison 1978

Table 7

INTERTIDAL CLAM AND OYSTER FARM LICENSES ISSUED
BY WASHINGTON DEPARTMENT OF FISHERIES, HOOD CANAL

Region	Clam Licenses		Oyster Licenses	
	Commercial	Personal	Commercial	Personal
HOOD CANAL				
Quilcene	1	1	1	2
Dabob Bay	1	0	2	5
Wa Wa Point	0	1	0	2
Jackson Cove	0	1	1	4
Seal Rock	1	0	3	1
Brinnon Beach Estates	0	1	0	2
Brinnon	0	1	1	11
Duckabush	0	1	0	0
McDonald (McDaniel) Cove	0	1	0	1
Triton Head/Cove	0	1	0	3
Eldon (Hamma Hamma)	1	0	1	0
Jorsted Creek	0	1	0	3
Eagle Creek	0	0	1	0
Lilliwaup	0	1	0	8
Hoodsport	0	0	0	12
Potlach	1	0	2	1
Union	0	2	3	15
Tahuya	0	3	0	6

Source: Washington Department of Fisheries register of intertidal fisheries licenses, Licensing Department, Olympia

II. EXISTING CONDITIONS

This section has been formatted to give a stream by stream summary of existing conditions across the pipeline corridor. For each stream, three types of discussion will be broken out:

- the first giving a physical and biological description based on field observations
- the second defining sensitive environmental areas from a combination of field studies and other existing data
- the third defining resources of known economic importance to Jefferson County

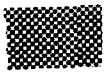
It should be noted in this context that not all valuable resources can be evaluated in economic terms. Many of the natural resources yield aesthetic values or provide a mode of living which are of high importance to county residents, but which cannot be quantified in economic terms.

The order of streams selected here is from north to south along the propsed corridor. The corridor enters Jefferson County from the northwest along the Clallam County border. After cutting southwest for several miles, it changes course to nearly due south, roughly paralleling U.S. Route 101 southbound. The pipeline corridor cuts through the town of Quilcene and then bears southwest along the western shoreline of Hood Canal to the Mason County border. South of Jefferson County, the pipeline bends east near Olympia and continues east and northeast across the Cascades to eastern Washington.

The field data sheets that follow cover physical, biological and important land use conditions in each of these water courses. The portion of each water course under consideration includes the area within one mile of the proposed corridor centerline. In the data sheets, the portion downstream of the proposed centerline is referred to as the bottom or lower end of the corridor and the upstream portion is the top or upper end.

The discussions which follow the field data sheets are keyed to a series of diagrams based on 7½ minute topographic maps of the area. Some sensitive features and resources are keyed on the map diagrams, while others are discussed only in the text. The key to map diagrams in this section is shown on page 13. Economic resources are discussed in the text, but are usually not indicated on the map diagrams.

KEY TO MAP DIAGRAMS

	Two mile wide pipeline corridor
	Tentative pipeline route
	Stream
W	Wetlands
TW	Tidal Wetlands
E	Eelgrass Area
S	Salmon Spawning and Utilization
T	Steelhead or other trout species
D	Waterfowl (Ducks and others)
H	Harbor Seal haulout area
C	Subtidal or interidal clams present
O	Oyster leases - harvest or spat collection
I	Other invertebrates (shrimp and crabs)
	Geologically sensitive areas (slope stability, steep slopes, or potentially erosive soils

SALMON CREEK

Location: The portion of Salmon Creek which was investigated includes section 23, 26 and 27 of Township 29 North Range 2 West, Willamette Meridian. The proposed crossing point occurs near the BPA power line in section 27, approximately one mile from the stream mouth.

Observation Points: The creek was observed at its crossing with West Uncas Road and at several points from the canyon walls upstream to approximately 1 mile upstream of the BPA power line crossing. Additionally, the streambed was waded from West Uncas Road, one mile upstream to the power line. Observations of the stream crossing of Route 101 near the mouth is reported in the Salmon - Snow Creek Estuary data sheet.

Streambed: Salmon Creek near West Uncas Road (bottom of corridor) is approximately 12 feet wide and 8 to 10 inches in depth, with flow velocity of 2.5 feet/second. Observed flow was roughly 20 - 25 cubic feet per second (cfs). Due to the shallow depth, riffles are predominant (75%) with occasional deeper pools of 18 to 24 inch depths. Stream substrate at the lower portion of the corridor consists of small gravel (2 to 3 inches of less in diameter) mixed with occasional rocks of six inch diameter or less. Stream gradient is low to moderate.

At the center of the corridor, stream gradient rises and the bottom characteristics change to larger rocks or boulders mixed with a coarse gravelly sand. Small waterfalls (6" - 2') are present in this area. Above the center of the corrider, the stream forks considerably. The south fork (perpendicular to the proposed route) becomes rapidly smaller, turning into the minor drainage channel within one mile.

Streambanks: Banks in the lower portion of the corridor range from 5 to 8 feet high near West Uncas Road to 40 to 60 foot cliffs ½ mile

below the corridor center. Along these areas, the stream typically has one low bank one to three feet high with the other bank forming the canyon wall. Bank slope ranges between 45° and vertical in a rather patchy, random manner. Streambanks are composed of loams and silt loams along the lower corridor section and sands or sandy loam along the upper reach. Streambank materials are highly erosive in places as evidenced by canyon configuration and severe undercutting.

Floodplain, Canyon and Valley: The floodplain varies considerably, ranging from only the width of the stream itself, to 100 feet wide in meander areas. In a few spots, patches of swamp vegetation are present in the floodplain. Large amounts of fallen timber are present in the stream and floodplain, apparently resulting from both erosion of side banks and past timber operations.

At the bottom of the corridor, the stream flows through rolling farmland (near West Uncas Road). However, within ½ mile of the mouth, canyon walls rise to a "U" shaped configuration with a 50 to 100 foot wide floodplain. Undercut sidewalls evidence a highly erosive layering of gravelly till and coarse sands. Near the center of the corridor, sideslopes become less vertical and less undercutting is present. This results in a "V" configuration along the central and upper portions, with side slopes up to 100 feet in height.

Biological Resources: Streamside vegetation is dominated by red alder (Alnus rubra), bigleaved maple (Acer macrophyllum), and western hemlock (Tsuga canadensis). Understory plants are mostly swordferns, salmonberry willows and grasses. Upland species on the canyon walls include maple, alder and douglas fir (Pseudotsuga menziesii).

No fish were observed during field observation. However, the lower creek provides spawning gravels which are utilizable by salmon and steelhead. The stream valley is forested and probably has high wildlife value.

Land Use Features: Human use of the land adjacent to the lower corridor is farming (mainly cattle). The upper corridor borders the Olympic National Forest. Forest harvesting has effected the stream channel through minor siltation and major amounts of jammed timber.

SALMON CREEK: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: Much of the creek basin above West Uncas Road has slopes in excess of 30 percent (U.S. G.S. 1973). The stream canyon is V-shaped, with little or no flat area on the sides. These areas have been mapped in Figure 1. The downstream portion of Salmon Creek, between West Uncas Road and the estuary, lies in a flat to rolling flood-prone area (Jefferson County 1978).

Soils and Erosion: The Salmon Creek basin can be divided into 2 basic soil types, roughly divided by the crossing of West Uncas Road. Those upstream of this crossing (including the proposed pipeline area) are Alderwood gravelly sandy loams on slopes of 15 to greater than 30 percent. These soils are generally only loosely compacted and are highly erodable (McCreary 1975, Jefferson County 1978). Severe undercutting of vertical and near vertical cliffs can be found along the stream channel.

The soils in the lower basin are predominantly Belfast soil loams. These soils are highly compressible (Jefferson County 1978, McCreary 1975), and are erodable during periods of flooding. Little erosion occurs at other times due to their low slope.

Vegetation: The vegetation along Salmon Creek, above the estuary, is not particularly sensitive.

Fish and Wildlife: Salmon Creek is accessible to migrating anadromous fish throughout the entire pipeline corridor. The only blocking falls occur above Mile 6 (Williams et al. 1975). Stream low-flow has been measured at 1 cfs (Williams et al 1975) average flow and may be well over 5 cfs. The stream is heavily utilized by steelhead trout (Jennings et al. 1977). The lower stream reach is a prime chum salmon spawning ground. Fish counts during spawning usually range into the hundreds throughout the lower stream mile. Peak counts of 1120 fish per mile occurred in September of 1976 (Egan 1977). These levels

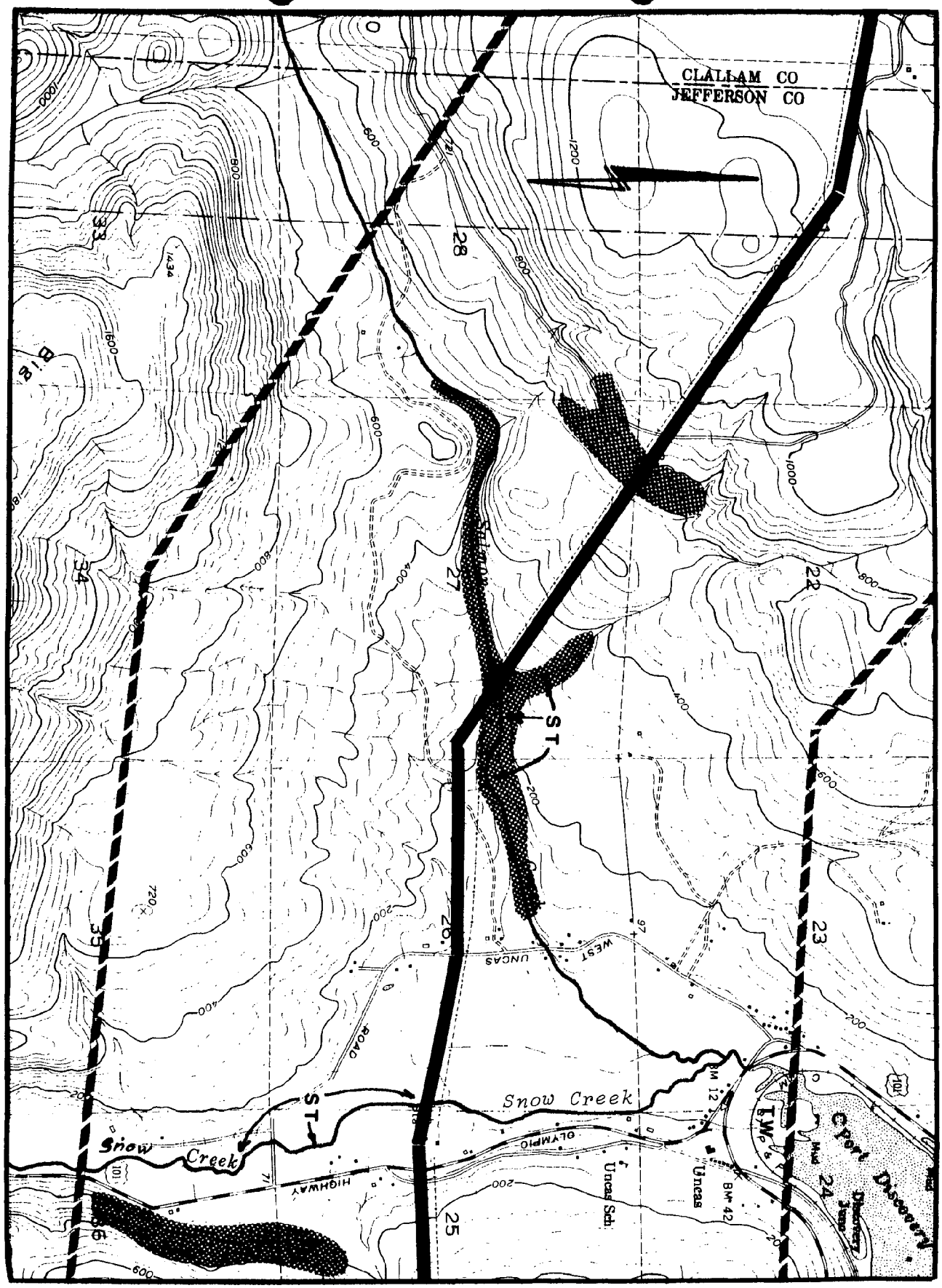


Figure 1. Salmon Creek, Snow Creek and Salmon - Snow Creek Estuary (Scale 1:24000)

may be typical on good escapement years. Coho slamon, fall chinook and a few pinks also use the upper stream reaches, but in lower abundance than chum. Various wildlife such as deer and blackbear use the nearby forest areas (Yoshinaka and Ellifrit 1974) and depend on the stream for habitat.

Economic and Recreational Resources: Salmon Creek is a well-used sports fishing area (Jefferson County 1978). Since the upper reaches are not easily accessable, the stream has remained largely natural with the exception of the fishing use. The Washington State Department of Game is using the creek for fish baseline studies in a long-term fisheries research program.

SNOW CREEK

Location: Snow Creek runs north toward Discovery Bay along the section lines of Sections 23 to 24, 25 to 26, and 35 to 36 in Township 29-N Range 2-W and in Sections 1 and 2 in Township 28-N Range 2-W Willamette Meridian. Upstream of this point, the creek turns west, away from the proposed pipeline route. The proposed crossing occurs near the BPA powerline, within one mile of the stream mouth.

Observation Points: The stream was observed at the Washington Game Department Fish Research Facility (fishtrap and holding area) near the proposed crossing point, at West Uncas Road and near the junction of Route 101 and State Route 104. Observations of the stream mouth are reported in the Salmon-Snow Creek Estuary data sheet.

Streambed: The stream is relatively uniform in width throughout the corridor, generally 15 to 20 feet wide. Depth varies from 6 to 12 inches in riffle areas and up to 18" at mid-channel or in pools. Flow velocity is 4 to 5 feet per second with an overall flow volume of about 50 cfs on the day of observation. Riffle areas make up 70 to 80 percent of the stream with the remainder composed of pools. On the day of observation (December 22), stream temperature was 3.2°C and conductivity was measured at 70 µmhos. (Conductivity is an indirect measurement of dissolved substances in water. The normal range in fresh water is 50 to 500 µmhos.) The streambottom is covered with fine gravels (0.05 to 2.0 inches) and coarse sands. Silty sands tend to settle out in slow moving areas on the outside curves of oxbows. The stream contains significant nutrients in the form of fallen leaves, but only moderate amounts of fallen logs or debris.

Streambanks: Streambanks vary from gentle 3 foot banks with 40% percent slope to nearly vertical 5 to 6 foot high banks along the farmfield in the southern end of the corridor. Further north, the stream passes through wooded areas and other fields with higher banks up to 20 to 25 feet high with 100 to 150 percent slopes. In this northern section, bank soils are very silty and appear prone to moderate erosion.

Floodplain and Valley: The stream floodplain is 20 to 30 feet wide in most areas. At the northern end, near Port Discovery , the banks funnel the stream closely, allowing little chance of overflow. Snow Creek meanders through a broad farm valley interspersed with wooded areas. There are no steep canyons or valley walls near the stream. However, moderately steep foothills of the Olympic Mountains do begin within a few hundred yards of the streambed in places.

Biological Resources: Streamside vegetation in the farmfield portions consists mainly of red alder and bigleaved maple. Horsetail (Equisetum spp.) and reed canary grass (Phalaris spp.) are scattered among salmonberry and blackberry bushes (Rubus spp.) to form the groundcover vegetation. In forested areas, alder, western red cedar and western hemlock form the major streamside species, with douglas fir being found in the adjacent uplands. Swordfern and horsetail form the main streamside groundcover in the forested areas.

Fish were not observed in the stream directly during field observations. However, the Washington State Game Department has reported extensive salmon and steelhead runs, which are documented in reports from their Fisheries Research Facility on Snow Creek (Jennings et al. 1977).

Land Use Features: The surrounding land use is agricultural, with some commercial establishments (gas station and cafe) near the mouth of Snow Creek. The creek is also used by the Game Department for fisheries research.

SNOW CREEK: ENVIRONMENTAL AND ECONOMICALLY SENSITIVE AREAS

Slope and Topography: Snow Creek runs through a relatively flat valley throughout the pipeline corridor. The basin is subject to flooding. Additionally the pipeline route crosses aquifer recharge areas which flank the entire corridor.

Soils and Erosion: Snow Creek soils are predominantly Belfast silt loam (McCreary 1975), a highly compressible organic soil. These soils would be subject to erosion only when unprotected, due to their low slopes.

Vegetation: Vegetation along Snow Creek, above the estuary, is not any more sensitive than any other riparian vegetation.

Fish and Wildlife: Snow Creek contains significant numbers of steelhead trout. It is also used by spawning chum and coho salmon, with numbers of spawners ranging into the hundreds at a given time. The chum are generally found near the mouth, with coho ranging above Stream Mile 4 (Egan 1977). Small numbers of pink and chinook salmon are also found.

Economic and Recreational Resources: Sports fishing is prevalent along Snow Creek due to both good fish populations and easy access. The Washington State Department of Game operates a fish trap research facility on the creek as part of a baseline program on fisheries resources.

SALMON SNOW CREEK ESTUARY

Location: The estuary is located near the section lines of Sections 23 and 24 of Township 29 North, Range 2 West, Willamette Meridian. The proposed crossing point occurs approximately one-half mile south of the estuary.

Observation Points: Stream measurements were made from the U.S. Route 101 bridge over Salmon Creek, and portions of the marsh between the creeks and their various sloughs were investigated on foot.

Streambed: Most of the sloughs are 10 to 20 feet wide, varying with tidal depth. Depths range generally from one to eight feet depending on tidal actions. Measurements from the Route 101 highway bridge showed Salmon Creek to have a temperature of 5°C and a salinity of 0.25 parts per thousand (fresh water) near the bridge on an outgoing tide. Some salinity undoubtedly reaches the bridge on strong incoming tides.

Tideflats and Wetlands: Salmon and Snow Creeks join to form a wide tidal marsh at the head of Port Discovery Bay. Wetland vegetation covers the tideflats for a distance of ¼ mile or more, with mudflats extending considerably further than this at low tide. The wetlands are composed to two marsh zones (high and low tidal marsh) and are surrounded by upland grasses along the highway. Channel-banks are moderately sloped (40 to 100 percent) and the substrate is a medium brown silty peat.

Geomorphology: Salmon and Snow Creeks drain into a narrow wedge shaped section at the head of Port Discovery Bay. The bay is surrounded by steep hillsides 100 to 300 feet in height along most of its border. The wetlands and tidal flats of the Salmon-Snow Creek delta form the major wetlands in Port Discovery Bay.

Biological Resources: The upper marsh is a fairly low diversity community dominated by marsh aster (Aster suspicatus) and bentgrass (Agrostis spp.). The lower marsh contains sedge along the slough edges (Carex spp.), as well as arrowgrass (Triglochin spp.), lovegrass (Eragrostis spp.), dock (Rumex brittanica) and yarrow (Acheillia millefolium). The vegetation indicates a brackish - fresh marsh which frequently experiences moderate to high salt concentrations. The marsh provides habitat for juvenile fish using Salmon and Snow Creeks and, together with the tide flats, habitat for shellfish and other invertebrates.

Land Use Features: The marsh area is bordered by highways, a railroad truck and nearby light density commercial and residential buildings.

SALMON - SNOW CREEK ESTUARY:
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: There are no slopes in the estuary.

Soils and Erosion: Estuarine soils and sediments are highly compressible peat and muck (McCreary 1975). This is not a sensitive soil type since the estuary lies well away from the pipeline route.

Vegetation: The estuary is a valuable tidal wetland throughout both the vegetated tidal marshes and the unvegetated tidal flats (NEC 1975). The vegetation is typical of a tidal saltmarsh as described in the previous section. Such vegetation is sensitive to rapid sedimentation or to damage by oils. The tidal mudflats and their associated fauna are also sensitive to these two factors.

Fish and Wildlife: Port Discovery Bay contains substantial shellfish resources, mainly concentrated in the wetlands of the Salmon - Snow Creek Estuary. The region from Maynard to Mill Point contains a major subtidal hardshell clam bed consisting of 21 acres. Recent counts revealed 118,918 butter clams and 155,507 littneck clams (Goodwin and Shaul 1978). Discovery Bay shorelines also contain sport beds of geoducks. The entire bayshore contains an estimated 591 acres of moderate density geoduck sports beds. The 2.5 million clams estimated in these beds result in a classification as a major bed (Goodwin 1978).

Additionally, the tidal marshes serve as spawning grounds for chum salmon and rearing grounds for salmon and trout.

Economic and Recreational Resources: The Salmon - Snow Creek Estuary and nearby areas of Discovery Bay serve as a major commercial shellfish resource. In addition, sports shellfish harvesting occurs throughout the delta and bay shoreline. The tidal marshes provide rearing and spawning habitat for anadromous fish.

LAKES

Peterson, Crocker, Tarboo and Leland Lakes are all contained within the two mile wide pipeline corridor. While the pipeline is not planned to physically cross any of these lakes, they will receive drainage effects from construction and could be affected by an oil leak. The potential for such effects depends on the exact route chosen. In some cases, a choice of another pipeline route could remove the pipeline from the drainage basins occupied by these lakes. Field observations or potential effects mentioned in the following data sheets are based on the assumption that the pipeline is to be placed in their respective drainage basins.

PETERSON LAKE

Location: Peterson Lake is located in Section 6 of Township 28 North, Range 1 West, Willamette Meridian, less than one mile north of State Route 104. The lake is within one quarter mile (to the east) of the BPA right-of-way and the proposed pipeline route and occupies the bottom of the drainage basin at that point.

Observation Points: The lake is privately owned by one landowner (Mr. Peterson) whose ancestors homesteaded the area in the 1800's. The lake was observed from the Peterson residence and eastern shoreline.

Physical Characteristics: Peterson Lake is a small lake, roughly 1,000 feet in length and 500 feet in width. The lake is surrounded by deciduous forest with one residence on the southeast side. Wetlands are composed only of sparse patches of canary grass and cattail. To the west, a low ridge rise to the BPA powerline right-of-way.

Biological Resources: The lake is surrounded by alder forest, with only occasional cedars or douglas fir. Ducks observed on the lake were 20 to 25 in number, including mallards, coots, widgeon and goldeneye. Evidence of beaver was also observed.

Land Use Features: Except for one residence, the lake is surrounded by second growth alder forest.

CROCKER LAKE

Location: Crocker Lake is located in Section 12 of Township 28 North, Range 2 West, Willamette Meridian. It lies ½ mile west of the proposed pipeline route and would be in the drainage basin if the pipeline were placed significantly to the west of the BPA right-of-way. Crocker Lake is man-made, created through damming the outlet within the past 20 years. The lake lies immediately southeast of the intersection of U.S. Route 101 and State Route 104.

Observation Points: The lake was observed from the public boat launch ramp on the west side and from nearby points along the western shoreline.

Physical Characteristics: Crocker Lake is a man-made lake created in the 1950's or early 1960's. It is roughly circular, being 2000 feet long in a north-south direction and nearly 1500 feet wide. The lake has moderate nutrient concentrations and conductivity was measured at 58 μmhos. Small marshes fringe the edges of the lake.

Biological Resources: The lake is mostly lined with grasses such as reed canary grass. However, fringe marshes of spirea (Spirea douglasii) and cattail (Typha latifolia) line the eastern, southern and western edges in 30 to 50 foot wide stretches of shallow water.

The lake and its marshes attract significant numbers of waterfowl. Fifty to seventy birds were observed on a typical December afternoon. Approximately ½ of the birds were coots, with another 20 to 25 being bufflehead. Other ducks included mallards and pintails. Fish are probably stocked by the State Department of Game.

Land Use Features: The lake is bordered to the north by a farm and is otherwise surrounded by open fields and thin woodlands.

TARBOO LAKE

Location: Tarboo Lake is located in Sections 7 and 18 of Township 28 North, Range 1 West, Willamette Meridian at the end of an unimproved gravelled road several miles in length. The lake is ¼ mile east of the BPA right-of-way and lies within the proposed pipeline corridor.

Observation Points: The lake was observed from the southeast side at the public boat launch ramp.

Physical Characteristics: Tarboo Lake is approximately 2000 feet long and less than 100 feet wide. The shorelines slope gradually and the lake does not appear to be unusually deep. The water is very clear, the lake apparently being oligotrophic. The bottom is composed of small gravels imbedded in sandy silt. The lake has many floating logs and other woody plant debris.

Around the lake the land grades off in a relatively low slope. Toward the west, the land rises slowly toward a low ridge, with the powerline running north-south immediately below the ridge. The proposed pipeline route is within the lake drainage bowl.

Biological Resources: The lake is fringed by minor marsh areas (cattail, spirea) and at the southern end by a more extensive swamp. Swamp dominants are alder, willow, red cedar and salmonberry, with salal extensively covering stumps and downed logs.

No waterfowl or fish were observed during the field observations. However, fish are undoubtedly present either as residents or stocked gamefish. One water ouzel (small water-dwelling bird) was feeding in the lake during field observations.

Land Use Features: The lake has a public boat launch ramp near the southeast corner and is otherwise surrounded by second growth trees.

LELAND LAKE

Location: Leland Lake is located in Sections 24, 25 and 26 of Township 28 North, Range 2 West, Willamette Meridian along U.S. Route 101. The lake is nearly one mile west of the BPA powerline and the proposed pipeline route. However, it is at the bottom of the drainage basin of several small streams which cross the powerline and pipeline route.

Observation Points: The lake was observed from three points along the southern shoreline, including the public boatlauch ramp.

Physical Characteristics: The lake is nearly a mile long and less than a quarter mile wide. The shoreline slopes down rapidly into deep water with only very minor fringe wetlands. The southern side of the lake is bordered by a road and scattered residences, while the northern side is bordered by deciduous forest. Water clarity is good, and the lake seems to have relatively low nutrient levels, as might be expected of a glacial lake. Conductivity was measured at 60 μmhos. A stream feeds the lake from the east, which begins in the vicinity of the BPA powerline right-of-way and the proposed pipeline route.

Biological Resources: Forest areas along the northern edge are composed mainly of alder with some western red cedar and douglas fir. The small, scattered fringe marshes contain only common rush (Juncus effusus) and reed canary grass (Phalaris spp.).

Waterfowl observed included 10 coots, 4 bufflehead, one swan and several domestic geese (the latter at or near a farm at the southeast corner of the lake). No fish were observed. However, resident and gamefish are probably present.

Land Use Features: The lake is bordered on the south side by a few residences and farms, as well as a motel and gas station. The north side is bordered by forest.

PETERSON, CROCKER, TARBOO AND LELAND LAKES: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: Peterson, Crocker and Tarboo Lakes are shown in Figure 2 . Leland Lake is shown in Figure 3. The lakes all occur at the bottom of moderately sloped drainage basins. Although the pipeline will not cross any lakes, drainage from pipeline construction or spills will flow toward the lakes entering directly from overland runoff or from the small streams that drain into the lakes. Flow out of Peterson Lake enters Chimacum Creek; flow out of Crocker Lake enters Snow Creek; flow out of Leland Lake enters Leland Creek, which ultimately connects with the Quilcene system; and flow out of Tarboo Lake is essentially non-existant, becoming groundwater and wetland seepage. Steep slopes (over 30 percent) around the lake drainages are indicated in Figures 2 and 3. Any contaminants from the pipeline would cross aquifer recharge areas in the vicinity of Peterson, Crocker or Leland Lakes.

Soils and Erosion: Peterson and Crocker Lakes are in an area of Alderwood gravelly loam on 0 to 30 percent slopes. Crocker Lake also has Mukilteo and McMurray peat around its borders. Leland Lake is in an area of Alderwood gravelly sandy loam, while Tarboo Lake has Alderwood gravelly sandy laom on the upper slopes, toward the pipeline, with Swanntown-Alderwood soils immediately around the lake. The Alderwood soils are weakly cemented and subject to erosion in steeper slope areas. The Swanntown complex contains excessive fine particles with a high surface water table (McCreary 1975).

Vegetation: Crocker Lake is surrounded by a marsh border generally 40 to 100 feet wide. This wetland is of importance to waterfowl and fish which are stocked in the lake. Freshwater wetlands in a contained lake would be susceptible to pollution by oil or hydrocarbons. Tarboo Lake contains a swamp wetland at the southern end. Peterson and Leland Lake have only minor fringe wetland plants.

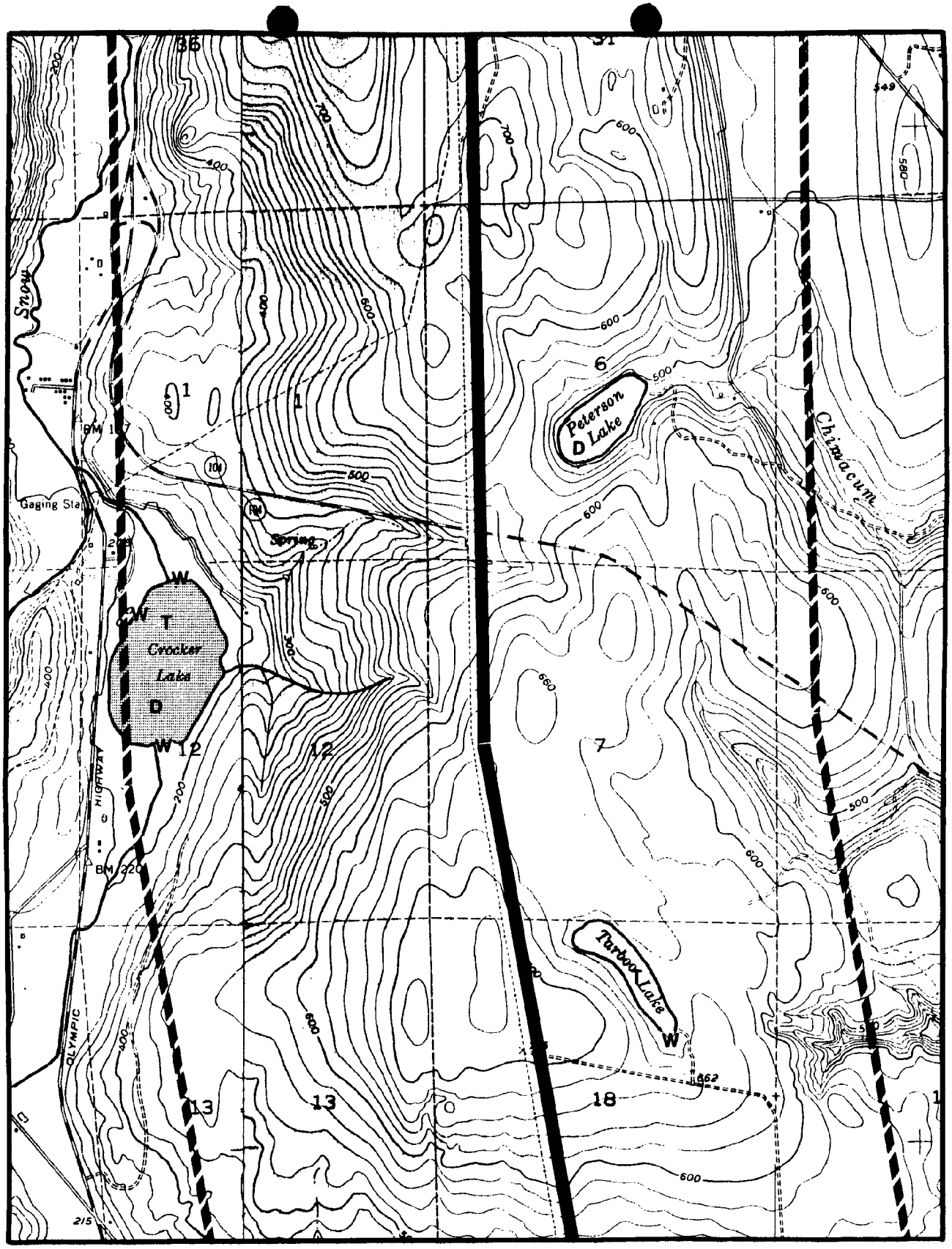


Figure 2. Peterson, Crocker and Tarboo Lakes (Scale 1:24000)

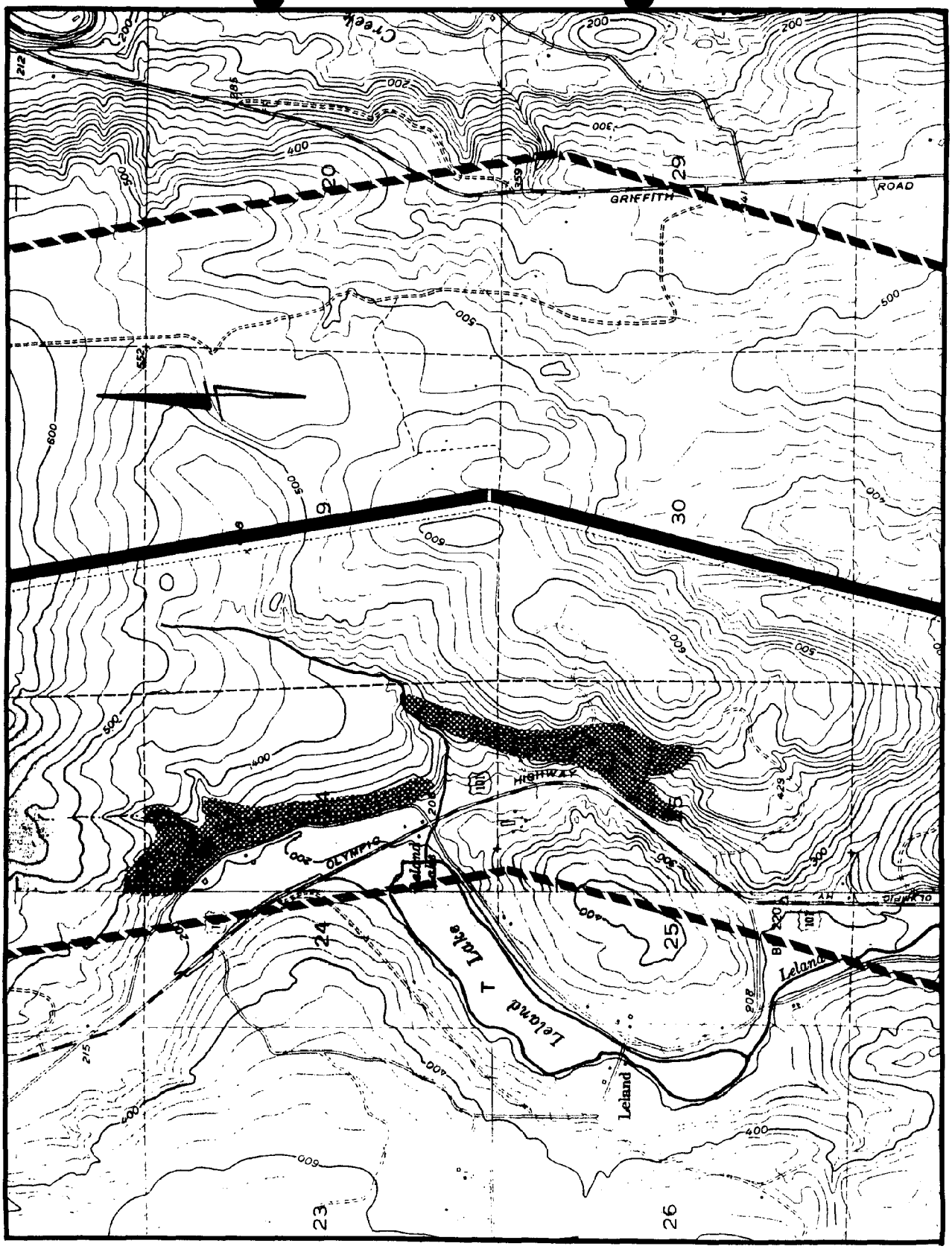


Figure 3. Leland Lake (Scale 1:24000)

Fish and Wildlife: All of these lakes (except Peterson) are stocked by the Department of Game with various trout species. Peterson Lake is privately owned and probably contains only indigenous fish. All of the lakes are also used by waterfowl to some extent. The largest counts were noted on Crocker Lake, probably due to the more extensive wetlands area. The lakes are also undoubtedly important to large mammals such as deer, bear and possibly elk, although little documentation exists on this subject.

Economic and Recreational Resources: Peterson Lake is privately owned and therefore has no public economic or recreation uses. Tarboo, Crocker and Leland Lakes all have boatlaunch ramps and are stocked with sports fish. They are important sport fishing and general boating areas.

LITTLE QUILCENE RIVER

Location: The portion of the Little Quilcene River System within the pipeline corridor is located in Sections 11, 13 and 14 of Township 27 North, Range 2 West, Willamette Meridian. The proposed pipeline route is within ½ mile of the river mouth at the crossing point.

Observation Points: The Little Quilcene River was investigated at four points in addition to the tidal flats at the mouth. Locations included two road pulloffs ⅛ and ¼ miles from the mouth to the east of U.S. Route 101, the U.S. 101 Bridge and one point ⅛ mile upstream from the U.S. Route 101 Bridge (this point being nearly one mile upstream of the proposed pipeline crossing). The river mouth area is reported in the Quilcene Estuary data sheet.

Streambed: The streambed is relatively consistant in character over the one mile reach above the pipeline route and almost to the river mouth. The streambed is generally 20 to 30 feet wide with a maximum depth of 2 to 3 feet in run-riffle areas. Water velocity on the day of field observation was 4 to 6 feet/second near the mouth and nearly 8 feet/second in areas near the U.S. Route 101 bridge. Total flow volume at that time is estimated at 250 to 300 cfs. Riffle areas probably comprise 50 percent of the lower stream reach, while runs and pools comprise 20 to 30 percent each. The substrate is large gravels (2 to 4 inch diameter) ranging up to large, one foot diameter rocks.

Streambanks: Streambanks are low (2 to 3 feet high) near the river mouth, rising to 8 to 15 feet through most of the corridor. Bank slopes average 50 to 125 percent. At some point upstream from the U.S. Route 101 Bridge, bank slopes become higher, forming nearly vertical erosional banks up to 30 feet in height. Bank soils in these areas are found to be a yellow brown sandy loam which is quite prone to erosion.

Floodplain and Valley: The floodplain varies from the width of the stream itself in high bank areas to a 50 to 75 foot wide plain. Near the river mouth, the floodplain becomes less distinct, merging with the surrounding lowland valley and tideflats. The flood channel is generally U-shaped and is less than 20 feet in depth in most areas. The surrounding lowland valley has been carved over geologic time by both the Big and Little Quilcene Rivers and is a broad rolling area. Above the first river mile, slopes and river gradient become steeper in low foothills of the Olympic Mountains.

Biological Resources: Riverbank vegetation is mostly alder and swordfern. In places, red cedars and bigleaved maples are mixed-in with the alders. Salmonberry and blackberry bushes are also found.

Numerous salmon, probably chum or coho, were observed swimming upstream against the current during field observations. Up to 50 fish were seen in stream segments less than 30 feet long. Stream escapement in the Little Quilcene is probably in the thousands. Shellfish are mainly confined to the Quilcene Estuary, which does not penetrate more than a few hundred feet up the river due to current and gradient.

Land Use Features: Land near the river is relatively flat or gently rolling. Most of the land is still devoted to farming. However, residential use is increasing, particularly toward the south and east of the City of Quilcene. The City of Quilcene uses the Big and Little Quilcene watersheds for domestic water supply.

LITTLE QUILCENE RIVER:
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The crossing of the Little Quilcene River occurs in a flat lowland. The area is in a flood-prone river valley. Steep slopes over 30 percent do exist in the upper river valley as shown in Figure 4.

Soils and Erosion: The Little Quilcene River floodplain lies in an area containing Belfast fine sandy loam and Belfast silt loam soils. The slopes above the river are diverse and include Quilcene silt loam, Alderwood - Quilcene complex, Hoodsport gravelly loam and Cassolary sandy loam. The Belfast soils are poorly drained and highly compressible. The Alderwood, Quilcene and Cassolary soils are highly erodable, but occur mostly above the proposed pipeline route.

Vegetation: The vegetation, upstream from the estuary, is typical riparian vegetation and is not overly sensitive.

Fish and Wildlife: The Little Quilcene River support runs of steelhead and searun cutthroat trout (Yoshinaka and Ellefrit 1974). Chinook chum and coho salmon utilize the river for spawning throughout the corridor, with most of the chum production near the mouth. Chum salmon spawn in the hundred during migratory times, occasionally peaking at 2000 to 2700 fish per mile. Densities over 900 fish per mile are quite common during September and October. Coho are less dense, but sometimes number 100 to 250 fish per mile (Egan 1977). Spawning gravels are prevalent in the lower river (Williams et al. 1975).

Economic and Recreational Resources: The river is an important area for sports fisheries. Spawning salmon which use the river are important to commercial fishermen after they rear and leave the stream for Puget Sound. Considerable commercial shellfish resources are found in the estuary below the river (see Quilcene Estuary).

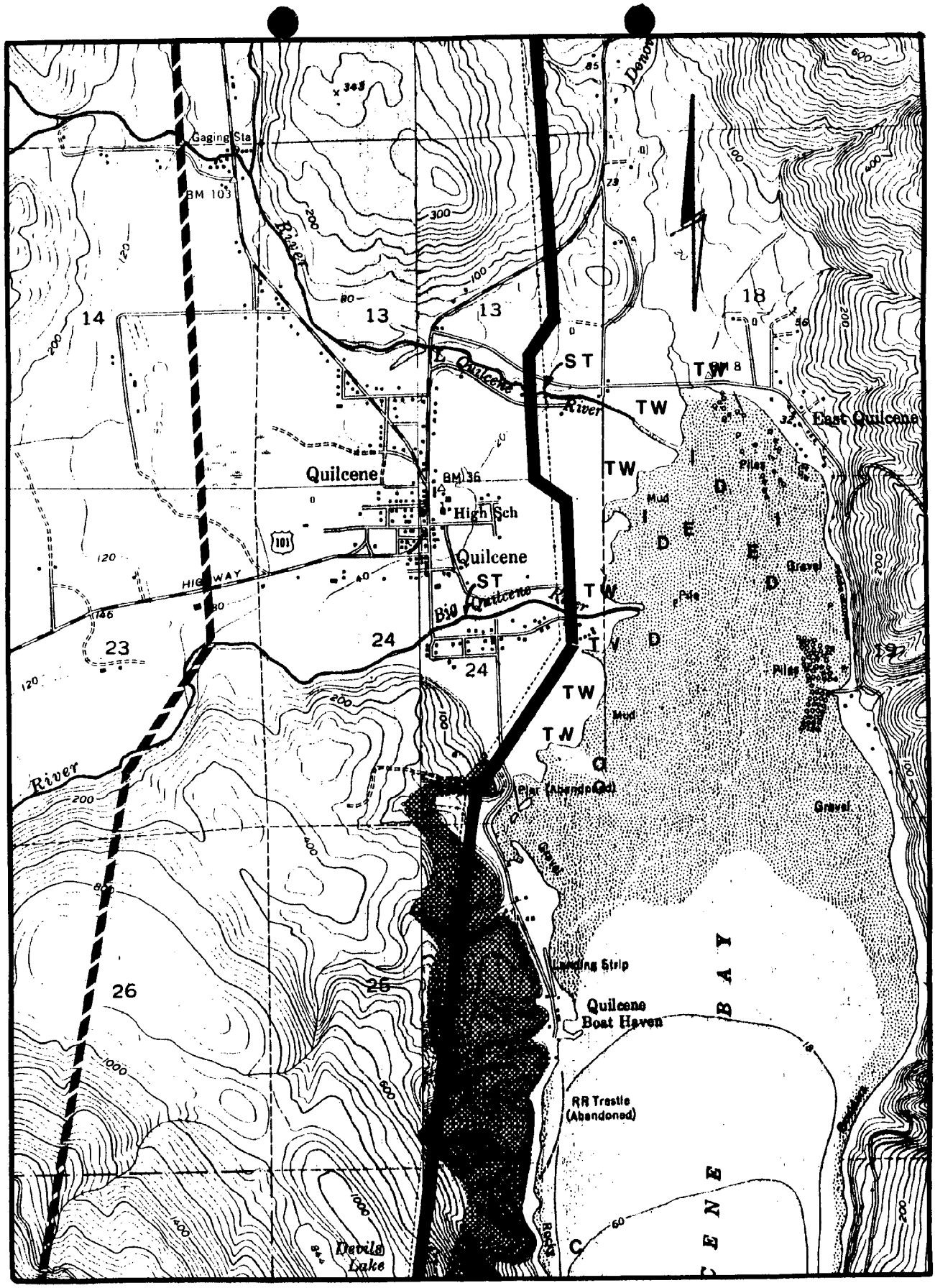


Figure 4. Big and Little Quilcene Rivers and the Quilcene Estuary. (Scale 1:24000)

BIG QUILCENE RIVER

Location: The Big Quilcene River (Quilcene River) is located in Sections 22,23 and 24 of Township 27 North, Range 2 West, Willamette Meridian, within the pipeline corridor. The proposed pipeline route crosses within ½ mile of the river mouth. The mouth area is reported in the Quilcene Estuary data sheet.

Observation Points: The Big Quilcene River was observed from the BPA powerline crossing, ⅓ mile above the river mouth. Other observation points were a county road crossing, 1000 feet upstream of the powerline and the U.S. 101 Bridge area, at the upstream extreme of the proposed pipeline corridor. The proposed crossing occurs on the east side of the BPA powerline right-of-way.

Streambed: The Big Quilcene River is generally 50 feet wide and 6 inches to 2 feet deep with a flow velocity during field observations of 2 to 4 feet per second. The estimated flow volume was 200 to 250 cfs. Most of the river is composed of riffle and run type flows with few pools in this lower reach. The substrate is generally medium gravels or large rocks intermixed in a matrix on the river bottom and lower banks. The gradient begins to rise in the area of the U.S. 101 Bridge and flow becomes more rapid, probably 4 to 6 feet per second.

Streambanks: The streambanks are 50 to 15 feet high along the lower end of the proposed corridor and are supplemented by 40 to 6 foot high dikes in places. Bank slopes are generally 50 to 200 percent. Banks become higher in the vicinity of U.S. Route 101, rising 30 to 40 feet above the stream. Banks are generally composed of a medium brown silt-loan.

Floodplain and Valley: The floodplain generally varies between the width of the stream in places and 100 feet wide where the banks do not rise directly from the streambed. The floodplain is generlly U-shaped within a gently rolling broad valley. The valley is generally cleared for agriculture near the river mouth,

becoming predominantly forested toward the upstream end of the proposed pipeline corridor.

Biological Resources: The river is predominantly lined with alders and a few maples. Evergreens are present only as a few scattered trees in the upper portions of the corridor.

Numerous spawning salmon were observed in the river during field inspections. In one 20 foot section of the stream near the U.S. Route 101 Bridge, eight spawning salmon and six dead salmon were observed. The salmon were probably chum and coho mixed; however, the dead fish were partly decomposed and could not be accurately keyed. Like the Little Quilcene, annual escapement of salmon and steelhead probably runs in the thousands. The salmon dying after spawning provides important food supplies for streamside scavengers such as raccoons and bears and form a particularly important food source for those animals who hibernate. The decomposing fish also add important organics to the streams.

Land Use Features: The lower river reach is surrounded by agricultural and residential land. The upper areas are surrounded by forest.

BIG QUILCENE RIVER:
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The proposed crossing occurs in a flat farm valley. Within ½ mile upstream the southern banks become steep with slopes greater than 30 percent. The lower area, however, is prone to flooding. South of the crossing, the pipeline route climbs steep, unstable slopes, overlooking Quilcene Bay. In addition to their geologic hazards, these slopes form an aquifer recharge area.

Soils and Erosion: The lower river valley soils are Belfast silt loam and Lummi silt loam. These are flanked to the north by Hoodsport very gravelly sandy loam, and to the south by Kitsap gravelly loam and Alderwood gravelly sandy loams. Alderwood and Everett gravelly sandy loams are found on the steep slops south of the crossing. These soils are highly erodable if exposed (McCreary 1975).

Vegetation: The riverside plant communities are typical riparian communities (above the estuary) which are not particularly sensitive.

Fish and Wildlife: In addition to substantial runs of steelhead and searun cutthroat trout, the Big Quilcene River supports roughly 9 miles of salmon usage by coho, pink and chinook, and two to three miles of usage by chum. It is the only river in the basin that can support substantial numbers of chinook, with runs sometimes exceeding densities of 100 chinook per mile. Peak chum runs frequently range between 1000 and 2200 fish per mile (Egan 1977). The entire lower river is heavily covered with gravel spawning areas.

Economic and Recreational Resources: The Big Quilcene River is heavily used by sports fishermen. Access is good and trout populations are high. There is a fish hatchery located on the river above the U.S. Route 101 highway bridge. Salmon escapment from the river is extremely high, particularly chum salmon in the lower reaches, and provides economic importance for the commercial and Indian salmon fisheries throughout Puget Sound.

QUILCENE ESTUARY

Location: The Quilcene Estuary is composed of the estuarine portions of the Big and Little Quilcene Rivers and associated tidal flats. It occupies parts of Section 24 and Township 27 North Range 2 West and Sections 18 and 19 of Township 27 North Range 1 West, Willamette Meridian. The estuary is within the pipeline corridor and is less than ½ mile east of the proposed pipeline route.

Observation Points: The estuary was observed from tidal flats near the mouths of Donovan Creek, the Big and Little Quilcene Rivers, and several points along the western shoreline of Quilcene Bay. In addition, a small slough, immediately south of the Big Quilcene River was investigated in some detail.

Tideflats and Wetlands: The Big and Little Quilcene Rivers, along with Donovan Creek and a variety of small sloughs, form an extensive wetland system along the west shore of Quilcene Bay. The wetlands are generally ¼ mile or less in extent from the shore to the bay and form a broad lateral band more than a mile long from Donovan Creek, south past the Big Quilcene River. Tidal flats extend a few hundred feet or more beyond the wetlands under normal low tide conditions. The low and high marsh zones are broken at the river mouths by intrusions of freshwater species including small alders. The substrate varies from sand to a silty mud.

Geomorphology: The two Quilcene Rivers enter the Bay at a distance of ½ mile on the western side of the Bay. Quilcene Bay is surrounded by low rolling hillsides to the east, and empties into Dabob Bay to the south. The tideflats and wetlands of the Quilcene Rivers and Donovan Creek form the major tidal wetlands of Quilcene Bay.

Biological Resources: The upper marshes are composed of aster (Aster suspicatus), silverweed (Potentilla pacifica) and angelica (Angelica lucida). The lower marsh is dominated by saltgrass

(Distichlis spp.) and contains sedges (Carex lyngbyei) along the sloughs and creekbanks.

Quilcene Bay is a major oyster growth and harvesting area. Commercial shellfish operations are located within ½ mile south of the Big Quilcene River. Chum salmon utilize the small marshy sloughs near the river mouths. Up to 20 to 30 spawning chum salmon were observed within a 30 foot long reach of a small slough in a tidal marsh located ¼ mile south of the Big Quilcene River. The marshes also provide important rearing grounds for salmon and other anadromous fish.

Land Use Features: The estuarine wetlands are bordered along their upper edges by scattered residences and farmfields.

QUILCENE ESTUARY:
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The estuary is a relatively level system of tidal marshes and mudflats. Steep slopes do occur to the south along Quilcene Bay. These slopes are geologically unstable (Jefferson County 1978).

Soils and Erosion: The estuarine soils are characterized as Lummi silt loam and tidal marsh (McCreary 1975). These soils are highly compressible. The steep slopes to the south are erodable, and any erosion or oil leakage would enter Quilcene Bay, with a good probability of being spread north to the estuary by tidal action.

Vegetation: The estuary is characterized by a relatively diverse tidal marsh, cut by many sloughs and guts. The vegetation supports substantial wildlife resources and would be sensitive to effects of sedimentation or oil spillage. Any major spill on the Big or Little Quilcene Rivers would cover the tidal marsh vegetation with oil which would be difficult or impossible to remove.

Fish and Wildlife: Quilcene Estuary and Bay supports one of the richest assemblages of fish and wildlife resources on the Olympic Peninsula. The upper bay is listed as a prime waterfowl area and an important eelgrass bed (Yoshinaka and Ellifrit 1974). The rocky shores south of the estaury form an important haulout area for harbor seals, with peak count reaching 168 seals in 1977 (Calambokidis 1978).

Chum salmon use the marsh guts and sloughs for spawning at very high densities (see field data). Coho chinook, pink and chum salmon also use the marshes for rearing. Searun cutthroat and steelhead trout which spawn in the rivers also depend on the estuary for vital protions of their life processes. Smelt and herring also utilize the estuary for spawning.

Quilcene Bay provides an oyster harvesting area of high significance. It is the only area on Hood Canal where spat are commercially set. Commercial spat set and harvest leases are dotted throughout Quilcene Bay.

Clambeds of subtidal and softshelled clams are present at the southern end of Quilcene Bay but are not intimately associated with the estuary. Shrimp and crabs, however, are harvested in considerable numbers at the north end, near the estuary.

Economic and Recreational Resources: Oyster harvest is probably the highest direct economic usage of the bay and estuary. In addition the estuary supports numerous salmon which are commerically harvested in Puget Sound. Other fish are utilized by commercial harvesters and sports fishermen. Shrimp and crabs are also harvested. The waterfowl also provide some limited hunting.

SPENCER CREEK

Location: Spencer Creek flows southeasterly along U.S. 101 through the pipeline corridor in Sections 11, 14, and 13, Township 27 North, Range 2 West, Willamette Meridian. The tentative pipeline crossing is just east of the B.P.A. powerline in the northwest ¼ of Section 13.

Observation Points: Spencer Creek canyon was observed from the top of the canyon at the B.P.A. powerline. The creek bed was inspected at the crossing of U.S. Route 101.

Streambed: The streambed is 5 to 7 feet wide and varies between 1 and 3 feet in depth in run and riffle areas. Pool areas are deeper; however, exact depths were not determined. The substrate is rocky with occasional large (to 2.5 feet diameter) boulders.

Streambanks: Streambanks are variable, ranging from 1 to 3 feet tall, and are composed of stream boulders and mineral soil.

Floodplain, Canyon & Valley: Spencer Creek has no floodplain except near its mouth. The creek flows in a "V" canyon. Canyon slopes vary and are steepest in the northwest quarter of Section 13, the tentative pipeline crossing location. Soils are similar to those of Jackson Creek canyon (see discussion below).

Biological Resources: Stream-side red alders provide a moderate to good stream canopy coverage along most of Spencer Creek through the pipeline corridor. Canyon slopes are forested by Douglas-fir and western redcedar except in the northeast quarter of Section 14, which has been logged along the northeast side of the creek.

Land Use Features: Land along the creek is used principally for forestry.

SPENCER ESTUARY

Location: Spencer Estuary is an arm of Jackson Cove in Section 13, Township 27 North, Range 2 West, Willamette Meridian.

Observation Points: Observations were made at the mouth of the creek.

Tideflats and Wetlands: There is no substantial amount of tidal marsh in Spencer Estuary. Narrow fringes of high marsh rim the estuary edge. The intertidal flats cover 6 to 7 acres.

Biological Resources: On the day of field inspection (21 January 1979) 130 to 160 chum salmon carcasses were lying in the lower 300 feet of the creek bed and head of the estuary.

Pacific oysters shells noticeably litter the beaches, indicating a substantial private sports fishery.

Land Use Features: The main uses are for forestry.

SPENCER CREEK AND SPENCER - JACKSON ESTUARY
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: Spencer Creek canyon is a V-canyon, 200 feet deep near the streammouth. Slopes at the pipeline crossing point are well in excess of 30 percent. Toward the western side of the corridor, the stream gradient climbs rapidly and side-slope steepness and depth decline (See Figure 5).

Soils and Erosion: The streambottom and floodplain soils of Spencer Creek are Swantown gravelly loams. Surrounding soils include Hoodsport very gravelly sandy loam, Ahl very gravelly loam, Grove very gravelly loamy sands and other more minor series. The sandy and gravelly loams are prone to erosion in steep slope areas all along the canyon walls.

Vegetation: The riparian vegetation is not unduly sensitive. Canyon-side vegetation removed on the route will be difficult to restore.

Fish and Wildlife: Spencer Creek has a limited spawning area, but does contain runs of steelhead and searun cutthroat trout at the lower end of the corridor. Salmon spawning investigations in recent years indicate that at least 400 to 800 chum are using the lower 0.7 miles of Spencer Creek particularly the lower 0.3 miles. No coho have been seen in recent years (Egan 1978). Eelgrass beds lie offshore in the Jackson - Spencer Creek estuary and soft-shelled clams are known to exist in this area (Yoshinaka and Ellifrit 1974).

Economic and Recreational Resources: Spencer Creek provides a limited trout sport fishery and a moderate amount of chum salmon which contribute to sport and commercial fisheries in Hood Canal and Puget Sound.

The cove into which Spencer Creek empties contains a geoduck

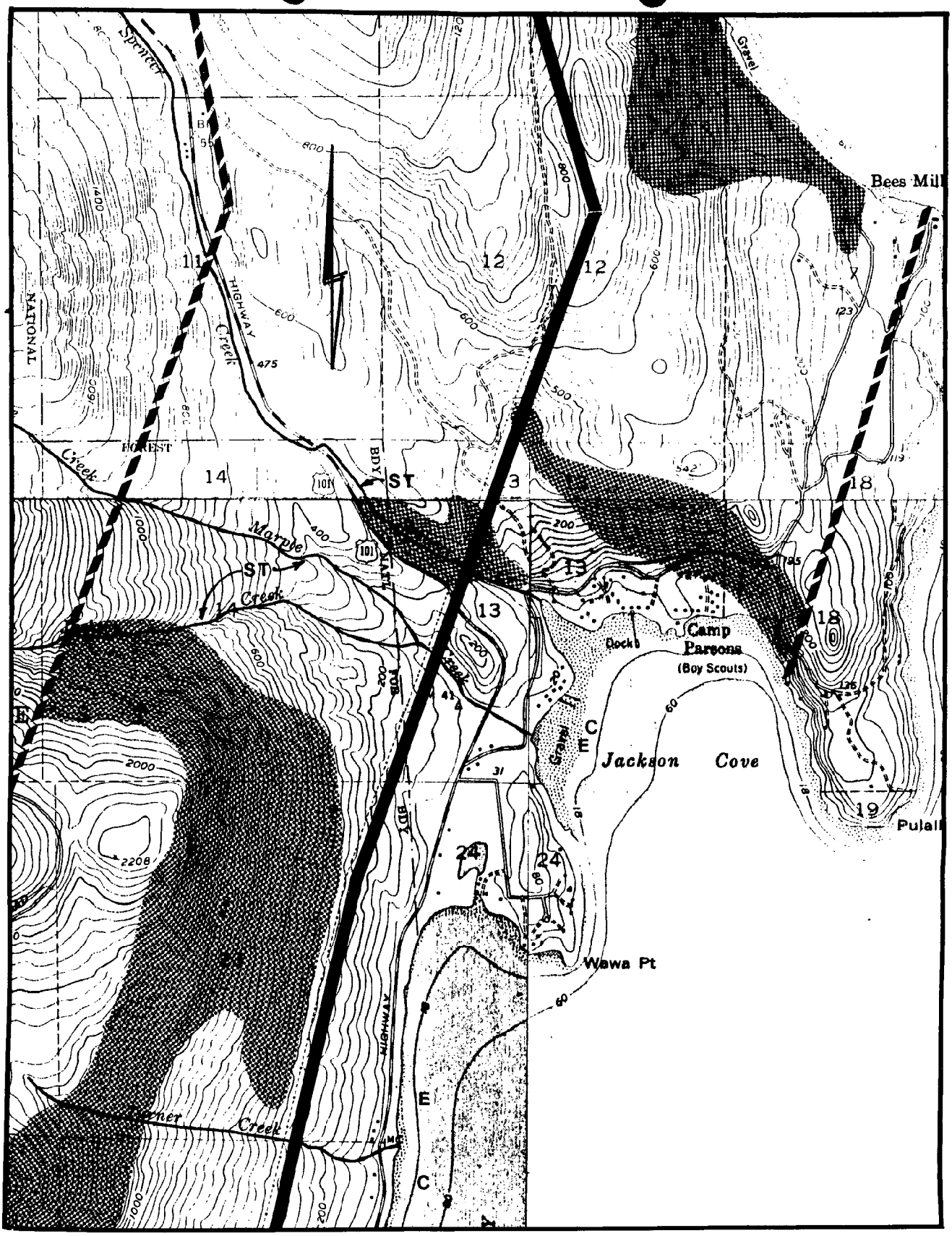


Figure 5. Spencer, Marple, Jackson and Turner Creeks. (Scale 1:24000)

bed of minor sports harvest value lying in 27 to 37 feet of water at the mouth of the estuary (Goodwin 1978).

The shoreline of Jackson Cove in general, including Spencer Estuary, is a herring spawning area. The waters of the cove are a shrimp fishing area (Division of Marine Land Management 1977).

JACKSON - MARPLE CREEKS

Location: Jackson and Marple Creeks flow easterly across the pipeline corridor through Sections 14 and 13, Townships 27 North, Range 2 West, Willamette Meridian. The two creeks combine to form lower Marple Creek immediately west of the proposed pipeline crossing. The proposed pipeline crossing location is just east of the B.P.A. powerline in the northwest quarter of Section 13 (see Figure 5).

Observation Points: Jackson and Marple Creeks were observed from US 101, from a distance at the B.P.A. powerline, and at a county road crossing near the mouth.

Streambed: The streambed averages 6 feet wide. The bed is mostly composed of cobbles and small boulders.

Streambanks: Streambanks are 1 to 3 feet tall with on average slope of 3:1. Below U.S. Route 101 the stream has been channelized through a residential development.

Floodplain, Canyon, and Valley: The streambanks rise directly to an alluvial plain of varying width. Soils on the north canyon wall-slope are a red-brown, very gravelly, silty sand, or a loose, stoney, gravelly loam overlying a medium brown to red-brown gravelly silty sand subsoil. A sand and gravel pit is located north of the creek and east of the B.P.A. powerline.

Under the B.P.A. powerline there is ample evidence of sheet and minor gully erosion, likely due to poor, inadequate re-vegetation.

Biological Resources: Stream-side red alders provide a good to excellent stream canopy coverage above U.S. Route 101. Below U.S. 101 extensive clearing for residential development has stripped most stream-side vegetation.

A few chum salmon carcasses were lying in the creek bed near the mouth of the day of field inspection (21 January 1979).

Land Use Features: There are scattered residences along the shoreline. The remainder of the basin is in forestry uses.

JACKSON AND MARPLE CREEKS
ENVIRONMENTALLY AND ECONOMICALLY SENSITVE AREAS

Slopes and Topography: Both Jackson and Marple Creek are low canyon cuts into Green Hill. They have moderately steep side-slopes, approaching 30 percent in places and perhaps exceeding this in small scale topography. Stream gradients are very steep for both streams.

Soils and Erosion: The streambottom and floodplain is composed of Belfast fine sandy loam. Surrounding soils are mostly Grove very gravelly sandy loam and Grove very gravelly loamy sand (McCreary 1975). All soil types in the area are subject to moderate to severe erosion if exposed on steep slopes.

Vegetation: Vegetation in the Jackson - Marple Creek Valleys is not particularly sensitive, except on steep slope areas where re-vegetation may prove difficult.

Fish and Wildlife: Both Jackson and Marple Creeks support limited steelhead and searun cutthroat trout populations. Chum salmon and a small number of coho use the lower reaches of the creeks for spawning. The Jackson Cove Estuary resources have been discussed previously under Spencer - Jackson Cove Estuary.

Economic and Recreational Resources: The two creeks provide a limited trout sports fishery at the lower end. Salmon spawning investigations reveal that 80 to 120 chum spawn in the lower 0.1 mile of Jackson Creek annually and that less than 10 coho occupy this area annually. Fifty or more chum salmon are known to use the lower 0.5 miles of Marple Creek for spawning (Egan 1978). These salmon contribute to Hood Canal and Puget Sound fisheries.

TURNER CREEK

Location: Turner Creek has its headwaters in the pipeline corridor and flows easterly through Section 23 and 26, Township 27 North, Range 2 West, Willamette Meridian.

Observation Points: Turner Creek was inspected in the vicinity of U.S. 101.

Streambed: The bed is 5 to 6 feet wide and is composed of a rough mixture of boulders, cobbles, and gravels.

Streambanks: The banks are 2 to 3 feet deep, rising at variable slopes (vertical to 300 percent).

Floodplain, Canyon, and Valley: Turner Creek is a shallow swale on the face of Green Hill. There is no true floodplain or canyon.

Creek Mouth: Turner Creek flows under U.S. Route 101 through a concrete culvert which cascades directly into Hood Canal. There is no delta or estuary.

Biological Resources: Pacific oyster shell mounds on the Hood Canal beach at the creek mouth are indicative of a substantial sports harvesting effort. No anadromous fisheries are expected to occur in the creek.

Land Use Features: Land use in the Turner Creek watershed is totally forestry uses.

TURNER CREEK: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: Turner Creek has a relatively steep gradient, but low side slopes. The creek is basically a drainage swale on the side of Green Hill.

Soils and Erosion: The creek is within the Olympic National Forest boundary and soils have not been mapped. Due to the lack of stream canyon, erosion is not expected to be a particular problem here.

Vegetation: Streamside vegetation is not unusually sensitive.

Fish and Wildlife: The creek drains to a culvert which drops water into Hood Canal. No anadromous fish use is expected. A minor hardshell clam bed containing butter and littleneck clams lies off-shore of the mouth of Turner Creek in 9 to 43 feet of water (Goodwin and Shaw 1978). The beaches along Hood Canal north and south of the mouth of Turner Creek are herring spawning areas (Division of Marine Lands Management 1977).

DOSEWALLIPS RIVER

Location: The portion of the Dosewallips River within the pipeline corridor is located within Sections 33 and 34 of Township 26 North, Range 2 West and Sections 2 and 3 of Township 25 North, Range 2 West, Willamette Meridian. The BPA powerline and the proposed pipeline route cross the river approximately one mile above its mouth.

Observation Points: The Dosewallips River was investigated along 3 portions of the pipeline corridor, in addition to the proposed crossing point, immediately west of the BPA powerline right-of-way (located roughly one mile from the river mouth). A one-half mile long stretch of the river upstream from the proposed crossing was waded in order to determine riverbottom characteristics in detail. A point ¼ mile below the powerline near Brinnon was also investigated and a ¼ mile long segment near the river mouth in Dosewallips State Park was waded.

Streambed: Within the 2 mile corridor, river flow characteristics vary sharply due to variable gradient and channel width. The upper reaches of the corridor are divided into runs, riffles and pools, with riffles occupying 40 percent, runs 40 percent and pools 20 percent or less. In run areas, stream depth was 8 to 24 inches and the velocity was typically 4 to 6 feet per second, but ranging up to 12 to 18 feet per second in a few narrow channels. Riffle areas occur where depth is less than 8 inches or where larger rocks protrude. The riffles are typically found near gravel bars and at bends in the river. Pools are up to 5 to 6 feet deep. Overall channel width is roughly 60 feet, although gravel bars tend to constrict this in many places. Average depth is 12 inches and maximum depth 24 inches in run-riffle sections.

The river seems to carry a high nutrient load in the autumn of fallen deciduous leaves and twigs, due to the prevalence of overhanging riverbank vegetation. This organic matter tends to

become trapped among the gravels in the riffle areas. The streambed substrate is medium cobbles (½ to 12 inches) mixed with deposited fine gravels and sand. Small gravels are present in patches.

Streambanks: Since the river meanders up to the valley sidewall, riverbanks vary from low banks on the floodplain side to steep valley cliffs. The lower banks vary from 2 to 8 feet tall and are generally on the north side of the river above the BPA powerline. Bank substrate is a brown-black silt loam. The southside banks form a washed away vertical cliff more than 40 feet in height in many places. Substrate was observed to be a series of coarse brown sand strata, occasionally mixed with cobble layers, underlain by a 15 to 20 foot layer of grey clay. All of these materials appear to be highly erosional, and undercutting and fallen trees are prevalent.

Toward the river mouth banks are lower (2 to 5 feet) and more gently sloped. The river broadens somewhat (80 to 100 feet wide) as it nears the estuary and the banks become laced with side channels and sloughs.

Floodplain and Valley: The main floodplain is contained between the banks and varies from 50 to 100 feet in width with the main stream channel being a 25 foot wide meander between gravel bars. Above the river banks, the valley floor (¼ mile or more wide) forms the floodplain for exceptional floods. The valley is basically U-shaped with steep walls mostly on the south side up to 100 feet in height. Large hills and small mountains (1000 to 3000 feet) rise to both the north and south.

Biological Resources: The riverbank vegetation is mainly red alder with scattered western red cedar, big leaved maples and black cottonwoods. Douglas fir trees occur in the upland areas. The forest understory is mostly salmonberry and snowberry, mixed with ferns. Near the river mouth, the forest becomes a less diverse alder bottom community dominated with alder. These trees gradually become smaller in height as they become closer to the estu-

ary and are eventually mixed with estuarine and marsh grasses before giving way to tidal marsh.

No fish were observed during fieldwork, although the numerous gravel beds undoubtedly provide spawning areas for anadromous fish. Shells were observed in the reach near the river mouth, indicating that clams and mussels are present (see Dosewallips Estuary). Near the river mouth, waterfowl, gulls and other birds became quite prevalent. Birds observed included dippers (water ousel), pine siskin (large flock), merganser, belted Kingfisher, mallards and widgeon. Evidently the lower river mouth and estuary provides considerable fish resources and vegetable matter for these birds' food supply, even in November and December.

Land Use Features: The valley is mostly in residential use or small farms. At the mouth, Dosewallips State Park provides a major recreation and fishing area.

DOSEWALLIPS RIVER: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The Dosewallips river forms a narrow valley floodplain among the Olympic foothills, which range up to 1500 to 2500 feet in elevation to the north and south. At the proposed crossing, slopes are greater than 30 percent. To the west, other portions of the river are lined with steep cliffs on the south side. There are areas, however, with more gradual slopes (see Figure 6).

Soils and Erosion: The floodplain soils are Belfast fine sandy loams and river gravels. The soils on the steep hill to the south are Grove very gravelly loamy sand with Hoodsport and Triton Soils on the surrounding upland terraces. The Grove soils are highly permeable and are erosive in steep areas (McCreary 1975). High volumes of subsurface water are probable in this area.

Vegetation: The riverine vegetation is typical for western Hood Canal and not particularly sensitive. The riparian vegetation does provide important bank sheltering habitat in some areas.

Fish and Wildlife: The Dosewallips river supports important runs of both steelhead and searun cutthroat trout. In addition, four types of salmon, chum, chinook, pink and coho, use the river for spawning. Peak chum counts generally range from densitites of a few hundred to a thousand fish per mile in the lower six miles of river. Chinook densities are low, usually 10 to 20 fish per mile. Coho levels have occasionally risen to several hundred fish, but have been low in recent years. The river does support a large run of pink salmon. Levels of pink salmon spawning in the Dosewallips peaked between 10,000 and 20,000 fish per mile in the 1960's, with peaks of several thousand being common in other years.

Economic and Recreational Resources: The Dosewallips River supports a major sport fishery. Dosewallips State Park is often filled with considerable numbers of sports fishermen. Additionally, the river is responsible for one of Puget Sound's major pink salmon runs.

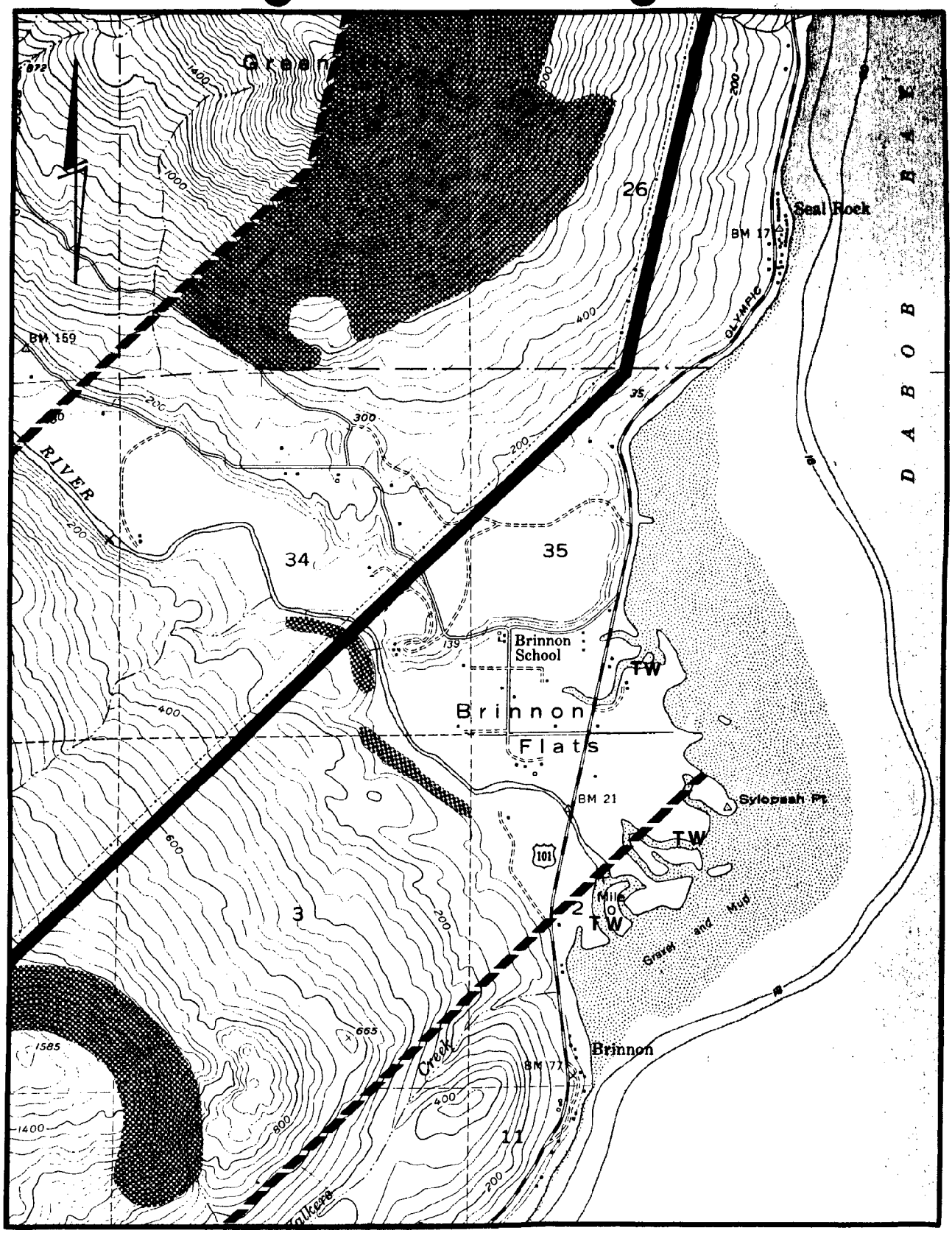


Figure 6. Dosewallips River. (Scale 1:24000)

DOSEWALLIPS RIVER ESTUARY

Location: The Dosewallips Estuary is located in Section 2 of Township 25 North, Range 2 West, Willamette Meridian. It is approximately 1 mile southeast of the proposed pipeline crossing.

Observation Points: The river mouth opens gradually from an alder bottomland into a slough system among salt marsh islands. The river mouth section was waded and several of the main saltmarsh islands were inspected in detail.

Streambed: The sloughs are generally 10 to 15 feet wide with the main river channel over 50 feet wide. The substrate is a grey-brown silt, still mixed with cobbles from the river in places. The marsh substrate is a black peat which forms steep sides to the sloughs.

Tideflats and Wetlands: The wetlands form a wide saltmarsh extending roughly a quarter mile from the uplands to open water and possibly ½ mile in lateral extent. The swamp bottomland of the river grades into the marsh as the trees become more sparse. High and low marsh zones are present as described more fully under Biological Resources.

Geomorphology: The river mouth broadens into meadering sloughs forming several isolated spits and salt marsh islands. Hood Canal water infiltrates the entire slough section on incoming tides. The area is thus a brackish estuary during most tidal conditions. The Dosewallips marshes form one of the five main tidal marshes along the west side of Hood Canal.

Biological Resources: The high marsh is dominated with aster (Aster suspicatus), silverweed (Potentilla) and several grasses (Deschampsia, Agrostis). The lower marsh is a diverse mixture of rush (Juncus maratima), sedge (Carex spp.), saltgrass (Distichlis spicata), arrowgrass (Triglochin spp.) and pickleweed (Salicornia virginica). The intertidal zone contains sedges, pickleweed and the brown alga,

Fucus.

Several waterfowl, including merganser, widgeon and mallards, were present, as well as glaucous-winged gulls, belted kingfisher and other waterbirds. A local fisherman reported catching several steelhead near the river mouth. The sloughs undoubtedly provide protected areas and rearing areas for anadromous fish using the river and other fish and shellfish of Hood Canal.

Land Use Features: The estuary is located within Dosewallips State Park, a major public recreation and sports fishing area.

DOSEWALLIPS ESTUARY: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The Dosewallips Estuary is a level tidal marsh cut by many stream channels and guts.

Soils and Erosion: The tidal marsh soils are defined as Belfast and Lummi silt loams in the upper marsh and as tidal marsh on the lower marsh area and mudflats. These soils are subject to tidal or scour erosion.

Vegetation: The estuarine vegetation is of a highly diverse tidal marsh community. The wetland vegetation present would be significantly damaged by massive sediment depostions or oil leakage from upriver. The damage would be magnified in terms of its effects on the associated marsh fauna.

Fish and Wildlife: The Dosewallips estuary supports eelgrass beds and is well-used by waterfowl (Yoshinaka and Ellifrit 1974). Steelhead, salmon and searun cutthroat trout utilize the tidal marshes for rearing habitat. In addition, chum salmon spawn in these areas. The Dosewallips delta also provides a major haulout area for harbor seals on Hood Canal. Peak counts of 160 seals were noted in 1977 (Calambokidis 1978).

Beds of softshelled clams and geoducks can be found within ¼ mile of the estuary shoreline. The softshelled clams and geoducks are harvested for sports purposes. The geoduck bed is estimated at 108 acres containing 867,192 clams, a moderate density for a major bed (Goodwin 1978). Shrimp and crabs are also present in the estuary and provide sports harvest. One commercial oyster harvesting area occurs outside of the estuary in Hood Canal.

Economic and Recreational Resources: Sportsfishing and Public Recreation occurs at the estuary, due to high fish populations and the access provided by Dosewallips State Park. Clam harvesting for sports purposes also occurs.

DUCKABUSH RIVER

Location: The portion of the Duckabush River within the pipeline corridor is located in Sections 16, 17 and 21 of Township 25 North, Range 2 West, Willamette Meridian. The proposed pipeline route crosses the river approximately one mile above its mouth.

Observation Points: The Duckabush river was observed from three main points: at roughly ½ mile above the BPA powerline, overlooking the river from the powerline, and at the U.S. 101 Highway Bridge near the mouth. Additionally the tidal marsh estuary was investigated in detail. (See Duckabush Estuary data sheet.)

Streambed: The Duckabush River is a lower gradient river with a broader floodplain than most of the other Hood Canal tributaries. The river has a well-developed system of branching channels throughout most of the forested islands between the channels. At the observation point ½ mile above the power line, the main channel was generally 25 to 30 feet wide with one or two 10 to 15 foot wide side channels, bringing total river width to 40 to 50 feet. The river is mostly braided run and riffle areas with maximum depths of 1 to 2 feet. Some of the deeper run areas may be interpreted as shallow pools. Currents ranged from 7 to 10 feet per second in constricted areas, with slower velocities (3 to 6 feet per second) in the riffles. Total flow was estimated at 150 to 200 cfs. Bottom substrate is a mix of small cobbles and coarse gravels.

Streambeds: The streambanks are generally low (2 to 4 feet) and moderately sloping (50 to 100 percent slopes) in the upper reach of the corridor. Near the mouth, the banks rise in places to 10 to 15 feet, diminishing again as the river enters Hood Canal.

Floodplain and Canyon: The floodplain is roughly ¼ mile broad between sharply sloping canyon hillsides. The canyon walls are steep hillsides in general, not vertical cliffs. The floodplain is a moist, swamplike bottomland which is apparently flooded with considerable frequency.

Biological Resources: The floodplain is forested by a mixed stand of old growth red alder, western red cedar, bigleaved maple and willow. Brush is sparse with salmonberry and ferns predominating. Wetsoil groundcover species such as mosses are also prevalent. No fish or wildlife were directly observed in the upper portion of the river. However, the gravels would provide good spawning areas for anadromous fish. Salmon were seen swimming near the river mouth.

Land Use Features: Country residences and small farms dot the upper valley, but few are on the valley floor. The floodplain is mostly forested.

DUCKABUSH RIVER: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The Duckabush forms a narrow river valley between foothills of the Olympic Mountains. The floodplain is a rather broad, flat expanse with slopes often greater than 30 percent rising toward the north and south. Steepslopes exist at the pipeline crossing on both the north and south valley walls (see Figure 7).

Soils and Erosion: River valley soils are Belfast silt loams. Surrounding soils on the valley walls are Lystair find sandy loam, grove very gravelly loamy sand and Hoodsport very gravelly sandy loam, along with more minor soil types (McCreary 1975). The silt loams are very compressible and subject to scour erosion. The sands and gravels are subject to moderate erosion if exposed.

Vegetation: The floodplain of the Duckabush estuary forms a riverine wetland. This is one of the few Hood Canal riverine wetland communities, and the only significant one in Jefferson County. The wetland associations present would be moderately susceptible to damage from sedimentation and oil leakage.

Fish and Wildlife: The Duckabush River support major natural runs of steelhead and searun cutthroat trout. In addition, chum, coho, chinook and pink salmon spawn in the stream with pink and chum ultilzing the lower three river miles and fall chinook spawning up to River Mile 7.0. Chum densities of 500 to 2000 fish per mile are not uncommon in the lower river and pink densities are often in the 2000 to 10,000 fish per mile range.

Economic and Recreational Resources: The steelhead and cutthroat trout provide the major sports fishery on the river. Salmon which ultilize the Duckabush contribute heavily to commercial and sports salmon fisheries on Puget Sound.

Figure 7. Duckabush River and Estuary. (Scale 1:24000)

DUCKABUSH RIVER ESTUARY

Location: The Duckabush River Estuary is comprised of the brackish lower reach of the Duckabush River and the tidal flats at the river mouth. It occupies portions of Sections 16 and 21, Township 25 North, Range 2 West, Willamette Meridian. The proposed pipeline crossing is one mile above the tidal flats and within ½ mile of the upper reaches of the brackish estuary.

Observation Points: The estuary was observed from the U.S. Route 101 Highway Bridge as well as from several points on the salt marsh.

Streambed: The streambed in the river channel is composed of gravels in a silt matrix. The banks diminish in height to 2 to 4 feet as the river enters the marsh area around its mouth.

Tideflats and Wetlands: A saltmarsh fringes the river mouth and nearby Hood Canal shorelines. The marsh is mainly composed of sedges and grasses, grading into dryer meadowlike areas adjacent to the uplands and roadbanks. A limited region of bare tidal flats is also present at the outer wetland edge.

Geomorphology: The Duckabush Estuary extends at least ½ mile upriver of the mouth due to the low gradient and slow flow of the stream. Considerable salt influence was detected above the U.S. Route 101 Highway Bridge on an outgoing tide. Thus the lower reach of the river is partially influenced by Hood Canal marine waters. The river maintains a straight channel until it intersects Hood Canal.

Biological Resources: The marsh flats at the mouth of the Duckabush are composed of aster (Aster suspicatus), yarrow (Acheillia millefollium), bentgrass (Agrostis spp.) and silverweed (Potentilla pacifica) in the upper marsh and saltgrass (Distichlis spicata) and sedges (Carex lyngbyei) in the lower marsh. The marsh is several hundred feet in width from the shore to Hood Canal and over a

thousand feet in lateral extent along the shoreline.

Waterbirds, including gulls and a belted kingfisher, were observed near the river's mouth. Some waterfowl probably use the marsh during migration times. Salmon were observed in the lower reach of the river, as were oysters, clams and other shellfish.

Land Use Features: Scattered residences and small farms occur to the north and south of the river mouth.

DUCKABUSH ESTUARY: ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The estuary is a flat tidal marsh, cut by numerous winding channels.

Soils and Erosion: The estuarine soils are soft tidal marsh sediments composed of silt and peat. These soils are subject to erosion from tidal action or river scour.

Vegetation: The Duckabush Estuary contains a substantial tidal marsh, fringed by extensive mudflats. The tidal marsh is a sensitive wetland community which could be significantly impacted by massive sediment deposition or oil leakage.

Fish and Wildlife Resources: The Duckabush Estuary has moderate waterfowl use of the marsh and offshore eelgrass beds (Yoshinaka and Ellifrit 1974). The delta also provides a major haulout for harbor seals. Peak seal levels were recorded at 163 here in 1977 (Calambokidis 1978).

Fish utilizate the estuary for rearing, including both trout and the four salmon varieties found in the river. Chum and pink salman also use the estuary for spawning.

There is a minor geoduck bed off-shore of the delta in 30 to 60 feet of water. Crabs and shrimp are also harvested in the estuary. A commercial oyster culture bed is also present off-shore.

Economic and Recreational Resources: The estuary of the Duckabush extends nearly a mile upstream of the mouth. The estuary, therefore, provides sport fishing in addition to that provided by the river. Searun cutthroat and steelhead provide the main sport fishery resource. The salmon in the Duckabush estuary contribute significantly to Puget Sound commercial fisheries, as well as to off-shore sports harvest in Hood Canal. Shrimp, crabs and clams are also harvested for sports purposes.

MC DONALD CREEK

Location: McDonald Creek has its headwaters in the pipeline corridor, and flows southeasterly across Sections 19, 30, and 29, Township 25 North, Range 2 West, Willamette Meridian. The tentative pipeline crossing location is immediately southeast of the B.P.A. powerline in the northwest quarter of Section 29.

Observation Points: McDonald Creek was walked from its mouth at U.S. Route 101 up to River Mile 0.1.

Streambed: The streambed is 18 to 27 feet wide with a main stream thread 6 to 18 feet wide. The substrate is gravel with a 90% coverage of cobbles and small boulders.

Streambanks: Streambanks average two feet deep.

Floodplain, Canyon, and Valley: McDonald Creek, where inspected, meanders across the north side of an alluvial plain from which rise canyon slopes. The canyon bottom plain is approximately 120 feet wide and extends upstream at least one eighth of a mile.

Canyon slopes near the the mouth are a mat of mosses and ferns directly covering recently fractured basaltic parent material. Few trees grow on the slopes, mostly bigleaf maple and western red-cedar. The undergrowth of sword fern and vine maple is dense in patches.

Biological Resources: At a time (21 Janauary 1979) when most other Hood Canal creeks and rivers had chum salmon carcasses lying in lower streambeds, none were found in McDonald Creek.

Land Use Features: All land along the creek is forested.

MC DANIEL COVE

Location: Mc Daniel Cove, the mouth of McDonald Creek, is in the northeast quarter of Section 29, Township 25 North, Range 2 West, Willamette Meridian.

Observation Points: The shoreline was walked at the head of the cove.

Tideflats and Wetlands: McDaniel Cove has only fringe tidal marshes along portion of the upper beach. The intertidal flats cover approximately 7 to 8 acres.

Biological Resources: No detailed survey of the tidal wetlands was carried out.

Land Use Features: The south shore of the cove was formerly used for commmercial enterprises.

MC DONALD CREEK AND MC DANIEL COVE
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: McDonald Creek forms a relatively steep canyon rising from a 120 foot wide creek floodplain. Slopes are generally in excess of 30 percent, except in the western portion of the pipeline corridor (see Figure 8).

Soils and Erosion: Floodplain soils are predominatly Grove very gravelly loamy sand. Valley wall soils are also of the Grove series. These soils are subject to erosion on steep slopes, particularly if exposed (McCreary 1975).

Vegetation: Streamside vegetation is not particularly sensitive. Valley wall vegetation may be difficult to re-establish following construction due to steep slope and poor surface soils.

Fish and Wildlife: McDonald Creek and McDaniel Cove are thought to be used by steelhead and cutthroat trout (Yoshinaka and Ellifrit 1974). Chum salmon may use the lower creek; however, recent investigations have shown that salmon use is apparently declining (Egan 1978). McDaniel Cove contains moderate densities of butter and native littleneck clams and high densities of Japanese littleneck clams.

Economic and Recreational Resources: The creek provides a limited sport fishery. The cove provides abundant softshelled clam resources for sports harvest.

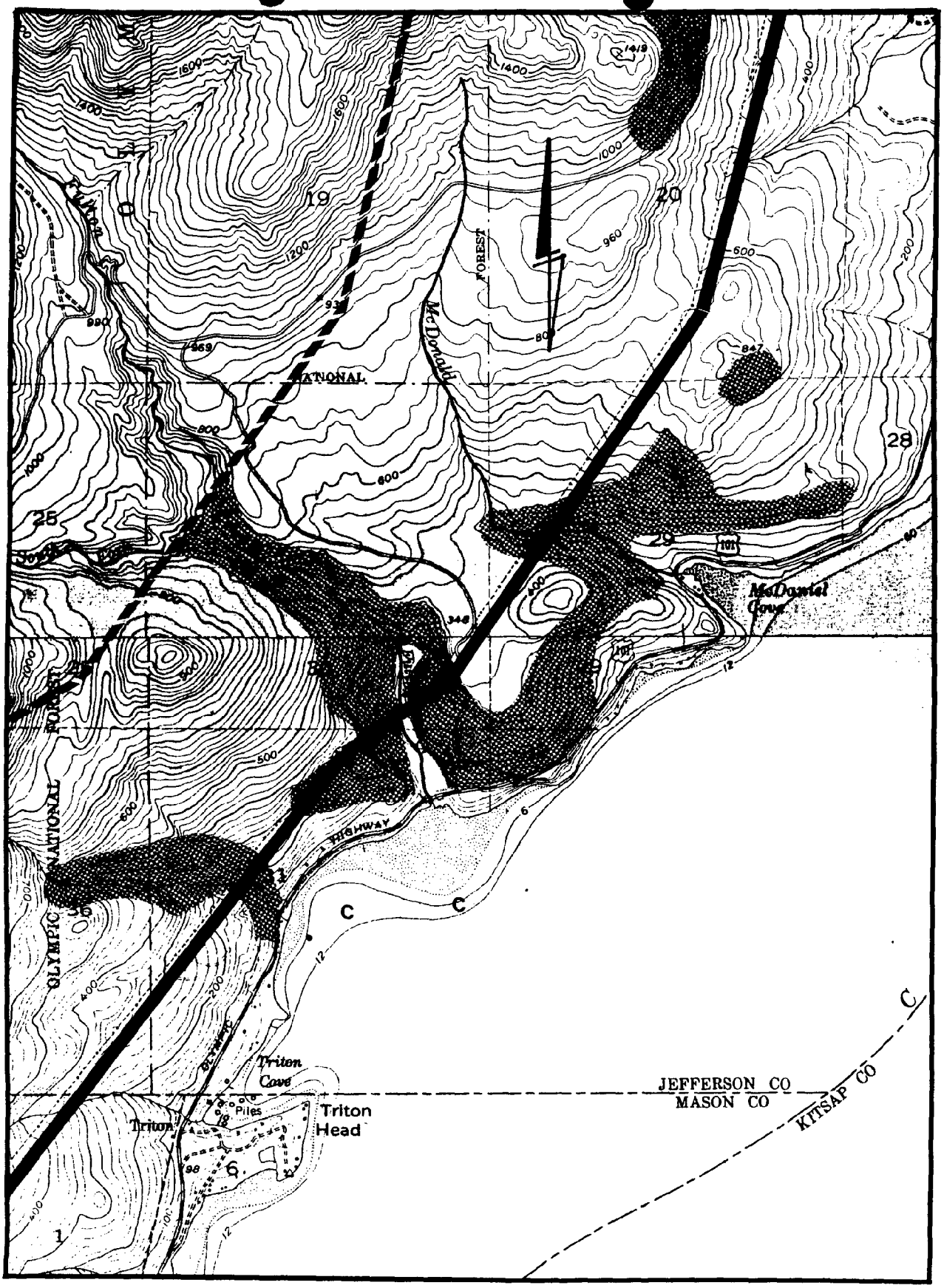


Figure 8. McDonald and Fulton Creeks. (Scale 1:24000)

FULTON CREEK

Location: Fulton Creek flows southeasterly through the pipeline corridor in Sections 30 and 31, Township 27 North, Range 2 West, Willamette Meridian. The tentative pipeline crossing is immediately southeast of the B.P.A. powerline in the southeast quarter of Section 30.

Observation Points: Fulton Creek was observed from the U.S. Route 101 bridge.

Streambed: Fulton Creek is a meandering stream with a highly variable bed width which averages approximately 60 feet. Substrate is a gravelly sand under a 30% coverage of cobbles.

Streambanks: Typical of meandering streams, erosional banks are relatively steep (30 to 100 percent slope), and accretional banks are relatively flat (3 to 5 percent slope).

Floodplain, Canyon and Valley: Fulton Creek meanders through the center of an alluvial plain which is approximately 300 to 400 feet broad near its mouth. Up-stream, the plain narrows to 100 to 200 feet wide at the B.P.A. powerline.

Biological Resources: Where natural vegetation remains on the alluvial plain, red alder and willow thickets predominate. The remainder of the plain has been cleared for residential and recreational development.

Copious amounts of filamentous green alagae are attached to stream cobbles in the lower 400 to 500 feet of the creek.

Few chum salmon carcasses were lying on the streambottom at a time (21 January 1979) when many other streams exhibited large numbers of salmon.

Land Use Features: The north canyon slopes and plateau have been developed for seasonal residences. Forestry is the predominant land use in the area.

FULTON CREEK DELTA

Location: The Fulton Creek delta protrudes into Hood Canal offshore of the northeast quarter of Section 31, Township 27 North, Range 2 West, Willamette Meridian.

Observation Points: The delta was observed from the U.S. Route 101 bridge.

Tideflats and Wetlands: There are no tidal marshes of any consequence along the Fulton Creek delta. The intertidal flats cover approximately 30 to 35 acres.

Biological Resources: Pacific oyster shell mounds on the delta beach are indicative of a substantial sport fishery. (Access is limited to property owners in the adjacent land development on the north side of Fulton Creek.)

Land Use Features: The delta shoreline is a private recreational preserve.

FULTON CREEK AND FULTON CREEK DELTA
ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE AREAS

Slopes and Topography: The Fulton Creek drainage has extremely steep side slopes rising 400 feet above the floodplain in places. These slopes are well over 30 percent in most places. The stream gradient is also relatively steep. South of the creek, the pipeline passes through a geologically unstable area (Jefferson County 1978).

Soils and Erosion: The stream floodplain soils are Triton very gravelly loam in the upper basin with Hoodsport very gravelly sandy loam and Belfast silt loam in the lower part of the corridor. Sideslope soils are mainly Grove very gravelly loamy sand. The sideslope soils can be expected to be extremely erosive on the steep areas bordering Fulton Creek (McCreary 1975).

Vegetation: The streamside vegetation is not overly sensitive. Vegetation on the steep sideslopes, however, may be difficult to re-establish following construction activities.

Fish and Wildlife: The stream supports a steelhead and cutthroat trout spawning run in addition to coho and chum salmon (Yoshinaka and Ellifrit 1974, Williams et al. 1977). Chum densities often range from 100 to 800 fish per mile during peak spawning periods. Butter and native littleneck hardshell clams are present off the Fulton Creek Delta.

Economic and Recreational Resources: Trout runs provide a moderate sports fishery in the creek. A major subtidal clam bed cover 54 acres off the creek mouth. Estimated clam resources include 3,229,000 pounds of butter clams, 24,000 pounds of littleneck clams and 330,000 pounds of horseclams.

III. POTENTIAL IMPACTS

Potential impacts of the proposed Northern Tier Oil Pipeline to physical and biological resources are divided here into two categories:

- construction impacts
- operational impacts

Construction impacts are discussed in the context of direct effects on the river crossing and sideslope construction within the basin. Operational impacts result basically from system malfunctions which cause oil leakage, either beneath the ground or beneath the river.

CONSTRUCTION EFFECTS

Construction Methods

According to the EFSEC Application, Northern Tier intends to cross all major and minor streams with a buried 42" diameter pipeline under the stream bottom. The top of the pipe would be placed at least 48" below a 100 year flood scour depth. Stream trenching would be accomplished by dredging with a backhoe, dragline or clamshell, either in the water or on-shore. Material taken from the trench will be left in the river until replaced over the pipe. Streams with sandy bottoms and subsurface water may be dewatered during construction. The presence of bedrock may necessitate blasting.

Trenching on river valley slopes will be accomplished by trenching machinery or blasting as necessary. The trenches will be backfilled with the native material and compacted as necessary.

Construction is expected to occupy the period April - November 1980. However, if the permit process is faster or slower than expected, Northern Tier may start earlier in 1980 or continue into early 1981.

Water Diversion or Blockage

The construction proceedures envisioned by Northern Tier are not stream specific. Apparently all river crossings in Jefferson County are to use below-ground burial. This will result in possible river blockage by:

- construction equipment
- portions of pipeline
- dredged material

In the smaller streams particularly, any blockage will increase water velocity and consequently scour of banks.

There is also apparently a possibility that streams with subsurface water will be diverted from their course or dewatered into point wells. Such dewatering will obviously expose downstream spawning gravels, kill downstream aquatic plants, fish and shellfish, and impact mammals which use the stream basin. Any dewatering or increase in stream velocity in spawning periods or during egg incubation will have a serious effect on anadromous fish. Dewatering may also effect downstream shellfish by raising estuarine salinity and altering habitat now used by brackish water species such as oysters.

Erosion and Stream Siltation

By far the greater construction impacts on the streams and river relates to erosion and siltation. Several of the canyons including Salmon Creek, Jackson Creek and Spencer Creek are narrow, V-shaped canyons with little or no room for construction equipment at the bottom. In these areas one can expect the following:

- larger than normal cuts and fills down the canyon sides
- extra road system winding down bank to accomodate heavy equipment
- erosion of trench material from canyon sides throughout construction
- potential liquidation, erosion and slippage of backfill material following construction

- lack of space to stockpile dredged material will result in channel diversion, bank erosion and high siltation from dredge spoils left in the stream

Many of the slopes in these V-canyons range from 30 to 50 percent to over 100 percent. In places the walls are nearly vertical. This canyon shape results from rapid cutting action by the streams over a relatively short geologic time period. The soils associated with V-canyons are thus highly erodable with crumbling and potentially unstable banks. Failure of revegetation efforts in these areas is likely. Such failure will continue erosion for many years after construction is completed.

Other rivers such as the Big Quilcene, Dosewallips and the Duckabush contain steepsided cliffs adjacent to one side of the river, or steep banks leading to the river floodplain. If the Big Quilcene is crossed at the proposed point, this will cause little problem. At the Dosewallips, steep hillsides south of the crossing will result in some of the trenching problems described above for V-canyons. On the Duckabush,the steep hillsides lead directly to a floodplain containing freshwater swamp wetlands. These wetlands are intimately connected with the river and large amounts of construction sediment will likely be resuspended and carried down the river during high water periods.

The ultimate biological effects of siltation depend on the stream and receiving waters. Sediments can cover or destroy gravel spawning beds by filling spaces and covering the gravels. During egg incubation , this effect would drastically reduce fish escapement. Earlier in the year, it might prevent successful spawning.

In the lower stream, sediment can be expected to precipitate out, clogging lower channels, raising flood levels, and burying some wetland and shellfish resources. It is expected that the effects of sediment on wetlands would only be temporary; however, filter-feeding shellfish might be more severely affected, particularly oyster spat. Sight feeding fish such as salmon and trout would also have their efficiency impaired. This might be particularly important for juvenile salmon rearing in the tidal wetlands.

Other Water Quality Effects

In addition to increasing turbidity and suspended solids through dredging and trenching, other water quality degradation can be expected. Vehicle leakage of oil and gasoline can be expected. This may be minor in most cases, but should be considered.

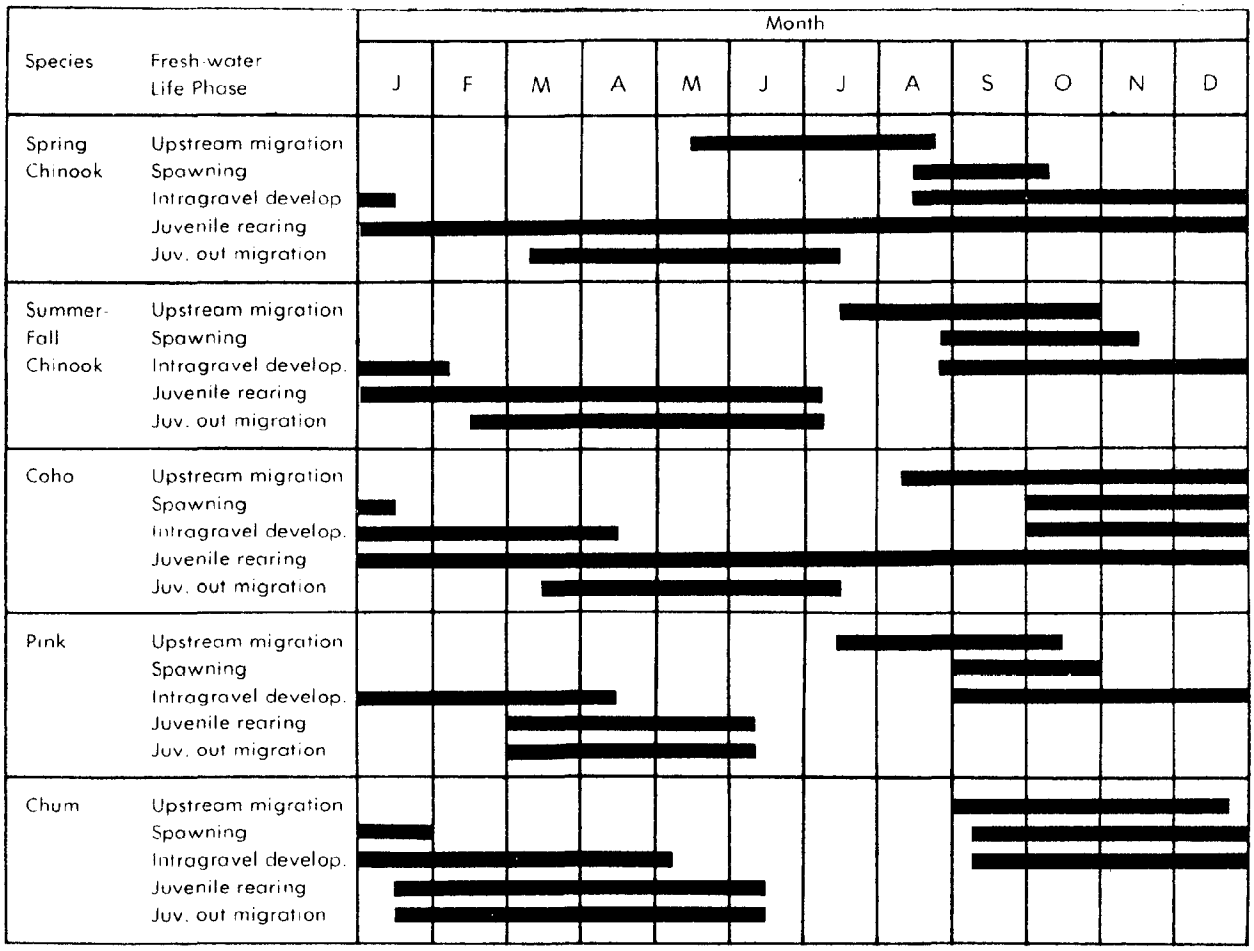
Construction Timing

Construction timing as proposed by Northern Tier is rather vague and is only loosely tied to biological considerations. Nearly all times of year pose some problems, either for engineering or for biological organisms. The ideal times for ease of construction are low-flow periods in the late summer and early fall. Unfortunately, this period coincides with anadromous fish spawning in some species. Anadromous salmon spawning periods for the Olympic basins are shown in Table 8. Chinook and pink salmon begin spawning during July and August. Chum begin in September and coho spawn from October through the winter months. Some of the species collect at the lower end of the smaller streams and wait until water levels rise in the fall to migrate upstream. Hatching generally occurs during the late winter for most species; however, fry do not emerge from the gravels to begin their saltwater migration until April or May. Thus late May, June and early July are the only months during which there is little salmon use of the freshwater areas (Williams, et al. 1975, Scott and Crossman 1973). In the cases where a river or stream enters a tidal wetland or estuary, juvenile salmon school in the marshes for several months during late spring and summer before they migrate seaward. During these months, low flow conditions would limit dilution of sediment or other pollutant concentrations and could affect successful rearing of the juvenile salmon. Thus, in rivers with estuaries or substantial tidal marsh, there is no "good" time to degrade water quality. The months of May, June and July, however, would probably be the best.

Effects of increase sediment on spat set of oysters or filter feeding by shellfish are less well studied, but should be defined before construction schedules are finalized.

Table 8

TIMING OF SALMON FRESH-WATER LIFE PHASES
IN THE QUILCENE AND NEARBY OLYMPIC BASINS



Source: Williams et al. 1977.

OPERATIONAL EFFECTS

Pipeline Operation and Oil Properties

The pipeline will be equipped with automatic pressure monitoring systems and check and block valves. Valves to halt major spills will be installed on both sides of major stream crossings and can be activated within 10 minutes, remotely. The maximum anticipated acute spill is 57,000 barrels. Pressure drop valves are capable of sensing 0.5 percent pressure drops; however, a small leak could theoretically go on indefinitely until observed on the ground or by periodic aerial reconnaissance. One way valves at valley bottoms will also reduce the risk of backflow along the pipe in case of a break.

The crude oil expected to be transported by the pipeline has a specific gravity of roughly 0.9 (water = 1.0) and will tend to float. Some fractions, however, have higher specific gravities. After a spill or leakage, oil released to the streams will separate with most of the hydrocarbons floating and some fractions settling along the bottom.

Acute Spills

Acute oil spills could come about through the rupture of a surface valve, sudden rupture or explosion within the pipe, or as a result of earth movement in the vicinity. The Olympic Mountains are a young and building mountain chain where earthquakes and unstable earth conditions are common. Any pipeline breakage is estimated to release less than 57,000 barrels of oil into the area surrounding the break. In most of the terrain surrounding the pipeline, breaks at the river crossing or the nearby slopes would rapidly drain major amounts of oil into the river, lake or stream. Based on observed stream velocities of 2 to 6 feet per second (1 to 4 miles per hour), floatable materials from a pipeline rupture approximately one mile above the receiving water would reach the estuary in 15 to 60 minutes. Tidal wetlands and shellfish beds would be affected long before any response team could begin isolation and cleanup procedures.

Salmon and trout spawning gravels would be covered with the tars and heavier hydrocarbon fractions. Floodplains and riverine wetlands would be inundated if the break occurred during high water.

Upon reaching the estuary, tidal action would tend to spread the oil throughout tidal marshes, seriously damaging waterfowl, coating and eventually destroying most plant productivity, damaging rearing areas for anadromous fish, and clogging intertidal shellfish beds. The literature is replete with studies of damaging effects of oil spills on salt marshes in England, France and the eastern U. S. coast.

As Northern Tier points out, the likelihood of a major spill is low. Be that as it may, the damage of such a spill on a major estuarine system such as the Salmon-Snow, Quilcene, Dosewallips, Duckabush or Fulton Creek would be to completely destroy mammal, waterfowl, fish, shellfish, vegetation and commercial and recreational uses of that area for many years, as well as potential effects on Hood Canal in general. The canal and its bays are poorly flushed with many nearshore eddy currents. The contamination of one estuary might also result in effects on nearby estuaries and bays.

Chronic Spills

While acute spills usually gain headlines and public awareness, low-level chronic leakages or pollutant discharges usually result in more widespread and lasting damage. Low levels of oil leakage could remain undetected for long periods of time and result in subtle changes in survival and reproduction for mammals, birds, fish and shellfish which utilize the streams and estuaries. Clogging of gills or filtering apparatus, introduction of toxic benzene derivatives, induction of sub-lethal tumors and effects on spat survival or hatching success are all potential sub-lethal effects which can be introduced by hydrocarbons and associated compounds. These effects are difficult to study under field conditions, but have been documented under laboratory conditions. It is important to realize that chronic, low level leakages can potentially cause such effects.

IV. POSSIBLE MITIGATIVE CONSTRUCTION OR ALIGNMENT MEASURES

This section begins with a discussion of ways to improve the proposed alignment at stream crossings. It should be pointed out, however, that the alignment may be improved significantly and still have major adverse effects. For this section only, we assume that the Eastern Olympic Peninsula route must be maintained, and carry out analyses to provide suggestions for better alignment. Such suggestions should not be taken in the context of absolute recommendations, since the fieldwork done in this study is not sufficient for such surety.

Crossing Alignment

Salmon Creek - The proposed crossing occurs in a steep V-canyon at the BPA power line. Alignments which would improve this to some extent might be to swing the pipeline south or east roughly 1/2 mile before the stream crossing. In this way, the pipeline could be brought:

- (east) across a relatively level plateau at the headwaters of the North Fork of Salmon Creek
- (south) across a main channel of Salmon Creek in a broader and less steep stream valley.

Snow Creek - There are no apparent problems with the proposed alignment.

Lakes - Nothing short of major route changes can be done about the fact that the pipeline passes through these lake basins.

Big and Little Quilcene Rivers - The main alignment problems here are that the crossings are near the estuary. Construction will be easiest in this area, however. South of the Big Quilcene, the pipeline passes through unstable, steep slope areas above Quilcene Bay. There is not presently enough information to suggest alternate routing; however, this should be explored more thoroughly in terms of possible major realignments.

Spencer, Jackson and Marple Creeks - An alignment change making a loop toward the west beginning north of Spencer Creek and re-entering the main corridor south of Jackson Creek should be explored. Alternatively, crossing the V-canyons with elevated pipe structures could be tried.

Turner Creek - The proposed alignment poses no significant problems.

Dosewallips River - The proposed alignment climbs a steep bank near to the river on the south side. A shift upstream 0.1 to 0.2 miles will yield more room in the floodplain for soils disposal and equipment operation.

Duckabush River - The proposed alignment passes through the riverine wetland and climbs a steep bank to the south. An alignment shift 0.2 to 0.3 miles to the east will lessen the bank grades; however, all alignments will pass through sensitive wetland or estuarine areas.

Mc Donald Creek - Re-routing the pipeline 0.2 - 0.3 miles to the west would avoid some of the steepest slope areas. Alternatively an elevated construction technique might be used.

Fulton Creek - The creek canyon is very steep and there are no good crossing points. Elevated construction is the only possible realignment possibility within the corridor.

Construction Options

It is the responsibility of Northern Tier to provide detailed design of alternatives and construction options. Based on field observations and data gathered for this report, however, some general categories of mitigative measures can be pointed out. Their ultimate usefulness will require further design work and study, and applicability to particular streams.

The most significant construction impacts will be caused from erosion and dredging. These impacts can be reduced in steep-sided V-canyons with:

- trestles over river beds
- trestles over narrow canyons

Bridge or trestle construction can reduce the problems with back-fill and re-vegetation of steep areas, lessen erosion, and eliminate the need to dredge or fill in streams. It will also slightly reduce energy required for pumping, although it may prove more costly than sub-channel burial.

In trestle areas, an interceptor pipe surrounding the main pipe could be used to direct any oil leakage back to holding ponds outside of the river floodplain.

If subchannel burial must be used on some streams, use of check dams made of non-erodable material could provide a means of dry trenching without completely dewatering the stream or river.

If wet trenching is carried out, spoils piles should be created alongside the stream in an area where the material will not re-enter the stream until replaced. Dredged material should not be left in the stream bottom. Other erosion control methods (hay bales, netting, etc.) should be used on any bare areas to be exposed for extended periods. Over-winter contorl measures, in particular, should be specified in detail by Northern Tier.

Revegetation

Revegetation will be difficult in poor soils and steeply sloped areas. Revegetation in such areas should include:

- careful soil preparation
- appropriate selection of soil holding species known to survive well in poor soils
- post revegetation inspection to monitor survival and erosion

Revegetation will be facilitated if the pipeline route can be closed to recreational motorists (4-wheeled drive vehicles and motorcycles). Barriers should be erected at all major road crossings to discourage such use. Such barriers could not be expected to effectively prohibit all ATV's and some surface disruption and enhanced erosion would none-the-less occur. Herbicide spray programs should be

carefully controlled or banned entirely. Such management practices increase erosion and degrade water quality in receiving waters.

Timing of Construction

Construction on important anadromous fish streams should be carried out only in late May, June and July. This may stretch pipeline construction over a 2-year period, in which event careful revegetation should be carried out at the end of each construction period.

Permitting and Construction Control

Detailed plans for stream crossing alignment and construction techniques should be required on all streams. Water quality and erosion control methods to be used should be documented in detail. If possible, Corps of Engineer Permits should be required on all streams defined as having potential hazards in this report. Additionally, all construction should be supervised directly by personnel from federal and state fish and wildlife agencies.

In particular, Northern Tier should be required to unequivocally commit themselves to adopting a construction schedule approved by specific agencies: the Washington Department of Fisheries, the Washington Department of Game, and the U.S. Fish and Wildlife Service.

Reimbursement for Damages

A fund and mechanism for damage repayment should be set up at a state or regional level. Such a fund would be responsible to counties, cities or private landowners who suffer operational damages from spills. Such a fund should be administered by a neutral, disinterested party or agency to prevent abuses.

V. EVALUATIONS AND RECOMMENDATIONS

The preceeding sections have demonstrated that the area along the proposed pipeline route:

- has valuable resources of importance to Jefferson County.
- is susceptible in many areas to severe impacts from proposed alignment, construction and operation of the pipeline.
- may be mitigated to some extent with available construction options.

However, it is clear that even with available mitigative measures, sensitive environmental areas and severe impacts will remain. Below, severe areas are summarized, followed by a general discussion of the advisability of an East Olympic Pipeline Route.

Severe Areas

The physical characteristics and biological characteristics discussed in previous sections of this report are summarized by the matrix in Table 9.

The most severe area in terms of physical construction problems, coupled with vital resources are:

- The Salmon-Snow Creek system
- The Quilcene system
- The Jackson Creek system
- The Dosewallips system
- The Duckabush system
- Fulton Creek

MacDonald, Turner, Spencer Creeks and the lakes are of lesser importance by comparison only. These systems may still be seriously impacted by poor construction or by operational hazards.

Advisability of an East Olympic Pipeline Route

From field observations and a compilation of the available literature,

Table 9
STREAM SENSITIVITY MATRIX

STREAM OR LAKE	SOILS			WATER		FISH			SHELLFISH & INVERTEBRATES				WET-LANDS	WATER-FOWL	HARBOR SEAL ANNUAL USAGE
	Steep Slopes	Instability or Slippage	Erosion Hazard	Aquifer	Flood Area	Salmon Spawning and Rearing	Trout Spawning and Rearing	Herring & Smelt	Intertidal Clams	Subtidal Clams	Oysters	Crabs & Shrimp	Tidal or other marsh		
Salmon Creek	X		X			X	X								
Snow Creek				X	X	X	X								
Salmon-Snow Estuary			X			X	X	X	X	X			X	X	
Crocker Lake			X	X			X						X	X	
Peterson Lake			X	X											
Tarboo Lake			X				X						X		
Leland Lake			X	X			X								
Little Quilcene River					X	X	X								
Big Quilcene River				X	X	X	X								
Quilcene Estuary	X	X	X			X	X	X	X	X	X	X	X	X	X
Spencer Creek	X	X	X			X	X								
Jackson & Marple Creeks	X	X	X			X	X								
Turner Creek			X												
Dosewallips River	X		X			X	X								
Dosewallips Estuary			X			X	X			X	X		X	X	X
Duckabush River	X		X		X	X	X								
Duckabush Estuary			X			X	X			X	X		X	X	X
McDonald Creek			X			X	X		X						
Fulton Creek			X	X		X	X		X	X	X		X		

it is clear that vital resources will be impacted by a project of this type and magnitude. Northern Tier and BLM have conducted brief analyses of cross-sound routes. No consideration has been made of a route passing west of the Olympics, to Aberdeen, then east to the Olympia area. Certainly such a route, or a cross-sound route, also pose environmental problems. However, the relatively pristine areas and vital resources of Hood Canal make selection of the proposed East Olympic Peninsula Route unadvisable. We recommend that Jefferson County contest this route as being not in the best long-term interests of the county.

REFERENCES

Calambokidis, J., et al. 1978. Chlorinated hydrocarbon concentrations and the ecology and behavior of harbor seals in Washington state waters. The Evergreen State College, Olympia, Washington.

Division of Marine Land Management, 1977. Washington Marine Atlas, Volume 2: South Inland Waters. Washington Department of Natural Resources. Olympia, Washington.

Egan, R. 1977. Salmon Spawning Ground Data Report: (Progress Report #17) Washington State Department of Fisheries. Olympia, Washington.

Egan, R. 1978. Salmon Spawning Ground Data Report (Progress Report #51.) Washington Department of Fisheries. Olympia, Washington.

Goodwin, L. 1978. Puget Sound Subtital Geoduck Survey Data (Progress Report #36). Washington Department of Fisheries. Olympia, Washington.

Goodwin, L. and W. Shaul. 1978. Puget Sound Subtidal Hardshell Clam Survey data. Washington Department of Fisheries Progress Report No. 44.

Jefferson County. 1978. Unpublished maps and data pertaining to soils and other physical features. Jefferson County Planning Department. Port Townsend, Washington.

Jennings, M., et al. 1977. Snow Creek Research Project and Facilities: A Draft Environmental Impact Statement, Washington Department of Game. Olympia , Washington

McCreary, F. R.. 1975. Soil Survey of Jefferson County Area, Washington. U. S. Soil Conservation Services. Washington, D. C.

Northwest Environmental Consultants. 1975. The Tidal Marshes of Jefferson County, Washington. Jefferson County Planning Department. Port Townsend, Wa. 1977.

Sandison, G. 1978. Letter and attachments to Allen Zink, April 4, 1978. Washington Department of Fisheries. Olympia, Washington.

Scott, W. B. and E. J. Crossman. 1973. Freshwater Fishes of Canada. Bulletin 184. Fisheries Research Board of Canada. Ottawa, Canada.

U. S. Geological Survey (USGS). 1953 (1973 photorevised). Topographic 1:24,000 scale map for Holly, Brinnon, Seabeck, Mt. Walker, Quilcene, Center,and Uncas, Washington.

Williams, R. W., R. M. Laramie and J. J. Ames. 1975. A Catalog of Washington Steams and Salmon Utilization: Vol. 1, Puget Sound Region. Washington Department of Fisheries. Olympia, Washington.

Yoshinaka, M. S. and N. J. Ellifrit. 1974. Hood Canal - Priorities for Tomorrow. U. S. Fish and Wildlife Service. Portland, Oregon.

Appendix B

STATEMENTS OF CONCERN

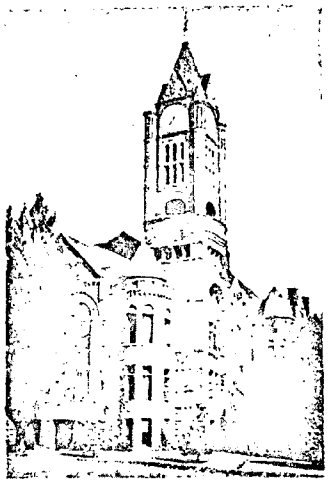
Jefferson County Department of Highways
Johnston and Gunstone
Earth Care Organization
Protect the Peninsula's Future
Admiralty Audobon Society
Protect the Peninsula's Future
Ohode

JEFFERSON COUNTY COMMISSIONERS

B. G. BROWN
CHAIRMAN

A. M. O'MEARA
MEMBER

CARROLL M. MERCER
MEMBER



Jefferson County Department of Highways

COURTHOUSE

PORT TOWNSEND, WASHINGTON 98368

EDWIN A. BECKER, DIRECTOR OF PUBLIC WORKS

December 13, 1978

Jefferson County Planning Department
Courthouse
Port Townsend, Washington 98368

Attn: David Goldsmith, Director

Re: Northern Tier Pipeline Proposal

Dear Sir:

You have requested a response to the probable impact of the above referenced pipeline on the County Road System. The following comments are addressed to the short and long term impact.

Short Term

1. The crossing of the county roads will require open cuts for this size of pipe. These pipe crossings will require some inconvenience to traffic on the more traveled roads and will be allowed by normal permit procedures. Close adherence to the permit conditions would restore the road to its original condition.

2. Assuming the pipe, construction equipment, etc. are truck hauled within legal load limits, there will still be some damage to the road system where the county road is unable to carry legal State Highway loads. Flexable L.B.S.T. type surfaces will "aligator", subgrades will yield to the large number of heavy loads causing a change in road profile and its riding quality. When the county roads to be used are identified, a before and after condition inspection will be made. Any damage to the road will be corrected under a road usage agreement with the pipeline contractors. The pipe line construction oriented traffic will consist mostly of the heavy haul type trucks which will create some traffic problems on narrow county roads. Due to the seasonal rains there will be some dirt and gravel roads that will require additional grading and rock surfacing to keep them passable to local traffic. The contractor will be responsible for keeping these access county roads suitable for local traffic.

Continued...

Northern Tier Pipeline Proposal

Long term

1. Pipe crossings on roadways seldom are backfilled and restored so they do not require some maintenance at a later date. For the approximate fifteen (15) crossings in Jefferson County, for the alignment indicated on the map you provided, this is not a serious problem.

2. The Jefferson County Road System is built and maintained to a large extent from money received from State and Federal gas tax. These revenues are in turn dependent on the available crude oil from which gasoline and diesel are derived. The net impact of this pipeline has to be considered favorable in that it will insure to some degree that funds will continue to come from this source of crude oil. The alternate of no crude oil, no gas tax, no cars, with little need for present road systems is indeed a bleek situation.

Very truly yours,

M. L. Sanstrom

Milton L. Sanstrom, Acting Director
Department of Public Works

MLS:al

December, 15, 1978

David Goldsmith
Jefferson County Planning Dept.
Court House
Port Townsend, Wa. 98368

Dear Mr. Goldsmith,

I wish to offer my objections on the proposed Northern Tier pipe line proposal to pass through Jefferson County.

I am proprietor of one of the largest native clam farms in our State. My clam producing areas are located on the shores of Discovery Bay and Sequim Bay. The pristine shorelines of these estuaries are historically noted for their high productivety and excellent quality of native hard shell clams. Good planning should consider and extol these natural estuaries as an invaluable nursery for the bounty of the sea. These Bays form the first link in our food chain, that is, clam larva fed upon by bait fish which in turn is fed upon by larger fish, and finally to human consumption.

With an ever growing need for more food to feed our world population I would suggest that an oil port and pipeline or any other petro chemical industry be discouraged and deleted from Jefferson County.

Sincerely

Charles W. Gunstone, Jr.

Charles W. Gunstone, Jr.

NORTH TIER

Earth Care Organization

807 P Street
Port Townsend, Washington

December 19, 1978

RECEIVED
JEFFERSON COUNTY
DEC 21 1978
PLANNING DEPARTMENT

The Jefferson County Planning Department
County Building
Port Townsend, Washington 98368

Gentlemen:

In response to your request for comment, we submit the following about the proposed pipeline from Port Angeles to Clearbrook, Minnesota which Northern Tier Company wants to construct. The pipeline would transverse most of Jefferson County, and the matter is of prime importance to those of us who live in the county.

First and foremost, this organization is adamantly opposed to construction of the line and of the oilport on general principles, as well as specific dangers. The line is unnecessary; a new oilport at Long Beach and a proposed one from Skagway would be cheaper and use a great deal of existing line. The product of new oil discoveries in Mexico can conveniently be channeled into existing lines. The oil companies in the midwest do not favor the Northern Tier. We suspect that if the oilport is built and the pipeline is not, then this beautiful peninsula would be despoiled by a petrochemical industry. If we must pile up a reserve of oil for emergencies, why not store it underground on the northern slope till we need it?

More specifically our membership has very grave concerns about the pipeline, as follows:

1. Many of our communities depend upon deep wells from aquifers arising in the Olympics. The pipeline would cross these. What assurance is there that a break might not ruin our water supply?
2. The proposed route for the line is over very unstable terrain subject to many slides and occasional quakes, which could break the line, polluting the surface and underground water.
3. The line would pass over several rivers emptying into Hood Canal, an immense reservoir of sea life and the location of an oyster industry vital to the whole United States. The several estuaries in the area are the base for a whole chain of food supply for animals and man. A break there could cause havoc.
4. Our roads are not heavy enough for the heavy traffic generated by the construction, and a special port might be necessary for unloading pipe. Who pays for the damage?
5. We fear the boom-and-bust of such a construction project could seriously disrupt schools and other public services.
6. Finally, by what logic is heavy industry to be foisted upon one of the last natural wonderlands of our country? The state should protect us from such action that might change our whole way of life, and our tourist and retirement industries.

Sincerely yours,

Richard Wojt
President

PROTECT THE PENINSULA'S FUTURE
P.O. Box 1677, Sequim, Washington, 98382

A non-profit corporation dedicated to the wise land use of the North Olympic Peninsula

RECEIVED
JEFFERSON COUNTY
DEC 22 1978

Dec 22, 1978

To:
Jefferson County Board of Commissioners and
Jefferson County Planning Office

From:
Marian Meacham, on behalf of Protect the Peninsula's Future (PPPF)

P.P.P.F. welcomes the opportunity to contribute to the "County Notebook" of citizen and agency concerns respecting the Autumn 1978 Northern Tier Pipeline Proposal (NTPP).

Another section to P.P.F.'s comments is being submitted by Jane Ross, co-chairperson (with me) of PPPF's "Save the Resources Committee" Items will be addressed as headed.

I. Air Quality:

1. A transshipment port handling 1.2 to 1.6 million barrels of crude oil a day will heavily pollute the air of the Puget Sound Basin. The prevailing winds from Port Angeles are from the West. This means Jefferson County is in direct line for a heavy

load of atmospheric borne HC, NO, and SO^2.

The only effective mitigation for HC emissions from offloading vessels is to use only vessels with segregated ballast. Since 50% of the tonnage will be foreign oil carried in foreign vessels not subject to the Jones Act, it seems that beyond (Control of) U.S. shipping, there is no way to mitigate the impact of offloading an average of 600,000 to 800,000 bpd of Crude. To this must be added H.C. from the tank farm.

The NTPS Proposal does not - that I could discover - discuss (expected) the impact of these and other pollutants on human health or on the productivity of biomass, or what the risk-cost-benefit tradeoffs might be. P.P.F. asks that this problem be carefully addressed - including costs of lost health.

2. The Proposal notes a serious problem in obtaining firm commitments for electric power (Executive Summary) for the Port operations and to operate pumping stations. Clallam County (P.U.D.) is among those anticipating a heavy impact on available power in this region. Since E-FSEC can "appropriate" existing power to the pipeline system, it can well be expected that a perceived need for additional electric energy will result in pressure for a thermal plant (coal or nuclear)

PPF Comments on NTPS - Marian Meacham p. 3

to be located in Clallam or Jefferson County. Either will load the atmosphere with additional pollutants, and eastern Jefferson County - especially Quimper Peninsula will again be directly downwind from such a facility.

P.P.F. asks that this problem be seriously addressed, including both probable impacts and adequate mitigating measures.

(It is pointed out that the North Olympic Peninsula people have already made it very clear that they do not intend to live with a nuclear plant.)

II Population Boom during construction:

In addition to impact on housing & services of the county during construction, a substantial population "left over" from the construction period can be expected. Such residual populations are usually the lowest-skilled, those who cannot afford to move, and who will continue to place a burden on the County's services. How many people can we expect to remain? What can we expect the costs to the County to be? What about impact on the social fabric of the area? Data can be taken from the Alaska experience.

I can think of no way to "mitigate" the problem.

III Decommissioning of pipeline:

What becomes of an abandoned pipeline in 20 or 25 years? The following can be expected: for a time the line will be filled with oil-contaminated treated water (fungicide, bacteriacides, etc.). Later the pipe will be pulled up for the steel. At this time the trench will be torn up again and the water filling the pipe will be discharged somewhere.

P.P.F. asks that the N.T.P.S. Proposal include a thorough discussion of the procedures, expected impacts, risks and costs of decommissioning be discussed.

Some mitigation might be achieved if Northern Tier were to set aside a fund to fully cover the costs of decommissioning. The County should ask for at least this much.

Another possibility is that the pipeline will be cleaned and converted to regasified L.N.G. or L.P.G. It is P.P.F.'s position that the County should have positive assurance that this will not happen; however, the other side of this is that experience teaches us that "assurances", no matter what the source, count for very little when there is money to be made.

IV. Where is Northern Tier going to get the gravel and rock fill for the Pipeline bed? How much is coming from Jefferson County? How will it be transported? What will be the impact on the County roads as a result of hauling this material. Where will the haul routes be? How is the material to be got into the estuaries and wetlands & up the slopes? New roads will have to be built. Where will the materials for these roads to be obtained? Will the roads be left for purposes of future access to Pipeline? What is the expected impact of construction of these haul-roads and of the roads themselves on the fragile environments they will invade?

P.P.F. asks that this problem be fully addressed by Northern Tier.

Again, it is hard to see what possible mitigation there might be for such potentially serious disruption of natural systems & destruction of fragile slopes. Estuaries are among the most valuable lands of the State and the County Shorelines Master Program clearly acknowledges their irreplaceable value to the County & the State.

V - Land use:

In addition to the impact on wetlands, estuaries and slopes, the proposed pipeline will follow the Leland Valley.

The only way to mitigate... the impact of construction of the pipeline itself and of associated activities such as storing pipes, parking & driving machinery, hauling gravel on the Leland Valley is not to route the pipeline either through or near it.

P.P.K. notes that the Valley is a substantial and irreplaceable portion of the County's prime agricultural land. It would be inexcusable to sacrifice this resource for twenty years of all. The same goes of course for wetlands and estuaries and forestlands cost to the right of way - a 90' corridor for the length of the County.

VI. Disaster response: Admiralty

P.P.K. concurs with Audubon that the so-called "automatic control system" is totally unacceptable.

P.P.K. asks how emergency response to a pipeline rupture is to be met, and who is to pay the costs of the response? Also,

P.P.F. Comments on NTPS Marian Meacham p 7

Northern Tier does not address the problem of compensation for loss of living, loss of resources (for from 2 to 50 years or perpetual) by reason of chronic leaks, undetected leaks, major & minor ruptures - any event which will put substantial amounts of oil into the environment.

There is clearly no way the substantial or absolute loss of a renewable natural resource (such as fisheries, forests, farmlands, water quality and water,) can be compensated. Northern Tier does not even discuss mitigation.

P.P.F. recommends some provisions which might help:

1. strict liability of owner and/or operator of the pipeline system - this and following responsibilities would apply to any present or future owner and/or operator. Responsibility must be clear.

2. Establishment and maintenance of a $60 million fund in 1978 dollars to guarantee compensation to individuals, agencies, municipalities or other affected entities, where there are losses.

3. That these potential (and certain) losses be assessed in advance and given full & fair value

PPF comments on NTPS Marian Meacham p8

in current dollars with allowance for inflation.

4. The fund & payment of compensation should be under the control of the County. Claimants should be compensated for all losses immediate and in the future associated with any contamination or other impact by reason of the pipeline system.

In the event of the loss of a clean water supply, the claimant shall be provided with water equivalent to the pre-existing supply immediately.

Late discovery of a loss (such as an illness by reason of oil or other pipeline system related contamination) shall be no deterrent to quick and full compensation (For example, cancers, birth defects, and so forth are not evident .. for some time after exposure to the contaminant, neither would loss in productivity of a farm or woodlot or forest or damage to livestock.

5. The fund is only a contingency fund & would not limit the owner and/or operator's liability.

P.P.F. can cite published support for these concerns & proposed mitigating measures.

Marian Meacham.

ADMIRALTY AUDUBON SOCIETY POSITION
ON THE NORTHERN TIER PROPOSAL DEC. 22. 1978.

CONTENTS

Admiralty Audubon Concern
Alternatives
Effects
Oil Spills
Cleanup and Waste Disposal
Air Pollution
Pipeline Construction
Pipeline Testing and Flushing
Pipeline Operation
Pumping Stations
Hazards to Water Supply
Vulnerable Wildlife

ADMIRALTY AUDUBON CONCERN

This paper addresses the environmental aspects of the oil port and pipeline project proposed by Northern Tier Pipeline Company, referred to in this text as 'Northern Tier'. The proposal is referred to as the Northern Tier 'document'.

Admiralty Audubon Society appreciates this opportunity to voice its concern with protection of our natural resources, and especially the unique resources of the Olympic Peninsula. The proposed oilport, tank farm, and pipeline would cause drastic changes in all environmental aspects of the northern Olympic Peninsula, and of the eastern Strait and Puget Sound. These changes must be carefully assessed. Few of them can be called favorable. They should be weighed against the stated 'national necessity' for oil transshipment from this place.

As one speaker at the recent Environmental Faire said, if you use Detroit products, knowing what the air and other pollution is there, you have to take your lumps here to help trans-ship oil. This simply minimizes or avoids legitimate inquiry into the degradation of existing resources, versus the need for such degradation.

Locally impacted groups must ask: given the import facility and the huge tank farm, is Alaskan oil the principal feed, or will foreign oil be preferred? Foreign oil does nothing for the U.S. balance of payments. Is this the seed for a petrochemical complex in this area? If so, can the unique values of the environment be preserved? Or if not, is it a good trade-off?

ALTERNATIVES

Alternatives to the Northern Tier proposal have been detailed by groups in this area and by others. Senator Jackson recently referred to the pipeline route from Skagway to Edmonton, to serve midwest refineries, as environmentally preferable. We believe these alternatives exist, and that they are sufficient reason to assess carefully the damages to resources that can be predicted for the Northern Tier operation.

EFFECTS

The effects of the oil port will be felt on the water, shores, and air of Jefferson County. Construction and operation of the pipeline will have direct effects on the county. The Admiralty Audubon Society hopes to help mitigate or prevent damage to the natural resources of wildlife and vegetation; and to avoid long-term risks of damage taken for short-term profit or advantage.

The tanker traffic to the Northern Tier port, according to present statements, will be added to, rather than replace, the existing tanker visits to Puget Sound refineries. Existing tanker traffic through the Strait is as much as 300 vessels per year. The Northern Tier plan calls for about 300 port calls per year at full operation, and up to 395 calls at ultimate design of 1.2 million barrels per day; thus at least doubling the traffic, and with larger ships.

Regarding the Northern Tier pipeline proposal, a spokesman for Atlantic Richfield said at the Environmental Faire, October 1978, "Western Oil and Gas Association and Atlantic Richfield have taken no position on this pipeline. We are receiving our crude by tanker from Port Angeles"(note: he meant the portion of the trip represented by the distance from Port Angeles to Cherry Point) "at an expense of about 3 cents per barrel. There has been some mention that there are those who would like to see the existing refineries connect to that pipeline if and when it is ever built. The position that Western Oil and Gas Association and Atlantic Richfield has

taken on that is that we are now delivering to our facilities at the expense of 3 cents per barrel, a commodity that would cost about 80 cents per barrel if it were delivered by pipeline. For that reason we oppose a connection into that pipeline; but again we have taken no position on whether or not the pipeline is in fact needed."

Senator Jackson stated recently that he knew of no governmental power that could force these refineries to receive oil from pipeline rather than by ship.

OIL SPILLS

The Northern Tier document predicts a "total vessel" spill averaging about 48,000 barrels once every 7 years; that would be three such spills during the project's nominal 20-year life. Also a barge spill (in Port Angeles harbor) of about 29,000 barrels every 11 years, or two during the 20-year life.

In contrast, the largest spill in the last 3 years in the 13th Coast Guard District (Washington, Oregon, Idaho, and Montana) was 26,000 gallons, or about 600 barrels. This came from a punctured fuel tank on a freighter. The first large spill will be a traumatic experience for Puget Sound residents.

On December 14, 1978 a log boom inside the Port Angeles harbor, "made of big logs and 6-inch chain attached to anchors and buoys, burst when westerly winds increased suddenly from 15 to 45 and 50 miles an hour, placing intolerable pressure on the boom. - - Logs were visible the next morning from west of the Hook eastward towards Green Point - -" (Port Angeles Daily News, Dec. 15, 1978).

Under such conditions spilled oil will spread rapidly. As much as 30% of the oil may be mixed into the subsurface water, where even the most sophisticated equipment cannot clean it up. Combined wind and tide currents make a strong easterly drift in these waters; test plates and floats released in Port Angeles harbor were found as far east as the shores of Whidbey Island and within the Sound. A major spill would inevitably touch the shores of Jefferson County, with attendant coating of the beach and oiling of shore birds, seabirds, marine mammals, and shellfish.

CLEANUP AND OIL WASTE DISPOSAL

A spokesman for the Clean Sound Cooperative (oil and transportation companies who are developing cleanup capability) has described the new equipment that can pick up as much as 600 gallons of oil per minute, and 300,000 barrels of oil per day. He made no mention of disposal of the salvaged oil.

That picked up in clean water probably can be returned to the tank farm. Undoubtedly some, especially that scraped off the beaches, will be unusable, and disposed of by burning or burial, which then is a new source of pollution.

Payment for cleanup is not mentioned in the Northern Tier document, unless these reviewers missed it. No doubt the Clean Sound Cooperative will finance their own equipment, but shoreline, boat, and oiled bird cleanups will be long and expensive after a considerable spill. Commitment for payment for these jobs should be assured.

AIR POLLUTION

Air pollution from the Northern Tier port and tank farm are said by the document to be a minimal hazard. Many other tank farms, however, have noticeable vapour odors downwind, and they are probably inevitable. The prevailing wind direction is nearly due east and will carry pollution across the Sequim-Dungeness area, Discovery Bay, and the Port Townsend area. Any refining or petrochemical plants, which may also be inevitable once the tank farm is established, will produce great pollution that will spread over these areas and into northern Puget Sound. Spread diagrams for air pollution in Vol. III-1 of the Northern Tier document appear not to take account of the prevalence of strong westerly winds.

PIPELINE CONSTRUCTION

Burial of the pipeline requires the denuding of a strip 90 feet in nominal width, plus access roads, trails around obstructions, etc. Probably a width of several hundred feet will be affected and will furnish silt runoff until covered by new vegetation, which may take several years. The strip will be kept cleared by spraying and mowing. Spraying always is easier and doubtless will be the major control, with use of 2,4-D and 2,4,5-T, or one of the broad-spectrum herbicides.

Thus the pipeline route, which runs through high-rainfall areas in Jefferson County, will be a major new source of stream contamination by silt and herbicide runoff.

Stream crossings are probably the largest hazard during construction of the pipeline. The Northern Tier document predicts large-scale siltation reaching downstream during and after excavation and backfill of the trench across floodplains and streambeds. The report states that gravel will be used as stabilizing backfill on the large streams. However, even the minor streamcourses can furnish large volumes of silty runoff during storms.

The backfill of all trenches cut across streamcourses should have an engineered fill of suitable material, with graduated fines upward into the surface material, to reduce the possibility of settling and continued erosion.

Siltation in bays and estuaries from disturbed ground already is a hazard to spawning beds of fish and shellfish, and to the complex life of estuaries. Dabob Bay, its tributary rivers, and others will be adversely affected by additional silt deposits.

PIPELINE TESTING AND FLUSHING

After the pipeline is completed it will be tested hydrostatically by filling with water at a number of entry points. The document says the large volume of water will be taken from streams during abundant flow periods so as not to disturb stream flow. After testing, the water will be released at the entry points into various waters: 2.4 million gallons directly into the Strait; 3.6 million gallons into the Dungeness River; 0.5 million gallons into Jimmycomelately Creek; 5 million gallons into Big Quilcene River, etc. Obviously the quality of the discharged water will be highly important.

The document says the discharged water will contain only soda ash (for pH control) and mill scale. However, new pipe often has residues or coatings of petroleum products. The presence of such deleterious substances in the pipe must be known beforehand, and if present they should be removed by appropriate processing before release into river systems.

The document states that if the water is kept in the pipeline over a stated time, a bactericide will be added. How this will be done after the pipe is full of static water is not clear. It appears likely that bactericide will be added during filling if the possibility of delayed emptying exists.

Many bactericides are toxic materials; some have the same basic formula as 2,4,5-T, and therefore contain the extremely toxic substance dioxin. The bactericide chosen for pipeline must be assessed, before use, for possible damage to stream water and streambed, animal life and vegetation. Releases of these magnitudes containing toxic substances would be a major disaster.

PIPELINE OPERATION

Leaks are inevitable in a pipeline, even though never expected by the operator. Inevitably this pipeline will leak, from pipe buried 3 feet deep,

much of it in permeable soil. How big is a significant leak? Oil in the subsoil degrades slowly if at all. The lighter fractions can move like water, through permeable layers, and will then at least taint the ground water. Such degradation would be permanent.

The automatic warning system described by Northern Tier is triggered only by a leak flowing at a rate that will spill about 4,600 barrels per day. Any smaller leaks will not be signalled, and will be found only if seen on the surface by patrols or visitors. 4,600 barrels is about 200,000 gallons. For comparison, the St. Lawrence River oil spill (in water) of 1976 totalled 250,000 gallons; it cost $8 million to clean up. A casual spill of this magnitude would be disastrous.

This is a totally unacceptable safety device. An entirely different type of warning system is essential. Small leaks must be signalled and found immediately, if irreversible damage is to be avaided during the life of this pipeline. A triggering value of 500 gallons is not unreasonable, considering that the larger spills into the subsurface never will be cleaned up. An improved warning system should be stipulated in any commitment to the Northern Tier project.

PUMPING STATIONS

Several pumping stations are planned [redacted], each station requiring several acres, access roads, and power. This and other power demands of the project will swamp the facilities of the Olympic area Counties. Presumably diesel engines will be necessary to power the pumping stations, therefore; they will add a string of emission sources upwind of the whole human community in Jefferson County.

HAZARDS TO WATER SUPPLY

The pipeline will be within or uphill from the belt of groundwater use in the eastern Olympics.Wells are used by many communities and by nearly all of the individual homesites in this area, and some irrigation is practised. All are vulnerable to the travel of light hydrocarbon fractions into groundwater. A project that carries a potential threat to the groundwater resources of this area must be considered with great care.

VULNERABLE WILDLIFE

The local Audubon Society is particularly concerned with the threat of direct damage to wildlife, by oil and toxic discharges into river water, and by oil in seawater. Especially the assemblages of shellfish, other shallow-water life, and birdlife on and near the beaches are an essential and treasured asset of the Olympic area.

After a cleanup (the professionals talk of 'handling' an oil spill), later observers generally mention 'partial recovery'; still later observers describe 'recovery over several decades'. Only a few like Jacques Cousteau have the temerity to suggest that the point of no recovery may be within sight in parts of the oceans and their shores.

For birds and other wildlife, that possibility means that a species is eligible for the Endangered Species list. If, for example, Protection Island were enveloped by spilled oil, the colony of Rhinoceras Auklets there would be wiped out, and that bird would then become an endangered species.

Like the Jefferson County shoreline, especially west of Fort Worden, Protection Island will be in the path of any large spill to the west in the Strait. The Island has the major breeding colony of the Rhinoceras Auklet in the entire northeast Pacific area. It is the last nesting site of the Tufted Puffin in the Puget Sound area. It has the largest breeding colony of the Glaucous Winged Gull in Washington. It is a major breeding area for Pelagic Cormorants, Pigeon Guillemots, and Black Oyster Catchers. It is also an important pupping and loafing area for harbor seals. All these animals will suffer or die in oiled waters.

State Parks, of which there are many in the County, are also wildlife sanctuaries. Those on the shore and on major streams are vulnerable to water degradation.

While the Admiralty Audubon Society hopes to establish an Oiled Bird Rescue capability, many of the birds and other animals treated for oil exposure are either killed or weakened by the experience. Prevention, therefore, is the prime objective.

The Admiralty Audubon Society urges that both the need and the probable effects of this major project be thoroughly considered.

December 22, 1978

Admiralty Audubon Society
Box 666
Port Townsend, WA 98368

by

Northern Tier

CONCERNS ADRESSING THE NORTHERN TIER PROPOSAL

December 22, 1978

These concerns are to be taken with those of Marian Meacham. All to be submitted for Protect Peninsula's Future to Jefferson County in response to the Northern Tier Pipeline and Oilport System Proposal.

This concern does not deal directly with the pipeline and its effects on Jeff. Co. but rather with the actual siting of a major oilport facility in Port Angeles Harbor. Probable implications of chronic oil pollution on the shores of Jefferson County must be considered. Surface and subsurface current and drift studies carried out by MESA (Marine Ecosystems Analysis, Puget Sound Project, NOAA Technical Memorandum ERL MESA-31 Surface Drifter Movements Observed in Port Angeles Harbor and Vicinity, April 1978) show that a significant percentage of materials reacting to the prominent drift patterns from Port Angeles harbor end up on the shores of Jefferson County. According to these studies, a majority of the material ends up on Cape George, with smaller amounts affecting other shorelines in Discovery Bay, along Quimper Peninsula and Protection Island.

Other studies of oil tanker spills (Preliminary Report on the Grounding of the Amoco Cadiz, NOAA and the U.S. EPA, Environmental Research Lab. April 1978, and The Metula Oil Spill, NOAA Special Report, Environmental Research Laboratories, Boulder Colo. 1976) indicate that large expanses of shoreline are typically impacted; up to 178 miles, by a major spill. Jefferson Co. is well within this range from the proposed oil port at Port Angeles. Based upon the published data Jeff. Co. must consider the potential of shoreline oil pollution caused by a marine oil spill anywhere within 200 miles of its shores. Centered at Port Angeles and along the shipping lanes, this area includes Pacific coast waterfront as well as major portions of those areas facing the inland waterways of the Straits of Juan de Fuca, Discovery Bay, Admiralty Inlet, and along Quimper Peninsula, Protection Island, Marrowstone and Indian Islands and all associated tidal flats and estuarine systems.

Probable effects may be; destruction and/or decertification of shellfish beds, disruption of bird sanctuary and nesting habitats, reductions in the year-class numbers of commercially important fish spawn, despoilation of recreation and park facilities affecting tourist acceptability, reduction in general fishing activity, fouling of fishing gear and resultant economic losses. Other effects on commercial and non-commercial activities and contributing shorelines have been documented and can be added to this list.

Secondary and tertiary problems will also arise. Disposal of cleaned up oil spill waste has been a major problem. Disposal in traditional land-fill sites can lead to severe ground water contamination. Incineration of the collected wastes leads to direct and severe air quality degradation. Any major or chronic spillage of oil into the waters connecting with the Straits of Juan de Fuca will eventually, if not immediately lead to water quality degradation in a double A class waterway including those parts touching Jefferson County.

Probability of oil spill occurrence as listed by the Northern Tier proposal is misleading in that it neglects to point out that probability of spill occurrence is just as high in the first year as it is in all subsequent years. Merely siting a major oil offloading facility in Port Angeles virtually assures that some percentage of the anticipated chronic and catastrophic oil spillage will reach the shores and waterways of Jefferson Co. Figures in the Northern Tier proposal base anticipated spill amounts on an operating capacity of .933 million barrels per day when the actual ultimate design capacity of the line is 1.2 and possibly 1.6 million barrels per day. All spillage estimated must be increased to reflect this additional 30 to 50% increase.

Mitigating measures may be able to alleviate possible financial losses to County residents and others involved. Financial losses must be judged upon possible long-term damage to fisheries, private and public properties. Time for recovery to some of the estuarine systems affected in the Metula spill (Petroleum Transfer Systems on Puget Sound, Sept. 14-15, 1977, U.W. College of Engineering, pg 163, An Ecological Survey of the Eastern Strait of Magellan, Two and a Half Years After the Metula Oil Spill, by John C. Emerick, ecologist NOAA) has been estimated on the order of "decades".

It would be necessary for the Washington State Legislature to pass a strict liability statute for oil spills so that fishermen and other persons who had encountered losses as a result of oil spills could recover fully. This legislation should cover not only traditional damages such as lost fish and oiled nets and lost boats but also loss of subsistence resources, the loss of a means of producing income and costs of all subsequant clean-up and disposal.

Other guarantees must include that tank vessels using the proposed facility be only the best in the industry. There must be a system whereby the oil tanker operator has to demonstrate that he does have a certain preestablished amount of financial responsibility to provide compensation for damages to third parties. Fifty million dollars (1978 dollars, adjusted for inflation) would not be to much.

It is important that the Washington State tug escort requirements be extended and strictly enforced to include all tank vessel approaches to Port Angeles from the entrance of the Straits of Juan de Fuca at Cape Flattery.

Another State requirement must be for development of an oil spill contingency plan for terminals, pipelines, and carriers.

It is necessary to promulgate by regulation a value, ahead of time, on the resources in a particular area and the potential damage that an outflow of oil might cause to those resources. For example, Alaska has developed this kind of regulation and has set assessment rates for damages upon amounts spilled and in what environments. The most sensitive categorie is an anadromous fish stream and other freshwater environments with significant aquatic resources and is assessed at the rate of $10.00 per gallon spilled. Intertidal, confined-saltwater-environment values are $2.50 per gallon and $1.00 per gallon for oil which enters an unconfined saltwater environment, public land, or fresh water environment without significant aquatic resources.

Mitigating measures for losses of other than financial nature will be harder to arrive at. There can be little reimbursement for losses to endemic bird and marine species due to physical oiling or destruction of habitat or food supply. Many of these are endangered species anyway and could hardly tolerate any reductions in habitat. The only mitigating measure would seem to be complete protection. The reality of locating oil transhipment facilities in this area precludes that possibility. By Northern Tier's own admission, chronic oil pollution amounting to thousands of barrels annually will result from the proposed facility.

Levi Ross

Trustee, Protect Peninsula's Future
Jefferson County, Washington

QUESTIONS:

1. If Olympic Peninsula residents can expect a pipeline associated spill every two years (Northern Tier's figures) what will be the cumulative effects of these predicted spills?
2. What are the comparative dollar values of the short term (15-20 years) economic "advantages" offered by the pipeline and its attendant development and the highly probable loss of Hood Canal as a fisheries and shell fish resource? These figures should reflect the fact that fisheries and shell fish can be managed indefinitely on a sustained yield basis.
3. What is Northern Tier's liability re: replacing water supplies ruined by a spill onto a major aquifer recharge area?
4. We feel Northern Tier's drift studies are inadequate and should be revised to include both extremes of winter and summer conditions; studies should be specifically conducted at the mouth of Ediz Hook, in the center of the shipping lanes and at the mouth of the straits.
5. What are the up and down stream effects of a spill into a drainage such as the Dosewallips or Duckabush?
6. Will pipeline construction and maintenance increase the use of herbicides in Jefferson County? If so, what are the environmental consequences of such a program?

7. What is Northern Tier's liability to construction related damage to properties bordering the corridor?

8. What is schedule of visual patrol of corridor? How much (maximum) oil can be spilled in a rupture not accessible to computer sensor before it is "spotted"? (126 gal/min for how many days?)

9. How many block valves are planned for the pipeline in Jefferson County? Will there be two at every major drainage crossing?

10. How will construction accomodate the life cycles of local fauna? (breeding, nesting, egg laying) Especially important is the accomodation of salmon cycles of egg laying and fry return to the Sound.

11. How will the pipeline affect forest practices of lands abutting pipeline route? Could the pipeline be ruptured by a major soil slide caused by improper roading or logging? (similar to Boulder Creek washout in Hamma Hamma!) In this regard will logging operations have to be modified as they near the pipeline?

12. What are the cumulative effects of logging and pipeline construction in the same drainage? In other words, though neither alone would be fatal to river and estuary eco-systems, cumulatively their effects may prove lethal. Correlate both activities and their effects.

13. How would a pipeline rupture affect the soil fertility of surrounding forests?

14. Have forest managers been questioned as to possible effects of pipeline construction on their activities?

15. How much will pipeline construction increase Jefferson County's road, fire and police costs?

16. If there is a spill in waters of or on those draining into Hood Canal, how long will the effects ripple through the surrounding eco-systems?

17. How can pipeline segments buried in rivers withstand heavy scouring in high runoff years?

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14103 7533