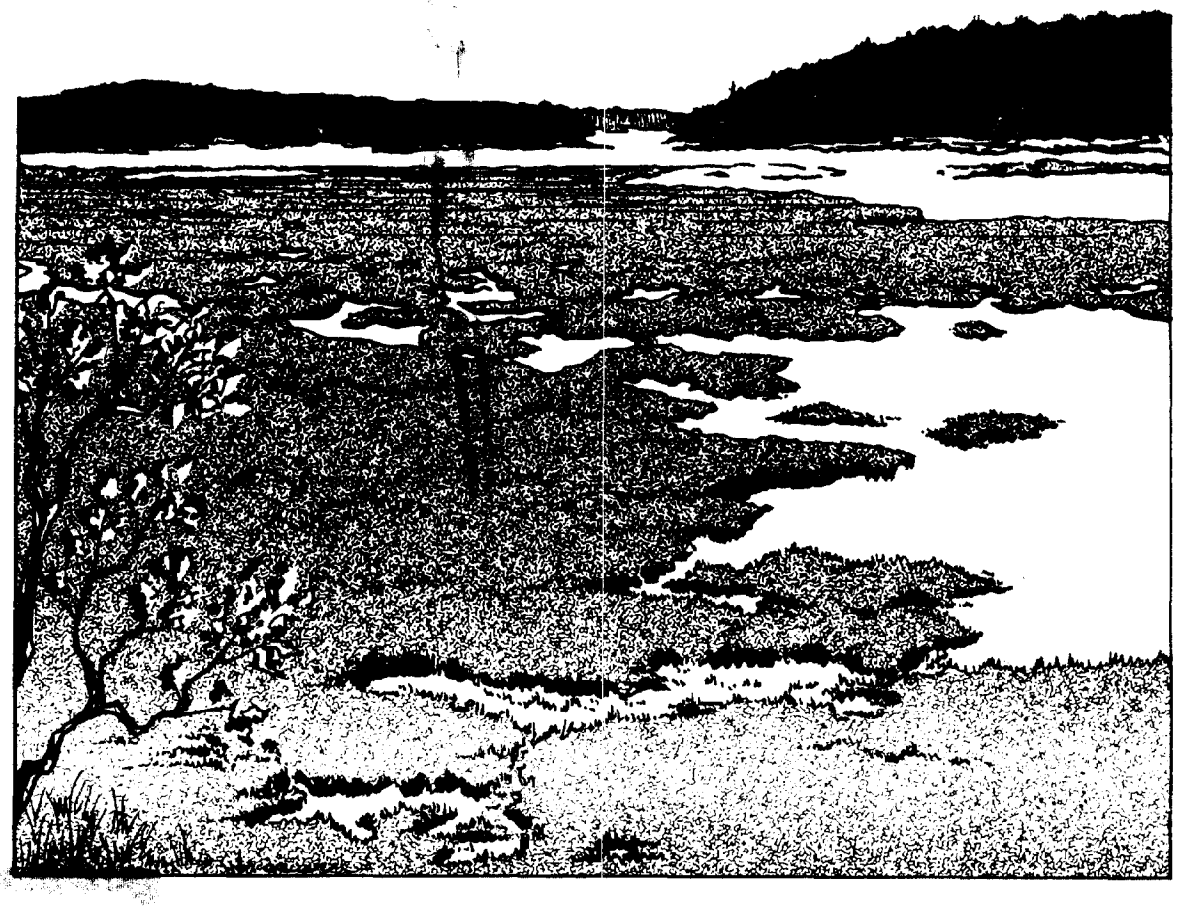
Puget Trough Coastal Wetlands

A SUMMARY REPORT OF BIOLOGICALLY SIGNIFICANT SITES



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DEPARTMENT OF NATURAL RESOURCES
Olympia, WA

for

WASHINGTON DEPARTMENT OF ECOLOGY
Olympia, WA

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To The Reader:

Puget Trough Coastal Wetlands, A Summary of Biologically Significant Sites was prepared for the Department of Ecology by the Department of Natural Resources' Natural Heritage Program with federal Coastal Zone Management funds.

The report provides information on "remnant" natural wetlands along Washington's inland marine waters. Nineteen wetland sites are identified and described. The report is intended for general use by those involved in wetlands and shoreline management including local, state and federal resource agencies, as well as shoreline users, development interests, conservation and citizen groups.

The Heritage Program, responsible for inventorying natural areas and implementing the Natural Area Preserve Act (chapter 79.70 RCW), was selected to conduct the project because of experience and staff expertise.

Heritage Program staff surveyed more than 2,000 miles of coastline in the Puget Trough to identify relatively undisturbed coastal wetland sites. Site selection was based on diversity of biological and physical features within the sites, rarity of the features, relative absence of introduced plant species, and quality of the site in terms of lack of human disturbance, water quality, size, and buffering from development.

Sites were found in both private and public ownership. The report makes no recommendations for their acquisition or management. Further, it should be kept in mind that recommended sites were evaluated primarily for their botanical condition. The value of these and other sites for geological, recreational, wildlife, archaeological, or other purposes were not evaluated as part of this project.

Significantly, the report found that no pristine coastal wetland system remains in the Puget Trough. It further concludes, however, that the Puget Sound region, unlike many regions in the world, is fortunate to still have wetlands resembling native systems. It is hoped that the information provided here will give these remnant sites the recognition and management attention they need.

ABSTRACT

This study was conducted to identify coastal wetlands throughout the Puget Trough region that might be appropriate candidates for inclusion within a statewide system of estuarine sanctuaries. The study was conducted employing a botanical and ecological perspective, supplemented with secondary source data on wildlife and land use history. The sites were evaluated in terms of the quality, representation and the diversity of physical and biotic features present. Nineteen sites were recommended as being appropriate for possible inclusion within an estuarine sanctuary system. Individual reports are provided for each site.

ACKNOWLEDGMENTS

A great many people contributed to this study.

I would like to thank the numerous private and public landowners who granted access to their property and especially those who spent time sharing related information.

I am indebted to the researchers who shared their data and experiences. I would particularly like to thank Dr. Robert Frenkel who freely gave of his time and expertise on coastal wetlands. Ron Hirschi, Ron Vanbianci and William Nelson shared biological and ecological information collected during their field work for the production of the Coastal Zone Atlas and individual research projects. Dr. Kern Ewing generously shared his data for the Skagit Bay intertidal marsh. Lynn Cornelius provided information from his research project at Foulweather Bluff Preserve.

A number of federal and state agencies provided assistance in the course of the study. I would like to thank the U.S. Army Corps of Engineers, Northwest Regional Office, photogrammetry section for access to their aerial photographic coverage of the Puget Trough region. I appreciated information provided by the National Park Service and U.S. Fish and Wildlife Service for sites within their jurisdiction. Personnel of the Washington Parks and Recreation Commission supplied information on areas and transportation to field survey sites. The staff of the Photos, Maps and Reports section, of the Washington Department of Natural Resources, provided invaluable service throughout the project.

I would also like to thank all those who assisted in the preparation of this report: Cathy Rucker for the design of the cover; Nancy Sprague for her gracious assistance in compiling data and in producing the site location maps; Reid Schuller and Elise Augenstein for their editing and comments; Mark Sheehan for his advisory and editorial role; and particularly, Charlotte Nelson for her excellent humor, skill and diligence in typing this report.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Until recently, intertidal wetlands were considered wastelands. This attitude, plus their typical location in bays and at river mouths, made these wetlands prime areas for conversion to more "useable" land. The areas often became sites for port, industrial, agricultural and urban development.

Today there is a growing public appreciation for the natural values of intertidal wetlands. They are unique and complex systems supporting a high diversity of plant and animal species. Intertidal salt marshes rank among the most productive ecological systems in the world.

An Estuarine Sanctuary System Project was developed by the Washington State Department of Ecology as a companion to the National Estuarine Sanctuary Program. The project was designed to assess the need and potential for development of a statewide system of estuarine sanctuaries. As part of this project, the Washington Department of Natural Resources, Natural Heritage Program was contracted to identify Puget Trough intertidal wetlands which, based upon biological and ecological criteria, would be appropriate candidates for inclusion within an estuarine sanctuary system.

STUDY AREA

The study area includes the shoreline of the Puget Trough physiographic region, including the Strait of Juan de Fuca, the Strait of Georgia, Puget Sound, Hood Canal and the San Juan Archipelago (Fig. 1).

USE OF ESTUARIES

PAST USE

Settlers first arrived in the Puget Trough region about 150 years ago. Bays and river mouths, the primary locations of coastal wetlands, were the centers of their settlement. Agriculture was one of the first uses of the coastal wetlands. The marshlands were used as pasture or were diked and ditched to produce arable lands. In many areas, such as the Snohomish estuary, the conversion was nearly total. Between 1880 and 1940, 9,000 of its pre-settlment 10,000 acres had been diked (Boulé, Olmsted and Miller, 1983). Diking of the Skagit River delta left only a narrow outer band of tidal marsh of what was once an extensive marsh and surge plain system.

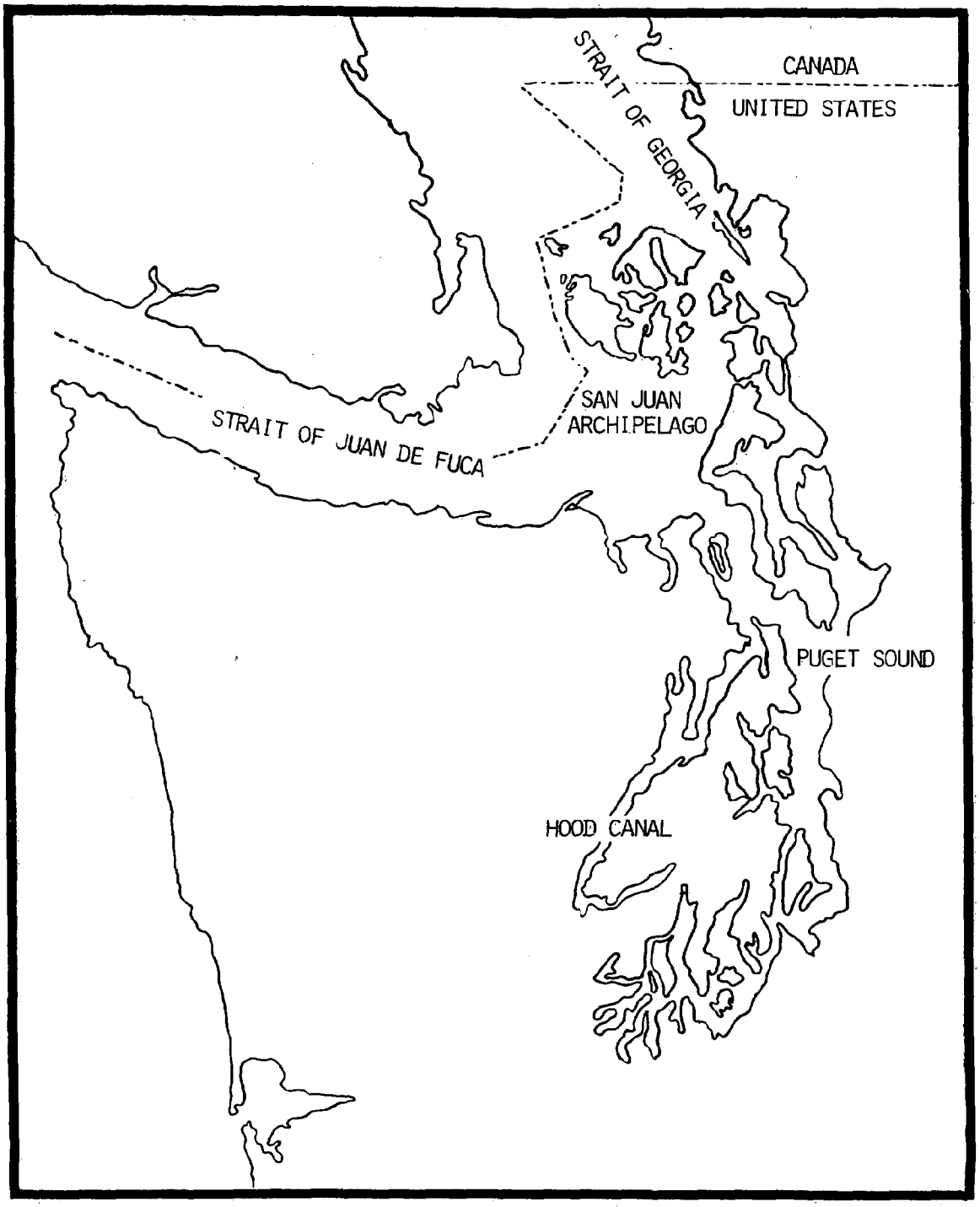

Figure 1. STUDY AREA

The readily available timber along the shorelines was among the first forestland to be cut. Trees were felled or dragged onto tidelands and rafted and stored there for later transport. Some areas were filled to create log storage yards and to allow the placement of mill facilities. Adjacent tidal areas became the repositories of mill wastes.

River mouths and bays became centers of port, industrial and urban growth. River and slough channels were dredged and diked to accommodate boat traffic and spoils were deposited as fill on adjacent tideflats. Port and moorage facilities were developed. Piers were built out to channels that could accommodate deep draft vessels. Intertidal wetlands and adjacent uplands were developed for industrial, business, transportation and housing. Coastal wetlands frequently became the repository of urban and industrial wastes and runoff. In Commencement Bay, of the approximately 1,700 acres of nonvegetated tideflats which occurred in 1880, 1,500 acres were dredged or filled by 1920 and 1,600 acres by 1980 (Boulé, et al. 1983). Virtually all of the 1,900 acres of tidal marsh which occurred in 1880 were filled by 1940.

Along with these physical alterations, the intentional and accidental introduction of exotic plant and animal species occurred with the development of the Puget Trough area.

CURRENT USE

A growing public awareness of the importance of native coastal wetland systems has led to recent federal, state and local policies to help protect these natural resources. However, historical uses of wetlands continue, though the rate of habitat conversion through ditching, diking and filling have slowed. Recently, there have been some additional or substantially increased uses.

Agricultural, industrial and urban point and nonpoint source pollution of marine and estuarine systems is becoming a serious problem in the Puget Trough region (Puget Sound Water Quality Conference, 1983). New organic and inorganic chemicals are being introduced to the system, while the volume of more conventional wastes has greatly increased.

Recreational and residential development is occurring at an accelerated rate along the shoreline. Wetlands and buffers are being altered or destroyed through development of recreational facilities, residences and intensive and widespread public use.

The net result of past and current land and water uses has been the virtual elimination of pristine coastal wetlands in the Puget Trough region.

METHODOLOGY

INITIAL SITE SELECTION

A number of criteria were employed in the initial selection of potential field survey sites. Most of these criteria focused on human-related disturbance. These criteria were:

1. The degree of human-related physical disruption of a wetland. This included alteration or destruction of the intertidal area through diking, ditching, filling, draining, cultivating, grazing or other development;

2. The presence and quality of an upland buffer. Assessment of quality was based on the degree of development, width of the buffer, vegetation and age of forested stands;

3. Dominance of the site by any of the three introduced species of Spartina resulted in the elimination of the site from further consideration;

4. An arbitrary minimum size limit for potential sites was set at 10 acres; and

5. Severe water quality problems resulted in the elimination of the site from consideration.

Using these criteria, a limited number of all the coastal wetlands in the Puget Trough region were identified for potential field survey. This initial evaluation was accomplished through a review of the Washington Coastal Zone Atlas (Youngmann, 1978) and a survey of the U.S. Army Corps of Engineers large scale, 1982 aerial photographic coverage for the Puget Trough coastline.

A review of related scientific literature, the Washington Natural Heritage data base, and interviews with researchers further helped to eliminate sites which were highly disturbed and helped to identify sites of relatively high ecological and biological value which had not been previously considered for field survey.

FIELD SURVEYS

Field surveys were conducted between April and September, 1983. Upon visiting a site, an initial determination was made to include or eliminate the site from further consideration based on the cover and frequency values of non-native plant species as well as the criteria for initial site selection outlined above.

For all survey sites, data were collected on human-related disturbance, physical and biotic features, hydrology, salinity, topography, soil texture and quality of the adjacent upland. Physical and biotic features include geologic features (e.g., berms, spits, coastal embayments and lagoon ponds), rare plant and animal species in Washington State (W.D.N.R., 1983) and intertidal marsh types.

Marsh types are subdivided into their component natural communities. The natural communities described are part of a classification system developed by the Washington Natural Heritage Program. Plant species nomenclature follows Hitchcock and Cronquist (1973). Salinity measures were taken using a method developed by Mitchell (1981). An American Optical, hand field refractometer was used. Samples for interstitial soil salinity measurements were taken at a depth of 3cm.

Aerial photographs on a scale of 1:12,000 were used as field maps with the exception of a few which were on a scale of 1:24,000. A map illustrating the site features was produced on a mylar overlay on the aerial photograph(s) for each site. All data are on file at the Washington Natural Heritage Program, Olympia.

EVALUATION CRITERIA FOR SITE RECOMMENDATIONS

In addition to criteria used in initial selection of survey sites, potential recommendations were further evaluated using the following ecological and biological criteria:

1. introduced species had to occur relatively infrequently and with low cover values for the natural communities, features and site as a whole to be considered for recommendation;

2. sites were generally chosen which contained a diversity of physical and biological features;

3. rarity of features occurring at the site affected the sites relative importance;

4. quality of features, e.g., the size, degree of development and diversity of the features occurring at the site, was key in determining the overall site importance.

SITE RECOMMENDATIONS

Nineteen sites are recommended which represent different kinds of coastal wetland systems and include a variety of features (Fig. 2). The kinds of systems and range of variability are defined below. Sites recommended within each kind of system are described in detail in Appendix I. Sites surveyed but not recommended are listed in Appendix II.

SYSTEMS REPRESENTED IN RECOMMENDED SITES

1. Coastal Lagoon

   A coastal lagoon is a body of water or tidelands with limited access to the open ocean or estuarine waters. Tidal influence may be continuous or limited to extreme high tides. Ocean derived salts exceed 0.5 ppt and may reach hyperhaline levels due to evaporation. Salinities show wide seasonal and even daily fluctuations. Horizontal stratification of salinities is typical. Berms, spits, salt marshes and brackish marshes associated with a lagoon are considered part of the system.

2. Coastal Embayment

   A coastal embayment is a body of water or tidelands partially enclosed by land but with an unimpaired connection with open marine or estuarine waters. Ocean derived salts exceed 0.5 ppt and may reach euhaline levels.

3. Tidal River

   Tidal river sites are estuarine systems occurring along the tidal reaches and mouths of streams and rivers. These areas typically have considerable freshwater influence. Ocean derived salts measure 0.5 ppt or greater, at least periodically. There may be vertical, as well as horizontal, stratification of ocean derived salts. Typically, only portions of these system are still in relatively pristine condition.

4. Bay Shore

   Bay shore sites are wetlands with limited channeled freshwater influence and with no restrictions to marine influence. These are typically euhaline systems, but may reach hyperhaline conditions through evaporation.

5. Coastal Spit

   Coastal spits are ridges or embankments of sediment which may or may not be attached to the land at one or both ends.

RECOMMENDED SITES

American Camp Lagoons (coastal lagoon)
Dungeness Spit (coastal spit, coastal lagoon and coastal embayment)
Foulweather Bluff Preserve (coastal lagoon)
Foulweather Salt Marsh (coastal lagoon)
Gull Harbor (coastal embayment)

Hamma Hamma River Delta (tidal river)
Henry Island (bay shore)
Lake Hancock (coastal lagoon)
Lynch Cove (bay shore and tidal river)
Nisqually River Delta (tidal river)
Perego's Lagoon (coastal lagoon)
Salt Creek (tidal river)
Skagit River Delta (coastal bay and tidal river)
Skookum Inlet (bay shore and tidal river)
Stavis Bay (coastal lagoon)
Tarboo Bay (coastal spit, bay shore)
Thorndyke Bay (coastal lagoon)
Westcott Bay (coastal lagoon)

SUMMARY

No pristine coastal wetland systems still exist in the Puget Trough region. However, we are fortunate in having coastal wetlands that still resemble the native systems, which is not the case in many parts of the world. Those remnants which are located in Washington's coastal wetlands continue to be threatened by human-related alteration and destruction and by the spread of introduced species. Through a coastwide system of sanctuaries, we have the opportunity to protect these fragile, diminished systems and to provide research and educational opportunities. This in turn may lead to a greater understanding of their importance and a fuller appreciation of their value.

RECOMMENDED SITES IN THE PUGET TROUGH REGION

1. American Camp Lagoons
2. Dungeness Spit
3. Foulweather Bluff Preserve
4. Foulweather Salt Marsh
5. Gull Harbor
6. Hamma Hamma River Delta
7. Henry Island
8. Kennedy Creek
9. Lake Hancock
10. Lynch Cove
11. Nisqually River Delta
12. Perego's Lagoon
13. Salt Creek
14. Skagit River Delta
15. Skookum Inlet
16. Stavis Bay
17. Tarboo Bay
18. Thorndyke Bay
19. Westcott Bay

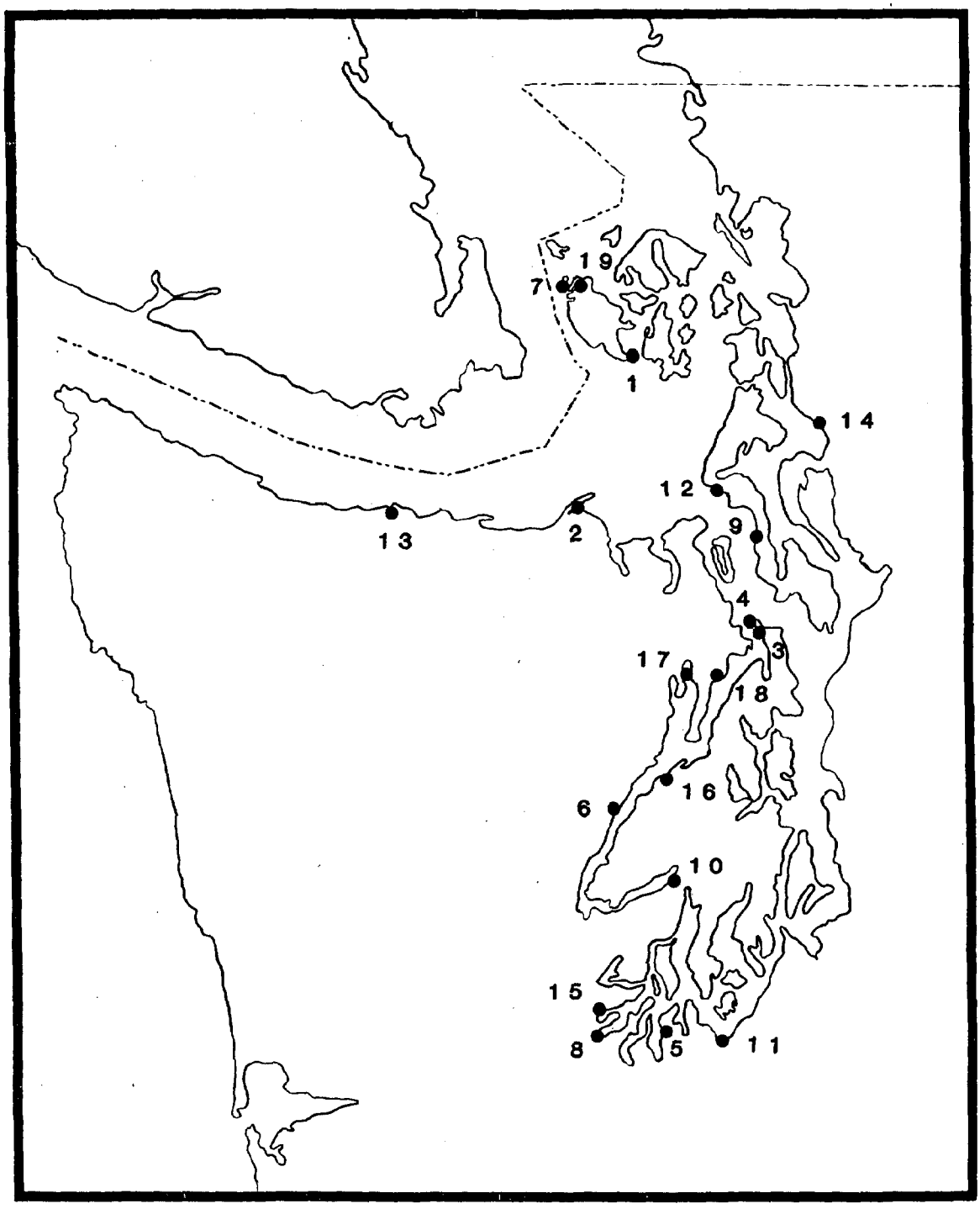

Figure 2. RECOMMENDED SITES IN THE PUGET TROUGH REGION

APPENDIX I

REPORTS ON RECOMMENDED SITES

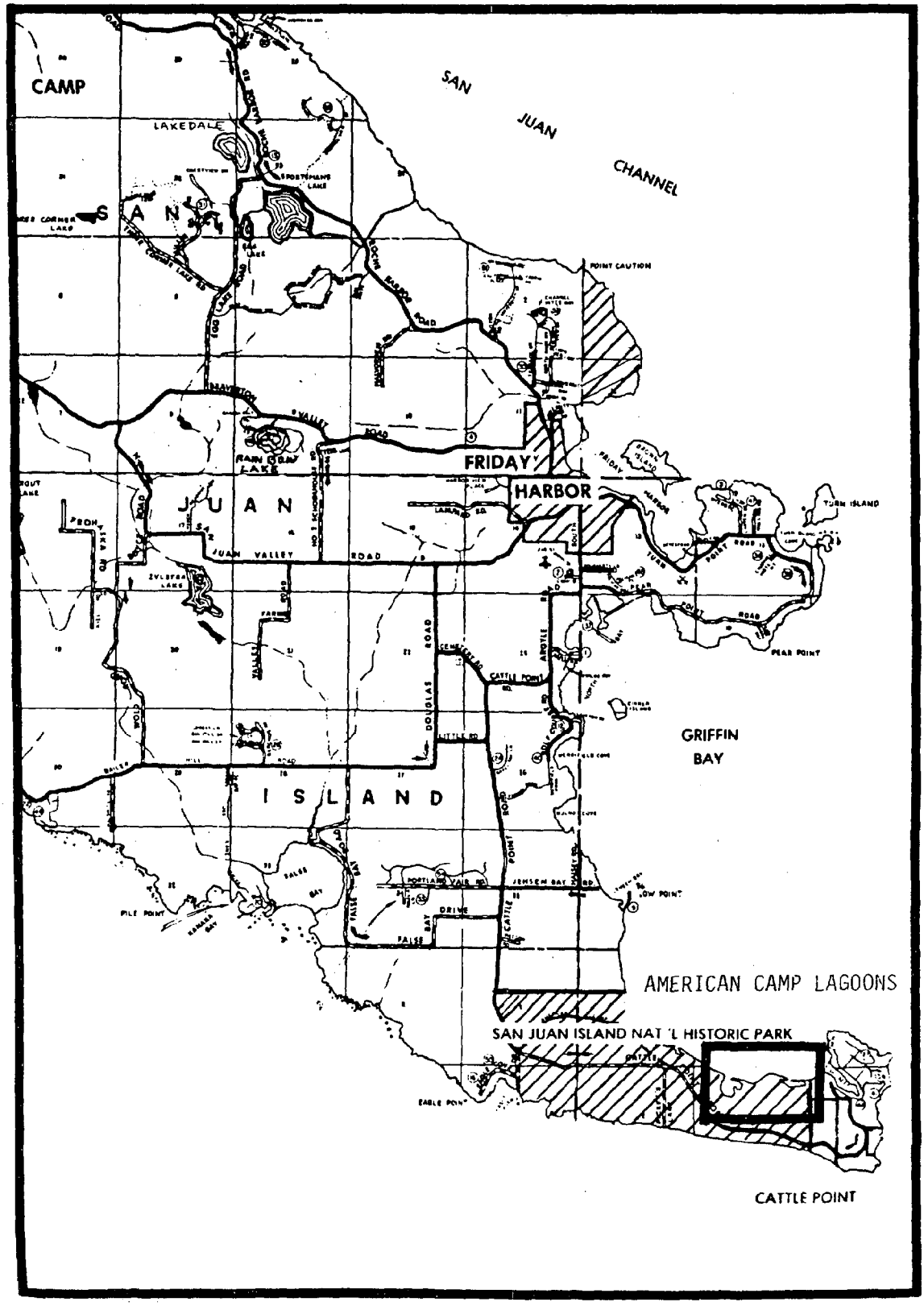

Figure 3. AMERICAN CAMP LAGOONS LOCATIONAL MAP

AMERICAN CAMP LAGOONS

LOCATION:

San Juan County; T34N, R2W, portions of sections 7 and 8. The area consists of the middle (Jakle's) and easternmost ("Third") lagoons in a series of three coastal lagoons located at the south end of Griffin Bay, San Juan Island (Fig. 3).

SIGNIFICANCE:

Jakle's and "Third" Lagoons are high quality coastal lagoons with intact uplands.

GENERAL DESCRIPTION:

Jakle's Lagoon

Figure 4 illustrates the distribution of features at Jakle's Lagoon. The features are:

1. a permanent lagoon pond;
2. a sandy, euhaline, low intertidal salt marsh; and
3. an associated bald eagle nest.

Jakle's Lagoon is approximately 12.4 acres. A berm, composed of sand, gravel and cobbles, restricts flow of marine waters between the lagoon and Griffin Bay. At present, a channel exists through the west end of the berm, allowing the flow of marine waters into the lagoon at high tides. Berm configuration, and the existence of an old delta midway along its length, suggests the past existence of a second or alternative channel.

Salinities were euhaline at time of survey. The lagoon is subject to freshwater surface run-off. Substrates found throughout the lagoon are sandy-gravels with some cobbles. A large, dynamic accumulation of driftwood exists along the berm and eastern side of the lagoon pond.

The lagoon occurs at the base of a steep drainage basin. Upland soils are Vashon recessional sands and gravels. The upland slopes are covered by second growth forest dominated by Pseudotsuga menziesii (Douglas fir).

Third Lagoon

Figure 4 illustrates the distribution of features at "Third" Lagoon. The features are:

1. a lagoon pond;
2. a low vegetated berm; and
3. a sandy, euhaline, intertidal salt marsh.

"Third" Lagoon is approximately 7.3 acres. A channel, located midway along the berm, connects the lagoon pond with Griffin Bay. The lagoon pond is centrally located, with salt marsh development at the west and east ends. Salinities in the lagoon are euhaline. Freshwater influence appears to be restricted to surface run-off. Substrates within the lagoon are primarily sandy-gravels with some cobbles. There is considerable driftwood accumulation, particularly along the berm and at the west side of the lagoon.

"Third" Lagoon occurs at the base of a drainage basin, which is steep to the west and gradual to the east. Upland soils are Vashon recessional sands and gravels. The upland is covered by second growth forest dominated by Douglas fir. An ecotonal region containing both salt marsh and upland species occurs along the margins of the lagoon. Picea sitchensis (Sitka spruce) dominates this zone, with Festuca rubra (red fescue) and Juncus balticus (Baltic rush) as dominant understory plant species.

FEATURES:

Jakle's Lagoon

I. Lagoon Pond

The lagoon pond is a permanent pond of about 6.5 acres. Salinity ranges from 25 to 35 ppt (Landry, 1978). The pond is a study site for researchers from Friday Harbor Laboratories, University of Washington. It is also a feeding and resting area for shorebirds and waterfowl.

II. Sandy, Euhaline, Low Intertidal Salt Marsh

Interstitial soil salinities in the salt marsh at Jakle's Lagoon measured 30 ppt. Jakle's Lagoon is sparsely vegetated. Salt marsh vegetation is dominated by Salicornia virginica along the lagoon pond margins, grading to an area dominated by Distichlis spicata at slightly higher elevations. The greatest area of salt marsh development is on a rise towards the center of the lagoon, where S. virginica and D. spicata codominate.

Distichlis spicata-Salicornia virginica community (mapping symbol 1)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Hordeum jubatum (foxtail barley)
Polypogon monospeliensis (rabbitfoot polypogon)
Puccinellia sp. (alkaligrass)
Spergularia cf canadensis (winged sandspurry

III. Bald Eagles

Federal Status: Threatened in Washington State

State Status: Threatened

A nesting site is located near Jakle's Lagoon. Young were successfully fledged through 1977, beyond which time the nest was abandoned. However, in 1983, a pair of eagles reoccupied the nest and successfully fledged young (Nongame Data Systems).

Third Lagoon

I. Lagoon Pond

The lagoon pond is a shallow, approximately 1 acre, permanent pond.

II. Berm

The berm is in relatively good condition with no apparent human alteration and few weedy plant species. It is sparsely vegetated by a combination of typically salt marsh and coastal dune species.

Berm Vegetation (mapping symbol 3)

General Vegetation

Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Atriplex patula var. hastata (saltbush)
Distichis spicata (saltgrass)
Hordeum jubatum (foxtail barley)
Polypogon monospeliensis (rabbitfoot polypogon)
Salicornia virginica (pickleweed)

III. Sandy, Euhaline, Low Intertidal Salt Marsh

Euhaline salt marsh occurs at the west and east ends of the lagoon. The marsh at the west end has developed over sandy-gravels and is codominated by Distichlis spicata and Salicornia virginica. The east end of the lagoon has greater soil development and is highly dissected by tidal channels. It is dominated by Salicornia virginica.

Distichlis spicata-Salicornia virginica community (mapping symbol 1)

Dominant Species

Salicornia virginica (pickleweed)
Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Potentilla pacifica (Pacific silverweed)
Puccinellia sp. (alkaligrass) (locally subdominant)
Spergularia cf canadensis (winged sandspurry)
Triglochin maritimum (seaside arrowgrass)

Salicornia virginica community (mapping symbol 2)

Dominant Species

Salicornia virginica (pickleweed)

Minor Species

Puccinellia sp. (alkaligrass)
Spergularia cf canadensis (winged sandspurry)

LAND USE HISTORY:

The uplands adjacent to both Jakle's and "Third" Lagoons have been logged at least once. Old logging roads and skid trails lead down to the east end of Jakle's Lagoon. Remnant logging cable, topographic irregularities and frequency of weedy plant species on the east end of the berm also indicate past logging activities.

Jakle's Lagoon was named for the family which homesteaded the immediate area. No remnant of that homestead exists.

In 1860, during the border dispute between the United States and Great Britain, American forces established a camp in the general vicinity. It is not clear what impact the establishment of the American Camp had on the lagoons.

In 1966, American Camp National Historic Park was designated to commemorate that dispute. With management by the National Park Service, much of the previous land use ended. A well was dug at the east side of Jakle's Lagoon to provide water for a proposed campground, but was capped when it was decided not to develop the campground. The lagoons are accessible by foot or boat for recreational day use. Prior to the establishment of the Park, a boy scout camp operated at the east end of Jakle's Lagoon.

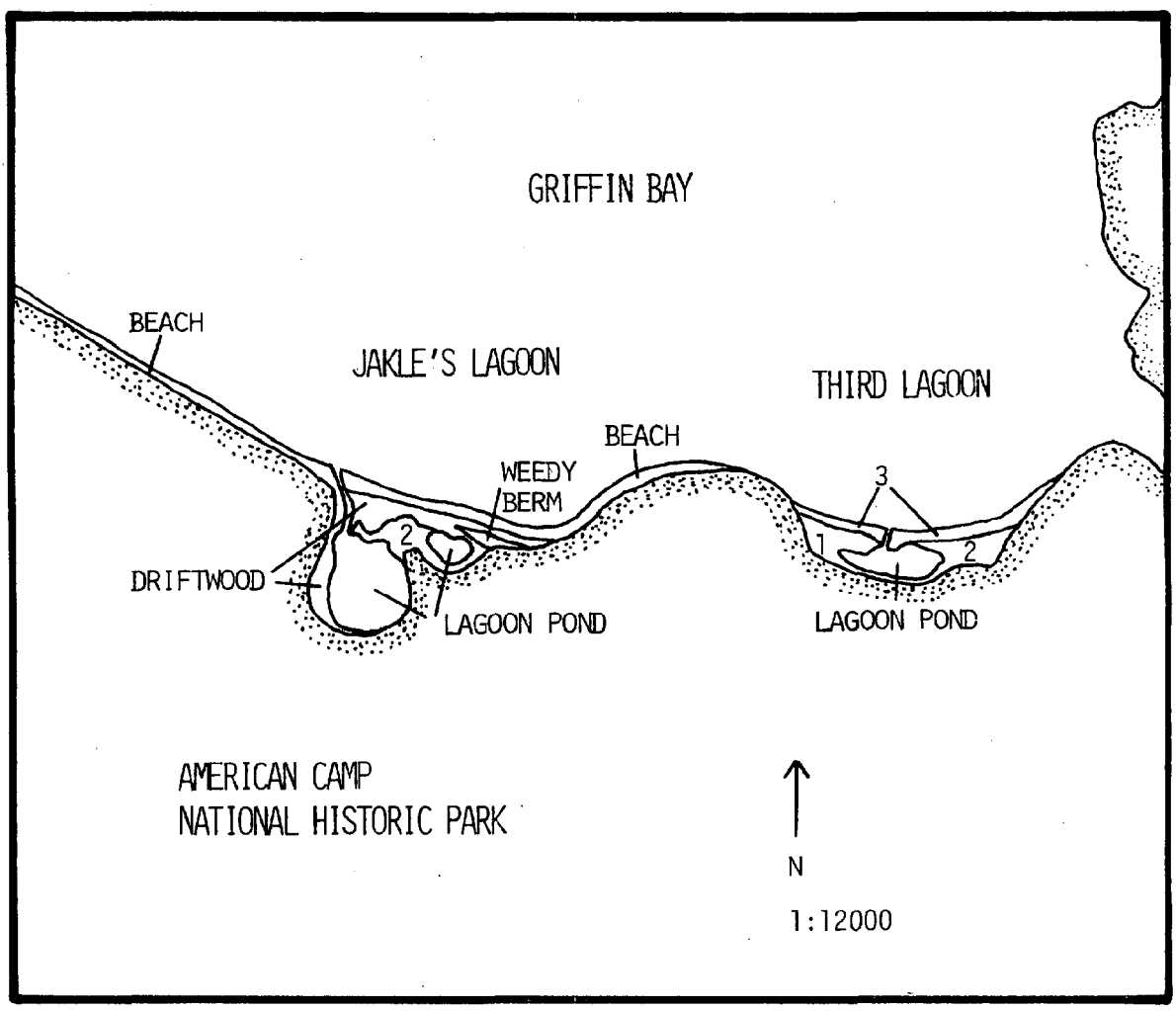

Figure 4. AMERICAN CAMP LAGOONS FEATURES MAP

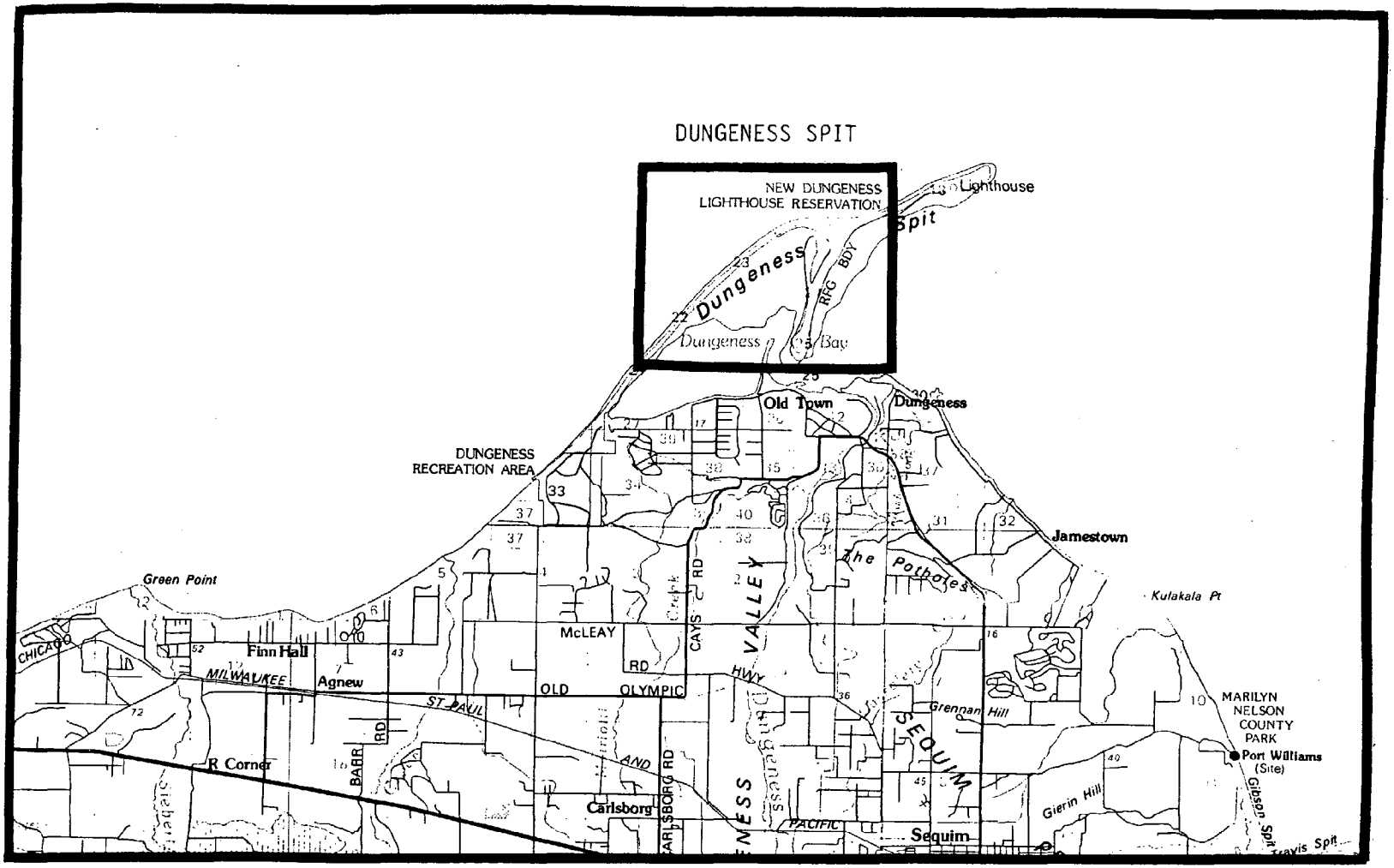

Figure 5. DUNGENESS SPIT LOCATIONAL MAP

DUNGENESS SPIT

LOCATION:

Clallam County; T31N, R3W, portions of section 18 and T31N, R4W, portions of sections 13, 14, 22, 23, 24, 25 and 26. The area of interest includes Graveyard Spit, a portion of Dungeness Bay and a portion of Dungeness Spit (Fig. 5).

SIGNIFICANCE:

Relative to other coastal spits in Washington State, Dungeness and Graveyard Spits are of high quality. The spits are vegetationally diverse and have relatively few non-native species. A high quality, sandy, high salinity, low intertidal salt marsh is well-developed at the site. Dungeness Bay is well known for its use by shorebirds, waterfowl, fish and marine mammals.

GENERAL DESCRIPTION:

Figure 6 illustrates the distribution of features at Dungeness Spit. The features of the recommended site are:

1. coastal sand spits
2. a sandy, high salinity, low intertidal marsh; and
3. a shallow bay and tide flats

Dungeness Spit is a narrow, high energy spit which extends northeasterly approximately 5.5 miles from the mainland into the Strait of Juan de Fuca. Graveyard Spit is a broad, somewhat sheltered spit which extends 1.4 miles south from Dungeness Spit towards the mainland. Dungeness Bay, a shallow marine to estuarine bay, lies between the two spits. Deep marine waters abut Dungeness Spit on the northwest side.

Substrates are primarily sands.

FEATURES:

I. Coastal Sand Spits:

Dungeness and Graveyard Spits are formed by the deposition of eroded sands and gravels. They are dynamic systems, variously eroding or accreting. Dungeness Spit has been breached by storms. This happened in 1871, 1971 and 1982. Currently, Dungeness Spit is growing at a rate of 25 to 40 feet per year (Vern Wray, pers. com.).

On the northwest side of Dungeness Spit, the sand and gravel beach grades sharply to a high ridge, on which there is considerable driftwood accumulation. This side of the spit is subject to the full force of prevailing winds and wave action. The southeast or leeward side of the spit has a more gradual grade. Substrates on the southwest side are sands and gravels with some cobbles. There is considerable driftwood accumulation, but also a line of dune vegetation. Near the top of the spit ridge is a zone of depauperate dune vegetation dominated by Elymus mollis. Midway between the dune ridge and tide flats of Dungeness Bay, occurs a line of relatively species-rich vegetation. Along the spit-tideland ecotone on the southeast side, small areas of salt marsh have developed.

Graveyard Spit is broader, has greater relief and is much more complex vegetationally than is Dungeness Spit. The spit has received extensive past human use (see land use history). It cannot be considered pristine, yet native vegetation dominates. The spit is a series of shallow dune ridges and troughs. A few vegetational patterns are apparently related to topography. Much of the outer boundary of Graveyard Spit is dominated by Elymus mollis, with Festuca rubra as a co- or subdominant. One small dune in the salt marsh is dominated by Festuca rubra. Dune troughs are sparsely vegetated (20 to 40% cover) and are dominated by Carex macrocephala. The predominant plant assemblage occurs on dune ridges. It is species rich, dominated by Artemesia campestris and Lomatium nudicaule and has 50% plant cover.

Elymus mollis community (mapping symbol 1)

Dominant Species

Elymus mollis (dune wildrye)

Subdominant Species

Ambrosia chamissonis var. bipinnatisecta (silver bursage)

Minor Species

Abronia latifolia (yellow sandverbena)
Achillea millefolium (yarrow)
Atriplex patula var. hastata (saltbush)
Cakile edentula (American searocket)
Galium aparine (catchweed bedstraw)
Grindelia integrifolia (gumweed)
Vicia gigantea (giant vetch)

Leeward Side of Dungeness Spit (mapping symbol 2)

General Vegetation

Abronia latifolia (yellow sandverbena)
Achillea millefolium (yarrow)
Aira praecox (early hairgrass) (non-native)
Carex macrocephala (large headed sedge)
Elymus mollis (dune wildrye)
Festuca rubra (red fescue)
Glehnia leiocarpa (glehnia)
Grindelia integrifolia (gumweed)
Hypericum radicata (spotted catsear) (non-native)
Lepidium virginicum var. menziesii (tall pepperweed)
Plantago maritima (seaside plantain)
Poa sp. (bluegrass sp.)
Poa macrantha (seashore bluegrass)
Polygonum paronychia (nailwort knotweed)
Vicia gigantea (giant vetch)

Elymus mollis-Festuca rubra community (mapping symbol 3)

Dominant Species

Elymus mollis (dune wildrye)
Festuca rubra (red fescue)

Minor Species

Atriplex patula var. hastata (saltbush)
Cakile edentula (American searocket)
Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed) (locally subdominant)

Festuca rubra community (mapping symbol 4)

Dominant Species

Festuca rubra (red fescue)

Minor Species

Achillea millefolium (yarrow)
Elymus mollis (dune wildrye)
Distichlis spicata (saltgrass)
Grindelia integrifolia (gumweed)

Carex macrocephala community (mapping symbol 5)

Dominant Species

Carex macrocephala (large headed sedge)

Minor Species

Abronia latifolia (yellow sandverbena)
Convolvulus soldanella (beach morning-glory)

Artemisia campestris-Lomatium nudicaule assemblage (mapping symbol 6)

Dominant Species

Artemisia campestris cf ssp. caudata (wormwood)
Lomatium nudicaule (barestem lomatium)

Minor Species

Abronia latifolia (yellow sandverbena)
Achillea millefolium (yarrow)
Aira praecox (early hairgrass) (non-native)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Armeria maritima var. californica (thrift)
Atriplex patula var. hastata (saltbush)
Bromus tectorum (cheatgrass) (non-native)
Carex macrocephala (large headed sedge)
Convolvulus soldanella (beach morning-glory)
Elymus mollis (dune wildrye)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Lepidium virginicum var. menziesii (tall pepperweed)
Linaria dalmatica (Dalmatian toadflax)
Poa sp. (bluegrass sp.)
Poa macrantha (seashore bluegrass)
Polygonum paronychia (nailwort knotweed) (locally codominant)
Rosa nutkana (Nootka rose)

II. Sandy, High Salinity, Low Intertidal Salt Marsh:

A high quality, sandy, high salinity, low intertidal salt marsh occurs at the junction of Graveyard and Dungeness Spits. Slightly over half of the marsh has developed in a lagoon, the rest occurs along the west edge of Graveyard Spit and on the leeward side of a narrow spit extending north from Graveyard Spit into Dungeness Bay. The marsh grades from areas of pure Salicornia virginica to areas with Distichlis spicata as a sub- or codominant. Driftwood has accumulated in the lagoon marsh, particularly at the northeast end.

On Graveyard Spit are located dune troughs periodically inundated by marine waters. These troughs are dominated by Plantago maritima, with Salicornia virginica co- to subdominant.

Salicornia virginica (pickleweed) monospecific community (mapping symbol 7)

Distichlis spicata-Salicornia virginica community (mapping symbol 8)

Dominant Species

Salicornia virginica (pickleweed)

Subdominant Species

Distichlis spicata (saltgrass) (locally codominant)

Minor Species

Atriplex patula var. hastata (saltbush) (locally subdominant)
Puccinellia sp. (alkaligrass)
Spergularia canadensis (winged sandspurry) (locally subdominant)

Plantago maritima-Salicornia virginica community (mapping symbol 9)

Dominant Species

Plantago maritima (seaside plantain)
Salicornia virginica (pickleweed)

Subdominant Species

Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Puccinellia sp. (alkaligrass)
Spergularia canadensis (winged sandspurry)

III. Shallow Bay

Dungeness Bay is a large marine to estuarine embayment. It is influenced by fresh water from small streams draining into the bay and from the Dungeness River, which enters the Strait of Juan de Fuca just outside the bay mouth. The bay floor consists of mud and sand flats. The bay has extensive eelgrass beds, providing an important food resource, particularly for wintering brant. The area is used by shorebirds, water fowl, anadromous fish and marine mammals.

LAND USE HISTORY:

The Dungeness Spit area has had a long history of human use. Clallam Indians apparently used the spits and bay prior to the arrival of white settlers. In 1857, the first lighthouse was erected at the end of Dungeness Spit. In 1914, the area was set aside as a wildlife sanctuary by presidential proclamation. Since 1946, the area has been managed by the U.S. Fish and Wildlife Service as a National Wildlife Refuge, although it was not given official status until 1953.

Graveyard Spit was the site of gun emplacements during World War II. A "Voice of America" radio site was located on the uplands above the spit at the same time. The sites were abandoned and many of the structures dismantled by 1945. Remnants of the gun emplacements, building foundations, walkways and cisterns still exist. Old fence posts near the salt marsh may also be remnants from that facility. Topographic and vegetational disturbance are still clearly apparent.

The area is accessible by foot, horseback or boat. The area is used for non-destructive recreation and seasonal hunting. Overnight camping was once allowed on Graveyard Spit. Camp fires are the primary cause of fires which have swept the spit. The last fire occurred in 1977 and involved all of Graveyard Spit. Evidence of the fire is still visible and the low plant cover values observed may indicate that the vegetation is still recovering.

The U.S. Coast Guard maintains the lighthouse at the end of Dungeness Spit. A road has been graded the length of the spit to service the light-house. Grading of the road alters the spit and disturbs the vegetation. This has resulted in the establishment of non-native plant species.

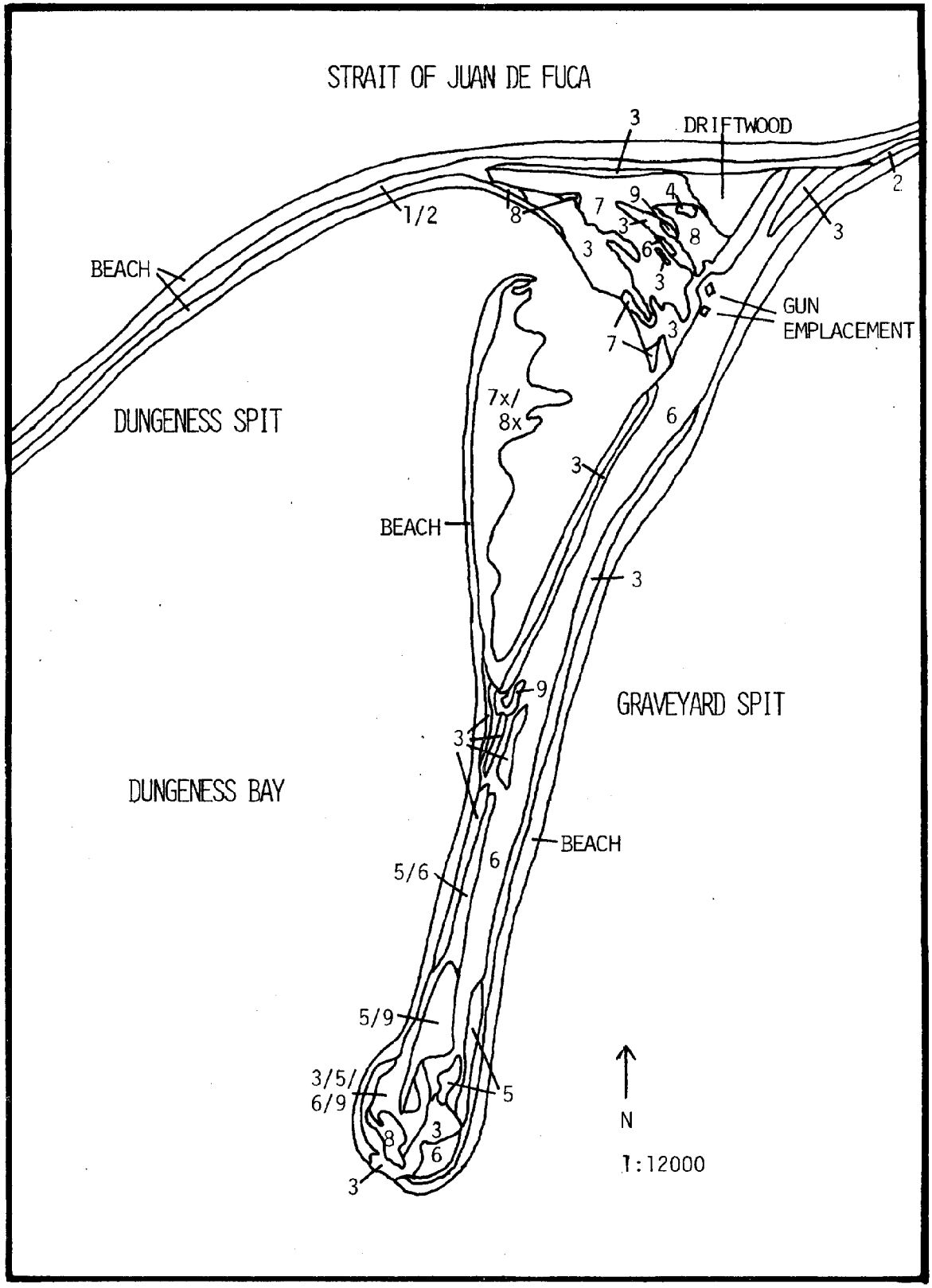

Figure 6. DUNGENESS SPIT FEATURES MAP

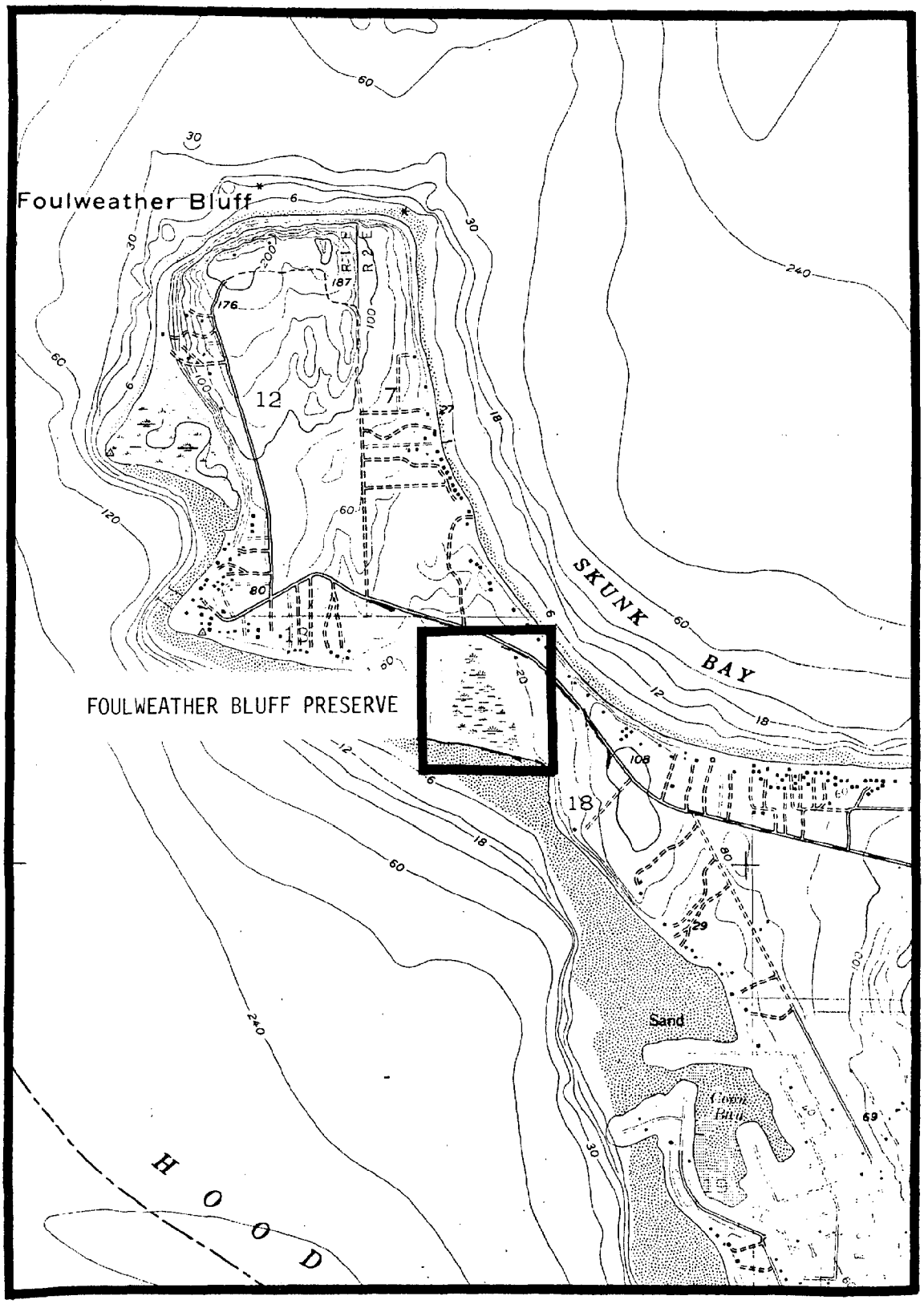

Figure 7. FOULWEATHER BLUFF PRESERVE LOCATIONAL MAP

FOULWEATHER BLUFF PRESERVE

LOCATION:

Kitsap County; T28N, R2E, portions of section 18. The site is part of The Nature Conservancy's Foulweather Bluff Preserve located on the south side of Foulweather Bluff, at the north end of Hood Canal (Fig. 7).

SIGNIFICANCE:

The site includes one of the highest quality, most diverse, brackish lagoons in the Puget Trough region.

GENERAL DESCRIPTION:

Figure 8 illustrates the distribution of features at Foulweather Bluff Preserve. The features are:

1. a lagoon wetland;
2. berm; and
3. intertidal area.

The lagoon system is approximately 22 acres. A brackish wetland has developed behind the berm. The berm was breached during a storm in December 1982. Prior to that time, marine waters apparently entered the wetland when tide levels exceeded the berm height and possibly through ground water intrusion. It is assumed that salt water intrusion through the breaches has subsequently increased the salinity of the system.

In 1983 a baseline study was conducted to characterize the berm, lagoon pond and vegetation (Cornelius, 1983). In that study, a previously assumed salinity gradient was documented. Salinities range from 14.5 to 21.0 ppt near the berm and 0.5 to 4.5 ppt at the north end of the lagoon near Twin Spits Road. Freshwater drains into the wetland from adjacent uplands, and by a seasonal stream which enters at the north end of the lagoon. Substrates of the north half of the lagoon are Tacoma silt loams (SCS, 1980). Soil cores indicate the existence of organic peat overlaying gravel in the south half (Thompson, 1977). There is considerable accumulation of driftwood in the northern half of the lagoon and along the berm. Approximately one-half of the lagoon is vegetated with typically brackish to freshwater species. Another one-third to one-half is open water. A large sand and gravel beach and intertidal area extends south from the berm. The site provides feeding, resting and nesting habitats for a large number of birds including bald eagles and osprey.

Uplands adjacent to the lagoon are covered by second growth forests of varying age classes. Upland soils on the west side of the lagoon are Ragner fine sandy loam and those on the north and east sides are Poulsbo gravelly sandy loam (SCS, 1980). East and west of the berm are eroding bluffs composed of glacial outwash.

FEATURES:

I. Lagoon Wetland

The lagoon wetland is shallow, having a maximum water depth of 7.4 dm, excluding human-built ditches (Cornelius, 1983). It is permanently flooded, with seasonal and some tidal variation in water depth. Acreages of open water, driftwood accumulation and emergent vegetation are variable. Currently, marine waters enter the lagoon at tidal levels of 12.5 feet or greater.

Four vascular plant species occur within the lagoon waters, each forming pure colonies. Adjacent to the berm, in the area with the highest salinity values, occur Scirpus maritimus and Eleocharis palustris communities. Scirpus maritimus is distributed most extensively in this area with small areas of E. palustris along the southeast and southwest lagoon edges. Scirpus acutus and Typha latifolia are concentrated in the lower salinity, northern half where they form a mosaic of dense marsh vegetation. Cornelius (1983) noted a reduction in productivity and reproduction of E. palustris, S. acutus and T. latifolia, presumably as a result of increased salinity following the 1982 storms. Along the northwest lagoon margin is a low area with mesic to saturated soils. Vegetation is dominated by Alnus rubra and Rubus spectabilis.

Eleocharis palustris (spikerush) monospecific community (mapping symbol 1)

Scirpus maritimus (seacoast bulrush) community (mapping symbol 2)

Scirpus acutus (hardstem bulrush) community (mapping symbol 3)

Typha latifolia (cattail) monospecific community (mapping symbol 4)

Alnus rubra/Rubus spectabilis community (mapping symbol 5)

Dominant Species

Alnus rubra (red alder)
Rubus spectabilis (salmonberry)

Subdominant Species

Sambucus racemosa (red elderberry)

Minor Species

Acer macrophyllum (bigleaf maple)
Athyrium filix-femina (ladyfern)
Galium sp. (bedstraw)
Gaultheria shallon (salal)
Oenanthe sarmentosa (water parsley)
Polysticum munitum (swordfern)
Rubus ursinus (Pacific blackberry)
Salix sp. (willow)
Spiraea douglasii (spirea)
Thalictrum sp. (meadowrue)
Thuja plicata (western red cedar)
Tsuga heterophylla (western hemlock)

II. Berm

The berm runs east-west across the lagoon mouth. During the storm of December 1982, the berm was breached in two places. The lowest breach occured at the west end of the berm and is equivalent in height to a 12.5 foot tide. The breach at the east end is slightly higher, at the 13.0 foot tidal level. The intact portions of the berm at the west and east ends are at the 14.7 and 14.3 foot tidal levels respectively (Cornelius, 1983). A comparison of photos taken in August 1982, prior to breaching of the berm and those taken in 1983, indicate a general decrease in berm height, driftwood accumulation and vegetation.

The berm is composed of sand and gravel which were probably eroded from coastal bluffs and deposited by wave action. Driftwood is embedded in the berm. The driftwood is thought to be an important element in the strengthening and development of the berm (Thompson, 1977 and Cornelius, 1983). Layers of organic peat are also found within the berm, possibly indicating a northern shift of the berm over wetland deposited organic matter (Cornelius, 1983). There are portions of the berm which appear to have breached at one time, but then were healed.

The leeward side of the berm is vegetated. Generally the vegetation grades from dune species, typified by Elymus mollis and Festuca rubra on the berm ridge to salt marsh vegetation, codominated by Potentilla pacifica and Agrostis alba, adjacent to the lagoon wetland.

Elymus mollis-Festuca rubra community (mapping symbol 6)

Dominant Species

Elymus mollis (dune wildrye)
Festuca rubra (red fescue)

Minor Species

Achillea millefolium (yarrow)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Angelica lucida (seawatch)
Atriplex patula var. hastata (saltbush)
Cakile edentula (American searocket)
Grindelia integrifolia (gumweed)
Lathyrus japonicus (beach pea)
Rubus ursinus (Pacific blackberry)
Rumex cf occidentalis (western dock)
Vicia gigantea (giant vetch)

Potentilla pacifica-Agrostis alba community (mapping symbol 7)

Dominant Species

Agrostis alba (redtop) (non-native)
Potentilla pacifica (Pacific silverweed)

Subdominant Species

Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Festuca rubra (red fescue)
Juncus balticus (Baltic rush)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

III. Intertidal Area

Thompson (1977) provides a physical and biotic description of the beach and intertidal areas at Foulweather Bluff Preserve. Substrates consist of sands and gravels. Zostera marina (eelgrass) and at least 74 species of marine invertabrates occur in the intertidal region, making this a rich feeding area for shorebirds and waterfowl.

LAND USE HISTORY:

Logging of uplands adjacent to the lagoon occurred prior to 1940. During this time, upland buffers around the wetland were not maintained and the lagoon was probably used for log storage. Channels were developed through the lagoon and berm at the southeast and southwest ends. These channels were used to skid logs into Hood Canal. Over time, the channels through the berm healed over. However, these points coincide with the breaches caused by storm driven tide waters in December, 1982.

In the 1950s, a cabin was built on the adjacent uplands southwest of the lagoon. The cabin was taken down in the 1970s leaving remnants of the foundation and fireplace.

Foulweather Bluff Preserve is currently managed as a natural area preserve, and provides protection for plants, animals and the native ecosystem. It receives day use which has little apparent impact on the area.

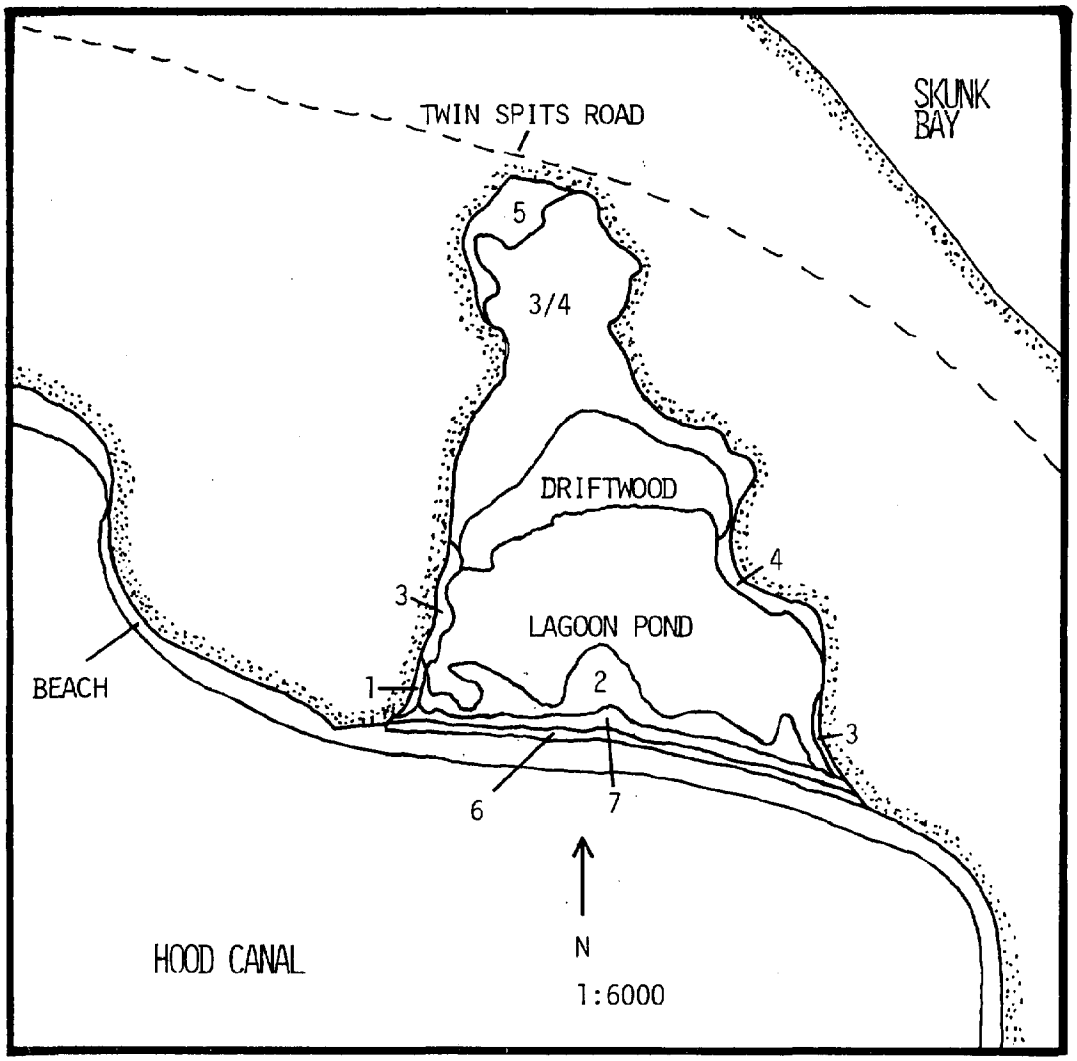

Figure 8. FOULWEATHER BLUFF PRESERVE FEATURES MAP

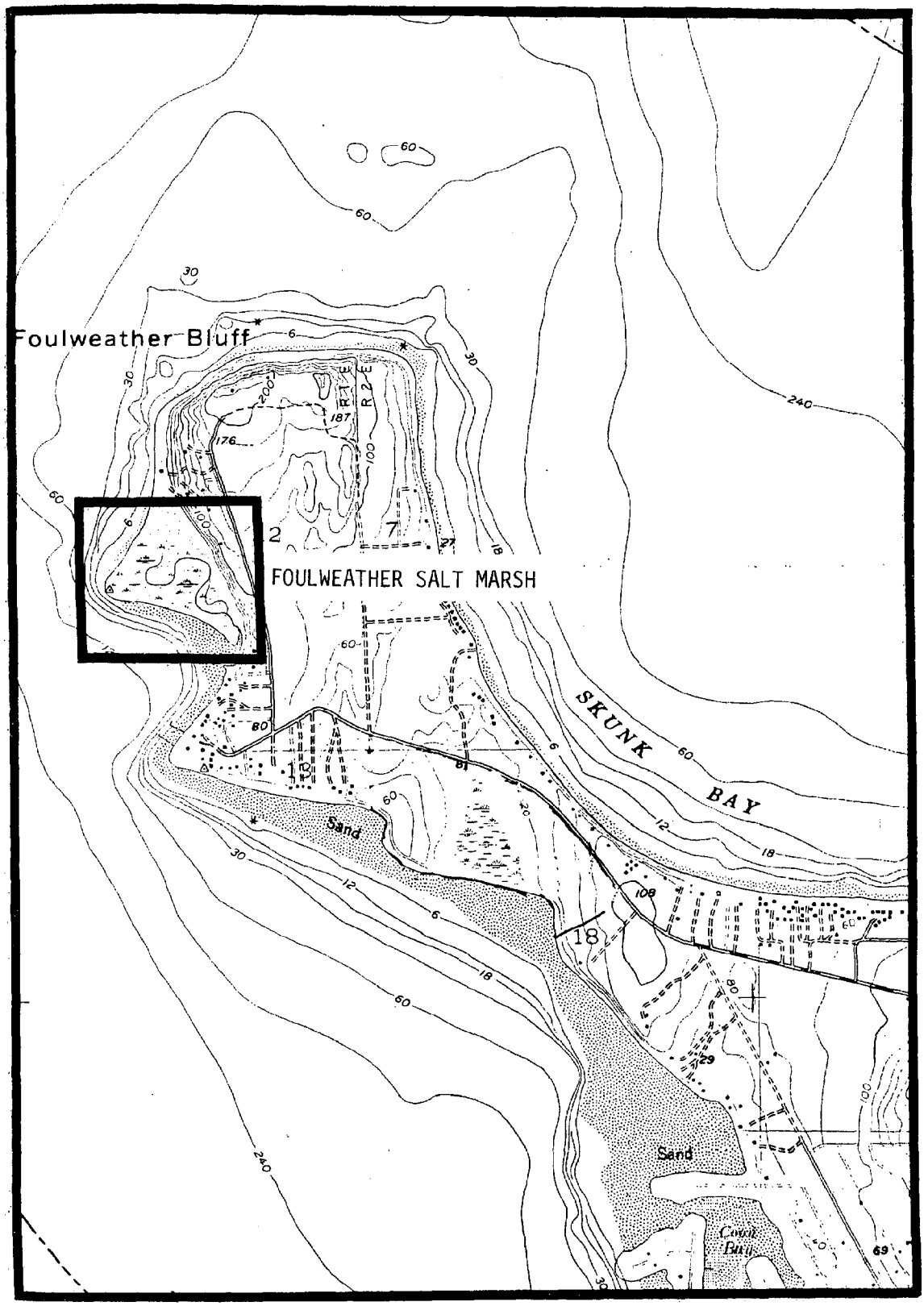

Figure 9. FOULWEATHER SALT MARSH LOCATIONAL MAP

FOULWEATHER SALT MARSH

LOCATION:

Kitsap County; T28N, R1E, portions of sections 12 and 13. The site is located at the base of a steep bluff on the west side of Foulweather Bluff at the northern end of the Kitsap Peninsula (Fig. 9).

SIGNIFICANCE:

The site contains a sandy, high salinity, low intertidal salt marsh of relatively high quality and large size.

GENERAL DESCRIPTION:

Figure 10 illustrates the distribution of features at Foulweather Salt Marsh. The features are:

1. a berm; and
2. a sandy, high salinity, low intertidal marsh.

The area of interest is approximately 33 acres. The berm bounds the salt marsh on the south and northwest sides. It is relatively high, composed primarily of sands and gravels deposited by wave action. A tidal channel enters between the southeast end of the berm and the adjacent uplands and winds through the salt marsh. The salt marsh occurs on low terraces adjacent to the tidal channel. Soils are primarily sands. The salt marsh is bounded to the west by a steep forested bluff. Soils of the bluff are dystric xerorthents; deep, moderately well drained soils probably formed in glacial till (SCS, 1980).

FEATURES:

I. Berm

The berm is unusual in shape, forming a triangle with the adjacent upland bluff. On the canal side, the berm has a steep sand, gravel and cobble beach. There is some driftwood accumulation on this side of the berm, along the berm ridge. The leeward side of the berm is vegetated with a varying assemblage of species. The berm vegetation is a mosaic dominated by Elymus mollis, particularly along the ridge. A number of exotic plant species occur along the berm suggesting human disturbance.

Berm Vegetation (mapping symbol 1)

Dominant Species

Elymus mollis (dune wildrye)

Minor Species

Achillea millefolium (yarrow)
Allium sp. (wild onion)
Ambrosia chamissonis var. bipinnatisecta (sliver bursage)
Angelica lucida (seawatch)
Bromus tectorum (cheatgrass) (non-native)
Festuca rubra (red fescue)
Galium sp. (bedstraw sp.)
Grindelia integrifolia (gumweed)
Honkenya peploides (honkenya)
Lathyrus japonicus (beach pea)
Lomatium sp. (biscuit-root)
Plantago lanceolata (English plantain) (non-native)
Poa pratensis (Kentucky bluegrass) (non-native)
Rosa nutkana (Nootka rose)
Rumex occidentalis (western dock)
Stellaria sp. (starwort)

II. Sandy, High Salinity, Low Intertidal Salt Marsh

The salt marsh has developed on the leeward side of the berm. A single tidal channel winds through the marsh carrying marine waters throughout the area with each high tide. Salt pannes occur throughout the marsh. The salt marsh is fairly uniform. Vegetational patterns are apparent, although on a scale too small to map. Salicornia virginica forms a monoculture at the lowest marsh elevations, along the tidal channels and around salt pannes. At slightly higher elevations, Jaumea carnosa becomes a minor to subdominant component. At slightly higher elevations yet, Distichlis spicata is found as well. Infrequently, soils shift from sands to silty-sands. In these areas, Triglochin maritimum occurs as a minor to subdominant species. Along the leeward side of the berm, a berm-salt marsh ecotone occurs. The ecotonal area is dominated by Plantago maritima. Along the base of the bluff there is a slight elevational gain where a few high intertidal marsh species intergrade with the low intertidal species. This grades into a narrow strip of Juncus balticus adjacent to the upland.

Salicornia virginica community (mapping symbol 2)

Dominant Species

Salicornia virginica (pickleweed)

Subdominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)

Minor Species

Atriplex patula var. hastata (saltbush)
Deschampsia caespitosa (tufted hairgrass)
Grindelia integrifolia (gumweed)
Juncus balticus (Baltic rush) (locally dominant)
Plantago maritima (seaside plantain) (locally dominant)
Spergularia sp. (sandspurry)
Triglochin maritimum (seaside arrowgrass)

LAND USE HISTORY

Not much is known about the human use history for this site. The salt marsh area and adjacent upland bluffs are all privately owned, with limited access down to the marsh. A tower with a spit marker stands at the western tip of the berm. A small house and trailer are located at the northern end of the berm, adjacent to the upland. It is possible that the house was built on fill. Two or three private roads come down over the bluff near the house. The major landowner of the salt marsh and adjacent uplands is in the process of clearing land on the bluff for a small housing development. The landowner has graded a road down over the bluff to provide access to the salt marsh below. Two to three years ago, a commercial clam harvester was reported to have dredged the clams out of the tidal channel in the salt marsh.

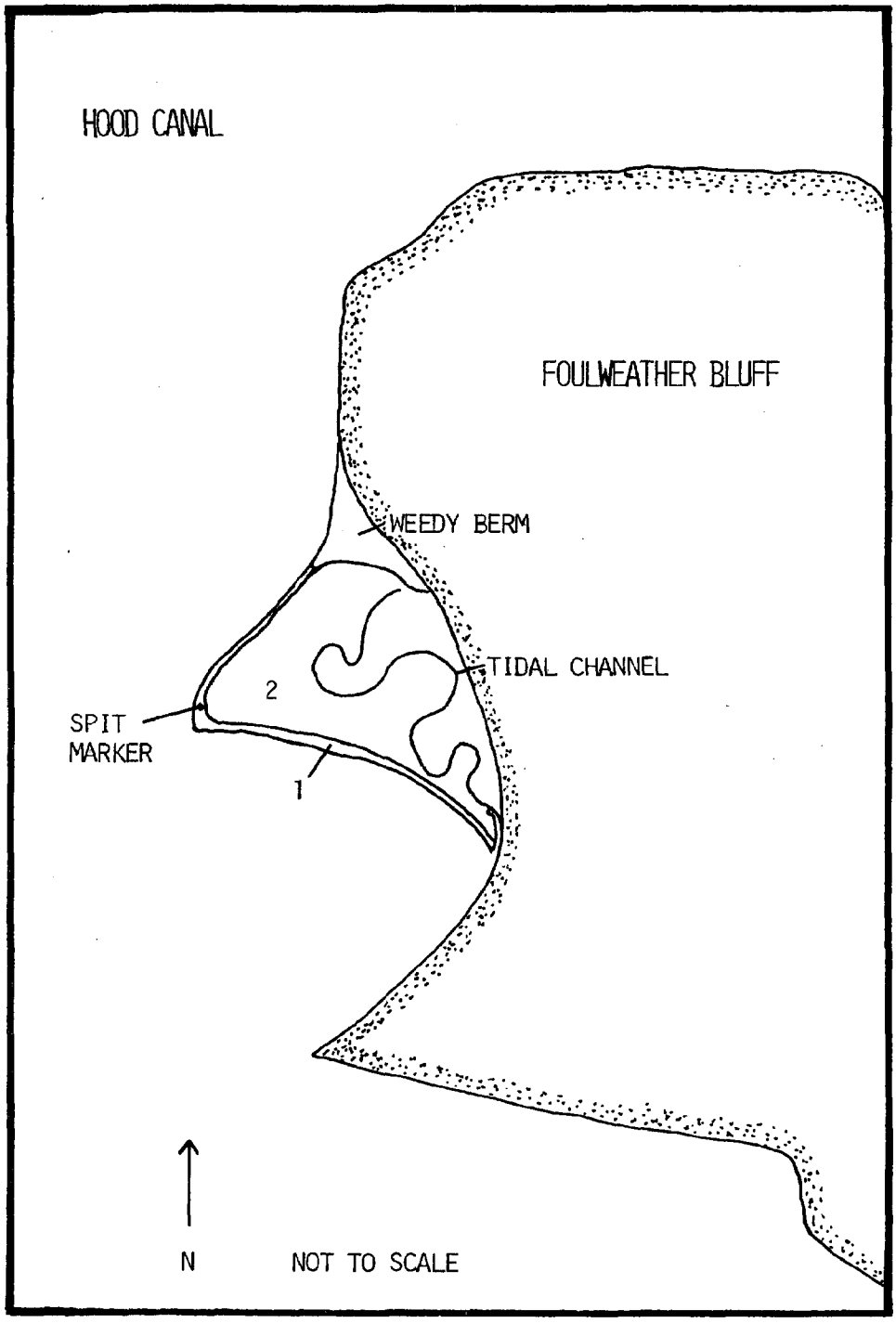

Figure 10. FOULWEATHER SALT MARSH FEATURES MAP

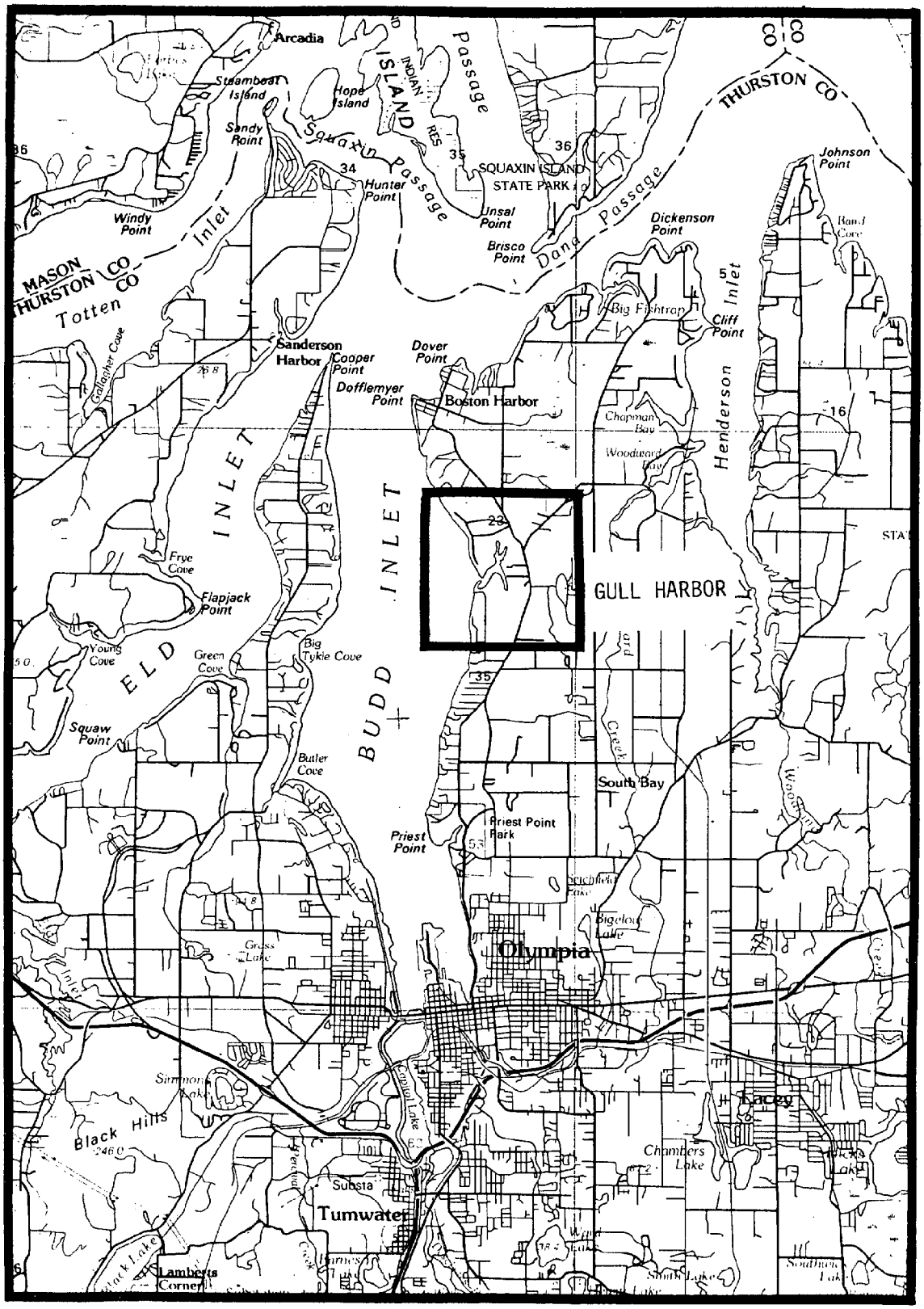

Figure 11. GULL HARBOR LOCATIONAL MAP

GULL HARBOR

LOCATION:

Thurston County; T19N, R2W, portions of sections 25, 26, 41 and 45. Gull Harbor is a small embayment on the west side of Budd Inlet in southern Puget Sound (Fig. 11).

SIGNIFICANCE:

Gull Harbor is a shallow, relatively undeveloped embayment around which an upland buffer has been maintained. Although coastal embayments are common in the Puget Trough region, it is rare to find one which is as undisturbed as Gull Harbor. A Washington State sensitive plant species, Woodwardia fimbriata, occurs in the area.

GENERAL DESCRIPTION:

Figure 12 illustrates the coastal embayment at Gull Harbor. It is approximately 27 acres with an additional 7 acres of delta located west of the harbor mouth. Three streams feed into the shallow harbor, one into each of the three arms. At low tide, most of the harbor floor is exposed. Substrates are composed of sand, gravel and cobbles, all overlain with a thin layer of alluvial sediments and organic matter. The spit and delta at the harbor mouth are sands and gravels. There is virtually no salt marsh development.

The uplands rise abruptly from the tidelands of Gull Harbor. The upland buffer consists of a mixed Alnus rubra (red alder) and Pseudotsuga menziesii (Douglas fir) forest. Most of the upland soils in the buffer zone are Alderwood sandy gravelly loam which has developed out of glacial till (SCS, 1958). Uplands along the southwest portion of the harbor are Kitsap silt loams. These soils have no gravel and have developed from stratified glacial lake deposited sediments. Steep coastal bluffs flank the mouth of Gull Harbor to the north and south. To the north, the bluffs consist of Kitsap silt loams overlaying glacial lake sediments. To the south, soils are Alderwood gravelly sandy loam underlain by variously cemented unsorted till. The area is used by a number of species of shorebirds and waterfowl.

FEATURES:

I. Coastal Embayment

The mouth of Gull Harbor is partially occluded by a spit. However, the channel entrance to the harbor is deep enough to prevent isolation of the harbor from Budd Inlet at low tides. Hence, the area is considered an "embayment" rather than a "lagoon". The lower reaches of three

streams draining into Gull Harbor provide spawning grounds for native populations of coho and chum salmon and cut-throat trout. Access to upper reaches of at least two of the streams is blocked by culverts. The harbor and delta region are feeding for juvenile marine and anadromous fish, particularly chum and coho salmon. Surf smelt spawn in the region are feeding areas for juvenile marine and anadromous fish, particularly chum and coho salmon. Surf smelt spawn in the sands and gravels of the delta area (Frasier, pers. comm.). Consequently, the area is a feeding ground for a number of species which prey on the smelt and juvenile fish.

II. Woodwardia fimbriata Sm. in Rees (chain-fern)

Family: Polypodiaceae

Federal Status: None

State Status: Sensitive (W.N.H.P., 1982).

General Description: Large, nearly erect ferns, 5-20 dm tall. Fronds are evergreen, divided into alternate pinnae (leaflets) which in turn are divided into opposite or sub-opposite segments (pinnules). Sori (reproductive structures) are oblong, occurring on the back side of the fronds, forming rows on either side of the pinnule and midveins. A technical key is needed for positive identification.

Habitat: Streambanks and other moist or wet (seep) areas in Washington, mostly near saltwater, often on unstable slopes.

Range: Scattered in the Puget Trough region, primarily along the coast in Jefferson, Kitsap, Mason, Pierce and Thurston Counties. Its range extends from southern British Columbia, Canada, to southern California and irregularly inland to Arizona and southern Nevada.

LAND USE HISTORY:

The human use history of the area is not well-known. Some logging has taken place on the uplands immediately adjacent to the harbor. It is probable that logs from the area were stored in the embayment. Three houses have been built within the buffer zone. One occurs on a bluff south of the harbor mouth. The degree of impact of this residence on Gull Harbor and the spit was not determined. The other two residences are located on the bluff on the east side of the southern arm of Gull Harbor. A small boat dock is located in the south arm as well. Gull Harbor currently has the designation of "conservancy" area under the Shoreline Management Act (Chapter 173-16 WAC).

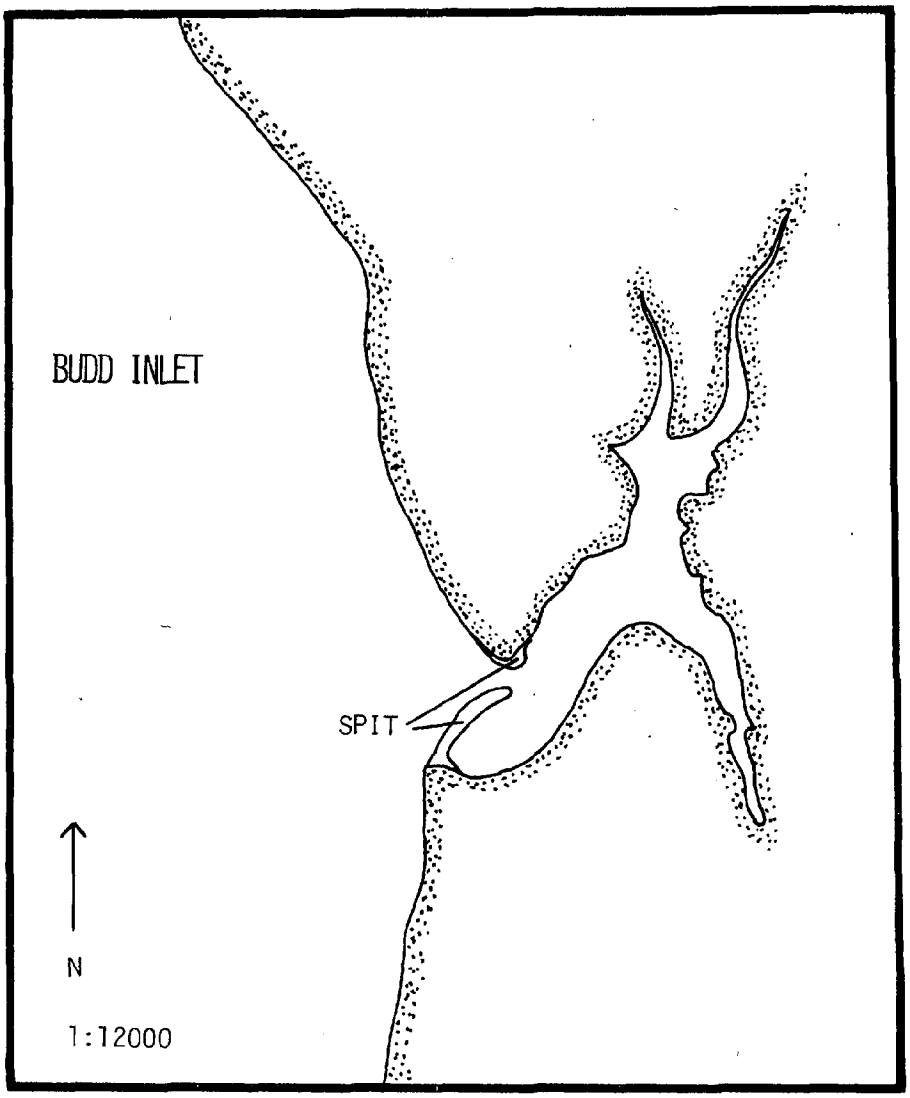

Figure 12. GULL HARBOR FEATURES MAP

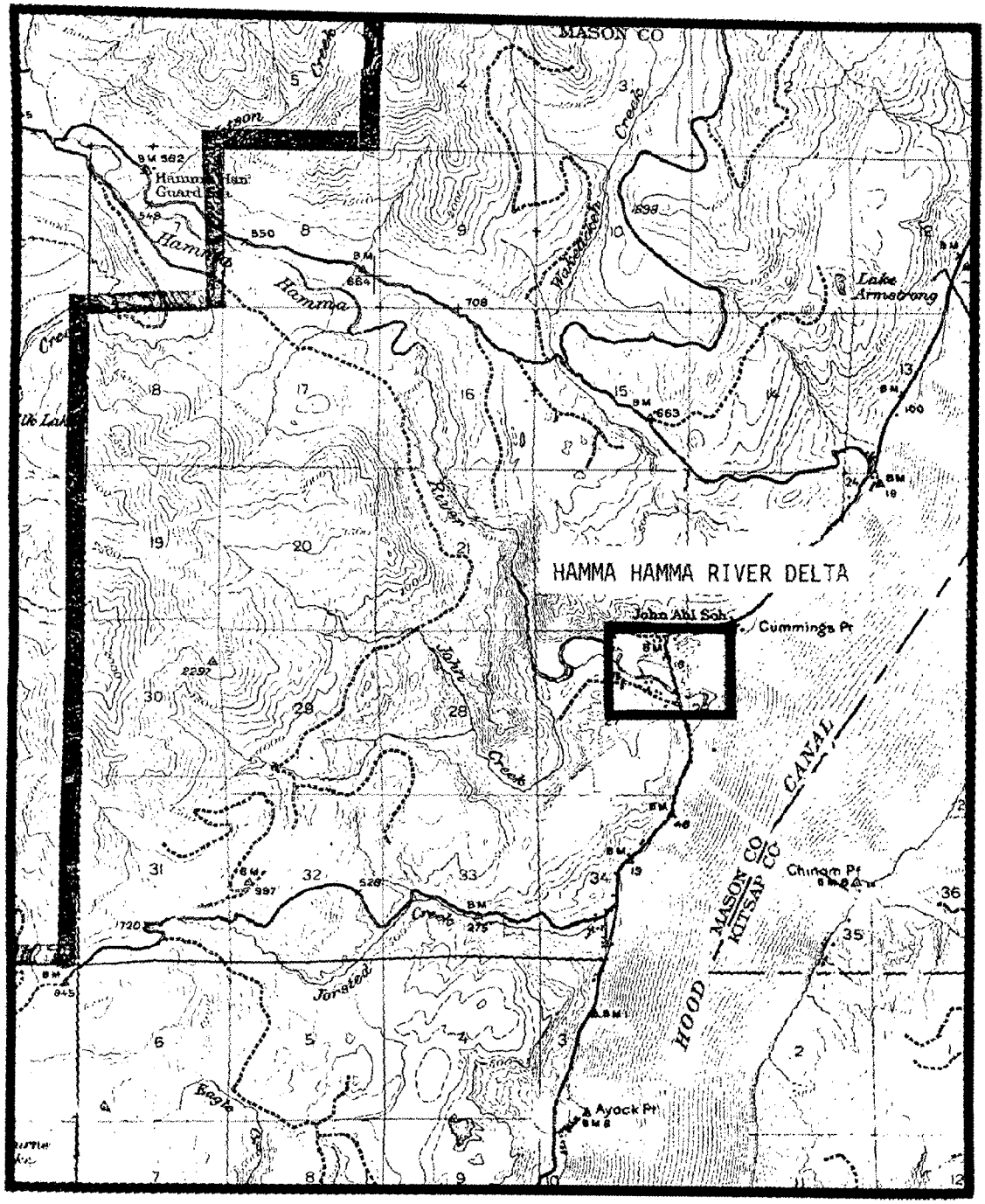

Figure 13. HAMMA HAMMA RIVER DELTA LOCATIONAL MAP

HAMMA HAMMA RIVER DELTA

LOCATION:

Mason County; T24N, R3W, portions of section 26 and 27. The area is located on the west side of Hood Canal, 28 miles north of Shelton (Fig. 13).

SIGNIFICANCE:

Relative to similar tidal river wetlands in the Puget Trough region, the Hamma Hamma is diverse and in good condition.

GENERAL DESCRIPTION:

Figure 14 illustrates the distribution of features in the Hamma Hamma tidal river area. The features are:

1. a mixed fine, high salinity, low intertidal marsh;
2. a silty, high salinity, low intertidal marsh;
3. a silty, low salinity, low intertidal marsh;
4. a silty, low salinity, high intertidal marsh; and
5. a transition zone forest.

The area of interest is approximately 50 acres, lying between the two main distributary channels. Substrates are alluvium. The eastern portion of the delta (bare tideflats and outer marsh edge) are sands and gravels. Substrates throughout the remaining area are mixed sand, silt and clay. The area contains numerous braided channels. This area, particularly the nonvegetated tideflats, is used as a feeding area by waterfowl and shorebirds (Hirschi, pers. com.).

FEATURES:

I. Mixed-Fine, High Salinity, Low Intertidal Marsh:

Mixed-fine, high salinity, low intertidal marsh occurs at the easternmost marsh edge. It is represented by a single community dominated by Glaux maritima. This community appears restricted in its range in Washington State to sandy-gravel river deltas along Hood Canal and in southern Puget Sound (Kunze, field observation).

Glaux maritima community (mapping symbol 1)

Dominant Species

Glaux maritima (saltwort)

Minor Species

Salicornia virginica (pickleweed) (locally codominant)
Spergularia sp. (sandspurry)

II. Silty, High Salinity, Low Intertidal Marsh:

This marsh type occurs at slightly higher elevations than the bare tideflats or Glaux maritima dominated community. Substrates are firm silty sands with varying clay content. Salt pannes, tidal channels and braided river channels occur throughout the marsh area. The plant community occurring at the easternmost edge of this marsh type is codominated by Salicornia virginica and Triglochin maritimum. The substrate is hummocky, with vegetation occurring on the hummocks. A second community, codominated by Distichlis spicata and Salicornia virginica, occurs inland (west) from the previous community. Along the main river channel is a depressional area bounded to the southwest by a dike and to the southeast, east and northeast by fill. This depressional area is codominated by Distichlis spicata and Jaumea carnosa.

Salicornia virginica-Triglochin maritimum community (mapping symbol 2)

Dominant Species

Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Minor Species

Distichlis spicata (saltgrass)
Glaux maritima (saltwort)
Spergularia sp. (sandspurry)
Triglochin concinneum (graceful arrowgrass)

Distichlis spicata-Salicornia virginica community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Minor Species

Spergularia sp. (sandspurry)
Triglochin maritimum (seaside arrowgrass)

Distichlis spicata-Jaumea carnosa community (mapping symbol 4)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)

Subdominant Species

Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Minor Species

Carex lyngbyei (Lyngby's sedge)
Glaux maritima (saltwort)
Plantago maritima (seaside plantain) (locally subdominant)
Potentilla pacifica (Pacific silverweed)
Grindelia integrifolia (gumweed) (local)

III. Silty, Low Salinity, Low Intertidal Marsh:

This marsh type occurs on low terraces or in depressions where there is considerable freshwater influence. It is primarily found on the west side of Highway 101. The major community is composed entirely of Carex lyngbyei, and occurs along fresh water channels. A minor community occurs in an old river channel meander and is codominated by Carex lyngbyei, Distichlis spicata and Potentilla pacifica.

Carex lyngbyei (Lyngby's sedge) monospecific community (mapping symbol 5)

Carex lyngbyei-Distichlis spicata-Potentilla pacifica community (mapping symbol 6)

Dominant Species

Carex lyngbyei (Lyngby's sedge)
Distichlis spicata (saltgrass)
Potentilla pacifica (Pacific silverweed)

Minor Species

Triglochin maritimum (seaside arrowgrass)

IV. Silty, Low Salinity, High Intertidal Marsh:

This marsh type primarily occurs west of the highway, with a narrow strip occurring along the highway fill to the east. The latter may be the result of a slight elevational gain caused by the roadfill. The single high intertidal marsh community in this area is codominated by Carex lyngbyei and Potentilla pacifica.

Carex lyngbyei-Potentilla pacifica community (mapping symbol 7)

Dominant Species

Carex lyngbyei (Lyngby's sedge)
Potentilla pacifica (Pacific silverweed)

Subdominant Species

Juncus balticus (Baltic rush) (locally dominant)

Minor Species

Aster subspicatus (Douglas' aster)
Deschampsia caespitosa (tufted hairgrass)
Heracleum lanatum (cow-parsnip)
Triglochin maritimum (seaside arrowgrass)

V. Transition Zone Forest

The transition zone forest occurs along the upper tidal river reach between the two main distributary channels. It is an area infrequently flooded by tidal water. The occurrence of some typically upland species suggest that even when this area is inundated, freshwater influence is high enough that typically salt intolerant species are not killed. The vegetational mosaic is dominated by Picea sitchensis and contains numerous snags (Non-game Data Systems).

Picea sitchensis mosaic (mapping symbol 8)

General Vegetation

Abies grandis (grand fir)
Adiantum pedatum (northern maidenhair)
Agrostis alba (redtop) (non-native)
Asparagus officinalis (asparagus) (non-native)
Aster subspicatus (Douglas' aster)

Athyrium filix-femina (ladyfern)
Atriplex patula var. hastata (saltbush)
Berberis aquifolium (shining Oregongrape)
Carex obnupta (slough sedge)
Equisetum telmateia (giant horsetail)
Gaulthera shallon (salal)
Hordeum sp. (barley)
Juncus effusus var. pacificus (common rush)
Lonicera involucrata (black twinberry)
Maianthemum dilatatum (beadruby)
Montia sp. (montia)
Oemleria cerasiformis (Indian plum)
Oenanthe sarmentosa (water-parsley)
Picea sitchensis (Sitka spruce)
Polystichum munitum (swordfern)
Pteridium aquilinum (bracken fern)
Pyrus fusca (western crabapple)
Rubus spectabilis (salmonberry)
Rubus ursinus (Pacific blackberry)
Rumex occidentalis (western dock)
Sambucus sp. (elderberry)
Symphoricarpos albus (snowberry)
Taxus brevifolia (western yew)
Thuja plicata (western red cedar)
Tsuga heterophylla (western hemlock)
Vaccinium ovatum (evergreen huckleberry)

LAND USE HISTORY:

The area has a long history of use. The town of Eldon was founded to the south of the Hamma Hamma River. Tidelands and adjacent uplands north and south of the river channels have been used for housing, farming and pasture. The area lying between the two main river channels has little evidence of housing or agricultural use. Highway 101 crosses the two main river channels on piling supported bridges, and the tidelands on fill. The marsh to either side of the highway has been altered by the fill. Weedy and typically upland plant species occur along the fill, and a short distance down into the marsh. The main river channel has been dredged and diked. Filling, dredging and diking have probably altered freshwater drainage and tidal influence. The primary landowner allows hunting on the tide lands east of the highway, but completely restricts human access to the area west of the highway. The landowner is trying to maintain the latter area as a wildlife sanctuary.

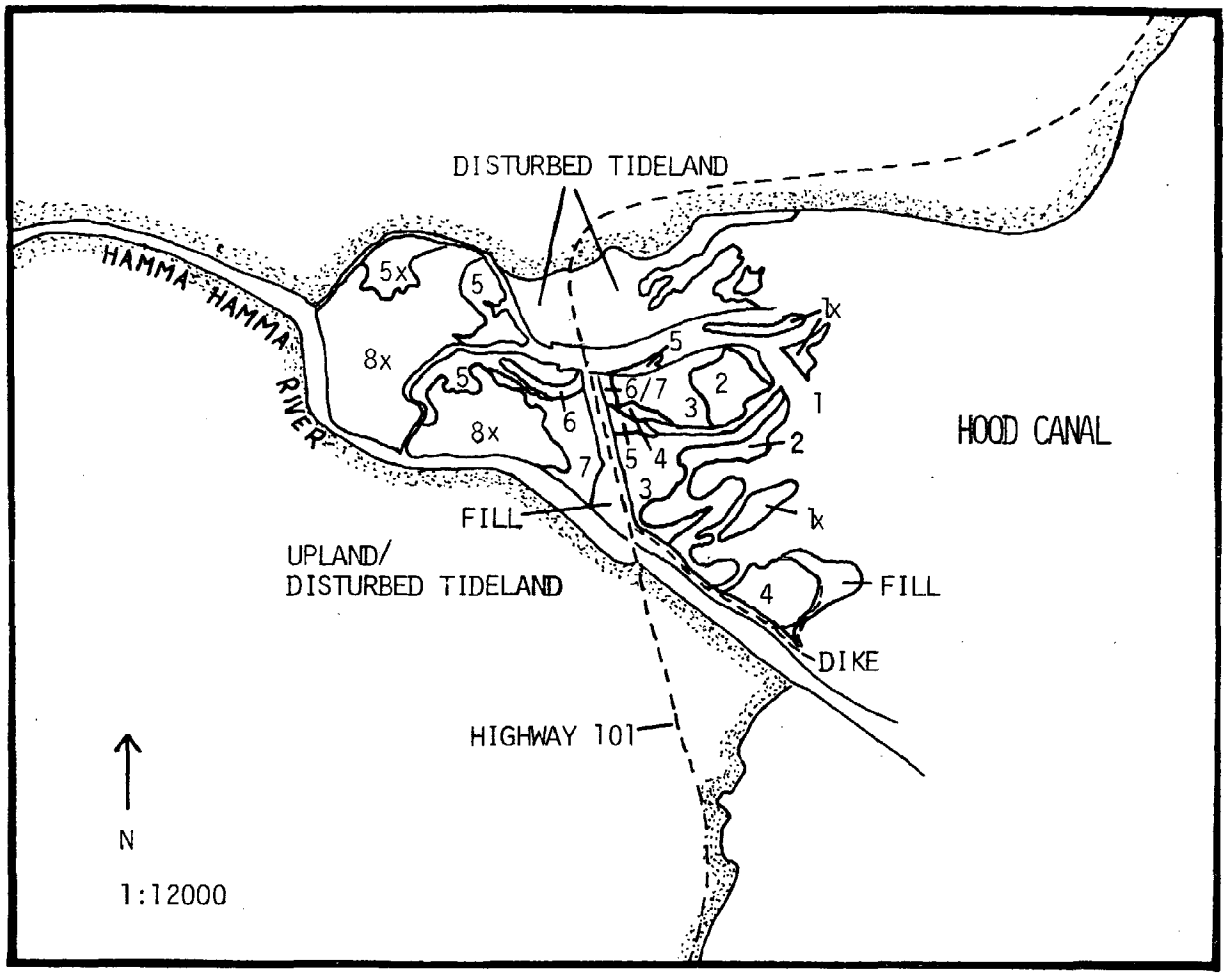

Figure 14. HAMMA HAMMA RIVER DELTA FEATURES MAP

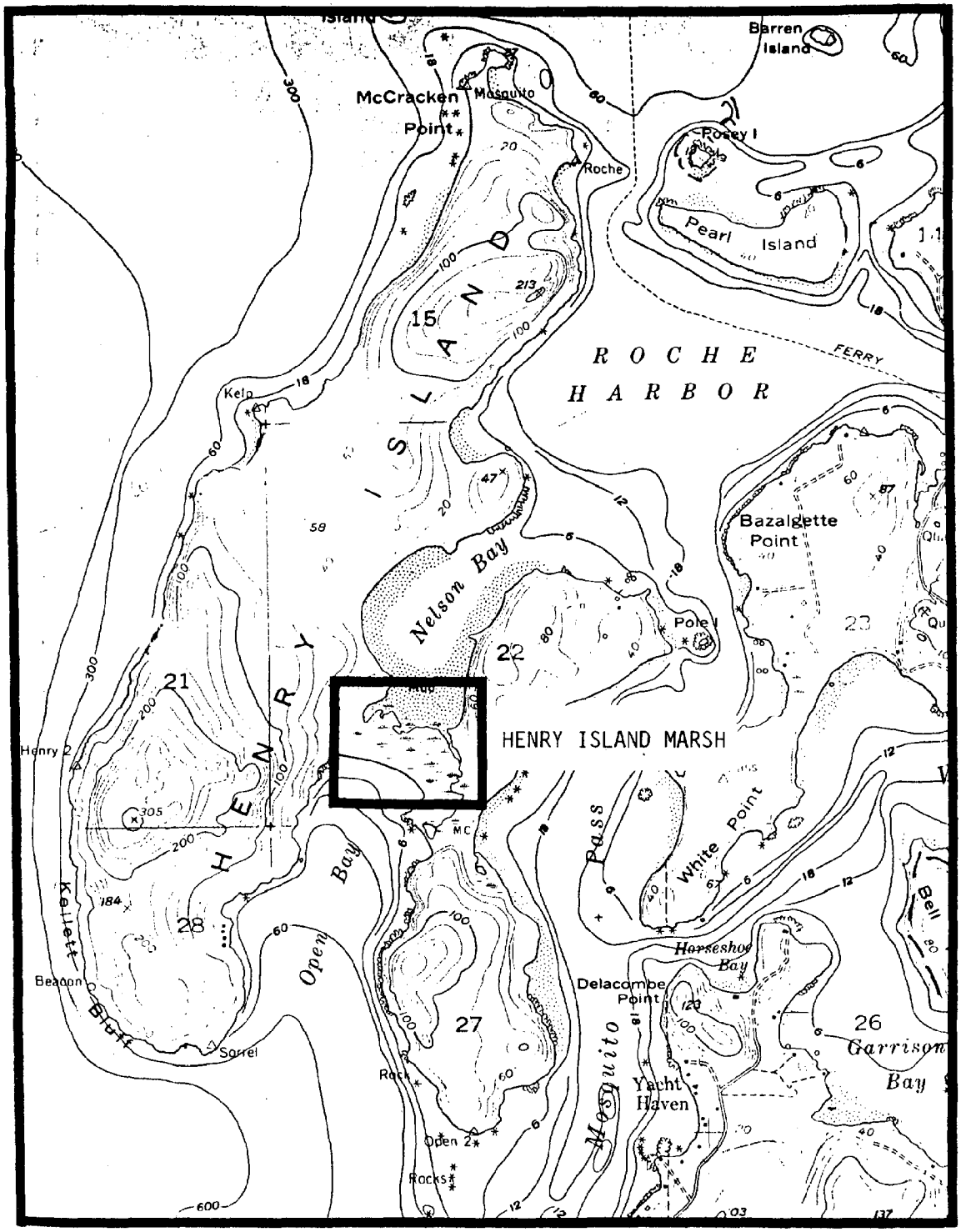

Figure 15. HENRY ISLAND LOCATIONAL MAP

HENRY ISLAND

LOCATION:

San Juan County; T36N, R4W, portions of sections 22 and 27. The site lies between Open Bay, Nelson Bay and Mosquito Pass at the south end of Henry Island (Fig. 15).

SIGNIFICANCE:

Henry Island bay shore marsh is a good example of a high salinity salt marsh and represents some of the highest quality Festuca rubra community development known in the Puget Trough region.

GENERAL DESCRIPTION:

Figure 16 illustrates the distribution of the two features which occur at the Henry Island site. These features are:

1. berm ridges; and
2. a sandy, polyhaline to euhaline, low intertidal marsh.

The area of interest is approximately 29 acres. It is located at the hub of three bays and three rocky upland areas. Substrates are comprised of beach derived sands. A series of berms have formed between Open Bay and Nelson Bay. The berms grade steeply to the south forming a beach at the head of Open Bay. To the north, the berms grade gradually down to a salt marsh and the shallow embayment of Nelson Bay. This area is bounded to the east by a berm running north and south along Mosquito Pass. Although Nelson Bay is not included in this recommendation, the dense eelgrass beds which occur there are noteworthy.

FEATURES:

I. Berm

A series of east-west oriented berm ridges between Open Bay and Nelson Bay are formed by sand and gravel deposition that appears to be progressing southward, with the most recently deposited ridges at the head of Open Bay. Festuca rubra dominates on the ridges, indicative of the low level of disturbance.

Festuca rubra community (mapping symbol 1)

Dominant Species

Festuca rubra (red fescue)

Minor Species

Achillea millefolium (yarrow)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Atriplex patula var. hastata (saltbush)
Bromus tectorum (cheatgrass) (local) (non-native)
Grindelia integrifolia (gumweed)
Holcus lanatus (velvet grass)
Lepidium virginicum var. menziesii (tall pepperweed)
Poa pratensis (Kentucky bluegrass) (non-native)
Poa sp. (bluegrass)
Potentilla pacifica (Pacific silverweed) (local)

II. Sandy, Polyhaline to Euhaline, Low Intertidal Marsh.

The marsh has a north aspect grading down from the series of berm ridges to the sandy gravelly beach of Open Bay. The marsh appears to be eroding. There is an abrupt elevational gain from the beach to the marsh surface. Tidal channels wind through the marsh, leaving marsh vegetation suspended on small plateaus. Salt pannes occur throughout the marsh. Interstitial soil salinities measured at low tide were 32 ppt. The primary plant community is dominated by Salicornia virginica, with Jaumea carnosa varying between a co- and subdominant. At slightly higher elevations, and between berm ridges, Distichlis spicata and Salicornia virginica codominate.

Salicornia virginica-Jaumea carnosa community (mapping symbol 2)

Dominant Species

Salicornia virginica (pickleweed)

Subdominant Species

Jaumea carnosa (jaumea) (locally codominant)

Minor Species

Distichlis spicata (saltgrass)
Plantago maritima (seaside plantain)
Puccinellia cusickii (Cusick's alkaligrass)
Puccinellia lucida (shining alkaligrass)
Puccinellia nuttalliana (Alaska alkaligrass)
Spergularia canadensis (winged sandspurry)
Triglochin maritimum (seaside arrowgrass)

Distichlis spicata-Salicornia virginica community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Lepidium virginicum var. menziesii (tall pepperweed)
Puccinellia sp. (alkaligrass)
Spergularia macrotheca (beach sandspurry)

LAND USE HISTORY:

The berm and a portion of the marsh near Mosquito Pass, to the east, have been excluded from this recommendation because of past use as pasture. A portion of that area has been ditched and old fence posts occur throughout it. Houses occur at a low density on the uplands adjacent to the marsh and berm area, with one house located on the berm near Mosquito Pass. Vehicle tracks follow the berm ridges between Open Bay and Nelson Bay. Vehicle use has caused some compaction of the soil and may be partially responsible for the occurrence of weedy plant species. Animals pastured near Mosquito Pass or on adjacent uplands may have had access to other portions of the marsh and berm. However, there were no signs of grazing or trampling elsewhere. The area probably receives some recreational use from local residents.

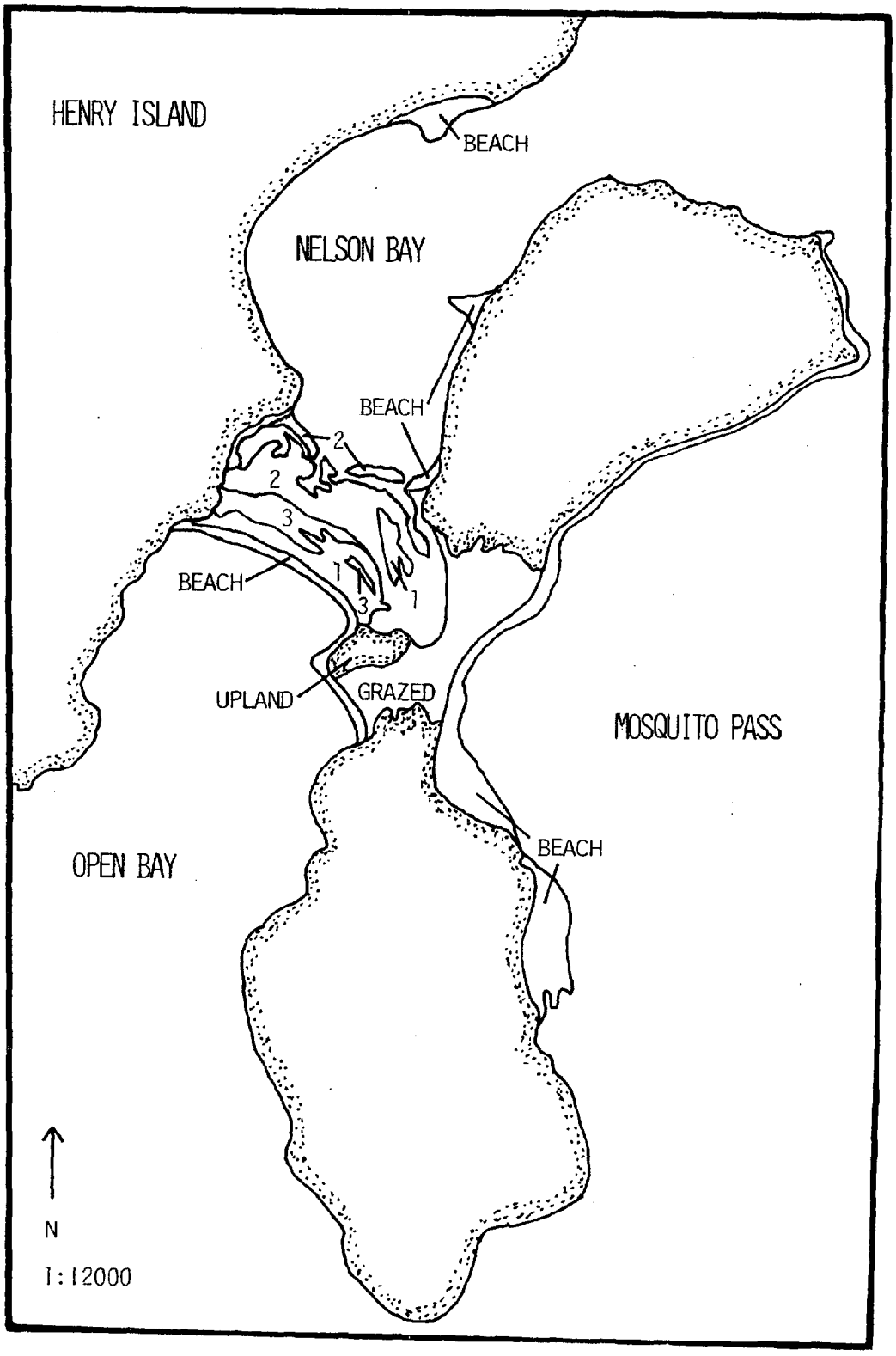

Figure 16. HENRY ISLAND FEATURES MAP

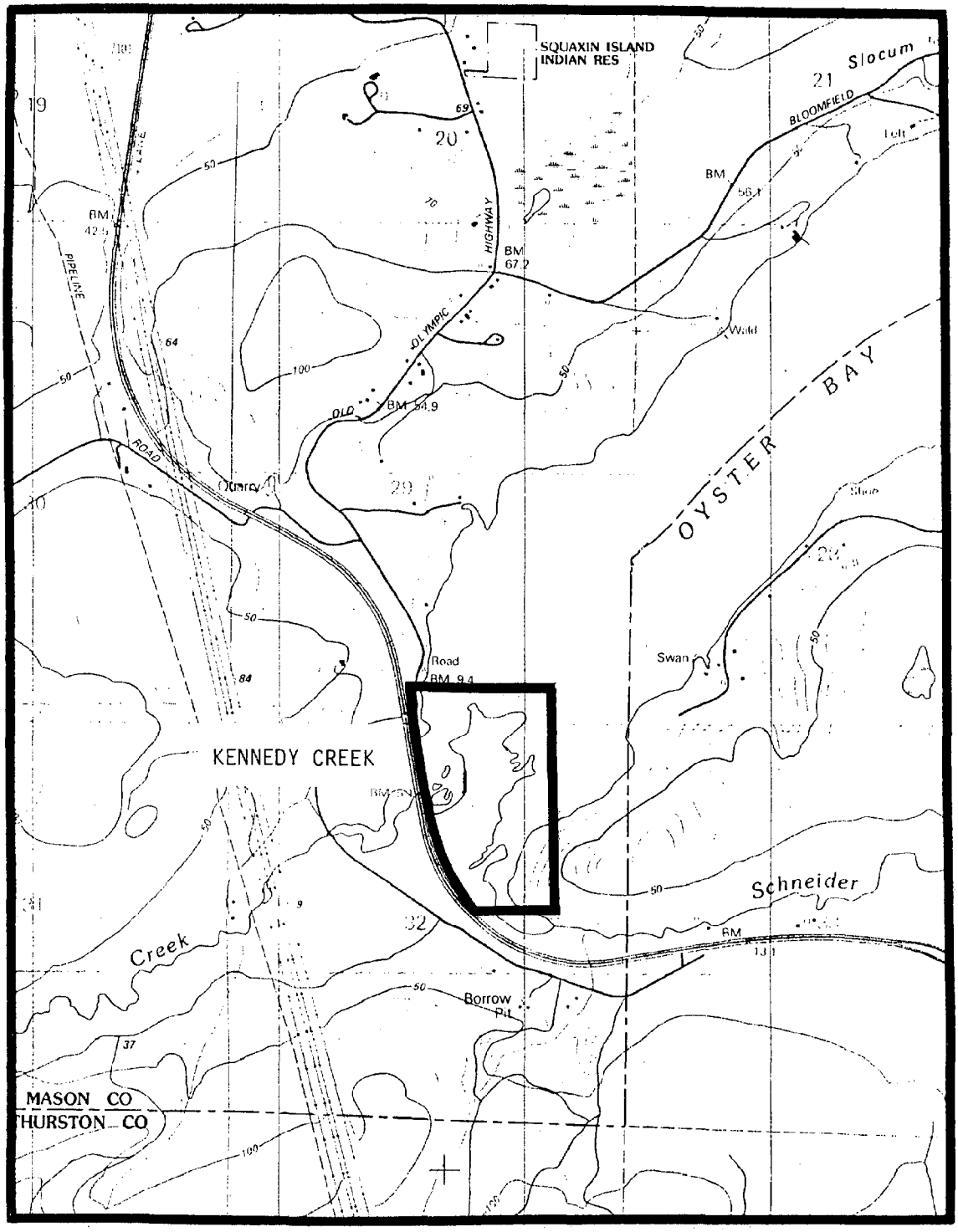

Figure 17. KENNEDY CREEK LOCATIONAL MAP

KENNEDY CREEK

LOCATION:

Mason County; T19N, R3W, portions of sections 29, 31 and 32. The area of interest occurs east and north of U.S. Highway 101 at the southwest end of Oyster Bay (Fig. 17).

SIGNIFICANCE:

The Kennedy Creek Marsh is a diverse, relatively high quality remnant of a larger tidal river marsh.

GENERAL DESCRIPTION:

Figure 18 illustrates the distribution of features at Kennedy Creek. The features are:

1. a clay, low salinity, low intertidal marsh;
2. a clay, high salinity, low intertidal marsh; and
3. a clay, high intertidal marsh.

The area of interest is approximately 32 acres. The marsh has developed on a peninsula between Kennedy and Schneider Creeks. Substrates are alluvial sand, silt and clays. The site is bounded to the south and west by second growth Pseudotsuga menziesii (Douglas fir) dominated forest and Highway 101.

FEATURES:

I. Clay, Low Salinity, Low Intertidal Marsh

Clay, low salinity, low intertidal marsh occurs primarily in the upper Kennedy Creek tidal drainage on flats or low terraces. This marsh type occurs here as pure stands of Carex lyngbyei.

Carex lyngbyei (Lyngby's sedge) monospecific community (mapping symbol 1)

II. Clay, High Salinity, Low Intertidal Marsh

This is the most extensive marsh type at the Kennedy Creek site. It occurs at the lowest marsh elevations at the northeast end of the peninsula. The marsh is dissected by tidal channels and salt pannes occur throughout. A single community, dominated by Distichlis spicata, Jaumea carnosa and Salicornia virginica, comprises this marsh type.

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 2)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Plantago maritima (seaside plantain)
Triglochin maritimum (seaside arrowgrass)

III. Clay, High Salinity, High Intertidal Marsh:

This marsh type occurs between the low intertidal marsh and upland vegetation. Two primary communities occur here, frequently intergrading with each other and with low intertidal marsh. One community is dominated by Juncus gerardii; the second is codominated by Deschampsia caespitosa and Potentilla pacifica.

Juncus gerardii community (mapping symbol 3)

Dominant Species

Juncus gerardii (mud rush)

Minor Species

Deschampsia caespitosa (tufted hairgrass)

Deschampia caespitosa-Potentilla pacifica community (mapping symbol 4)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)
Potentilla pacifica (Pacific silverweed)

Subdominant Species

Jaumea carnosa (jaumea) (locally codominant)

Minor Species

Aster subspicatus (Douglas' aster)
Atriplex patula var. hastata (saltbush)
Distichlis spicata (saltgrass)
Glaux maritima (saltwort)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

LAND USE HISTORY:

The upland forest adjacent to the site has been logged in the past. Old barbed wire can be found near the upland forest suggesting past use of some areas of the marsh as pasture. An upland knoll in the marsh peninsula has a number of weedy species which suggests past use. U.S. Highway 101 crosses the upper tidal reach of Kennedy Creek on a bridge and roadfill, and a second small stream drainage on fill. A second road occurs on fill along a small area of shoreline west of Kennedy Creek and east of Highway 101. It crosses Highway 101 and curves southeast to cross Kennedy Creek. The lower freshwater reach of Kennedy Creek has been logged, partially converted to agricultural land and most recently, an area has been graded for a recreational vehicle park.

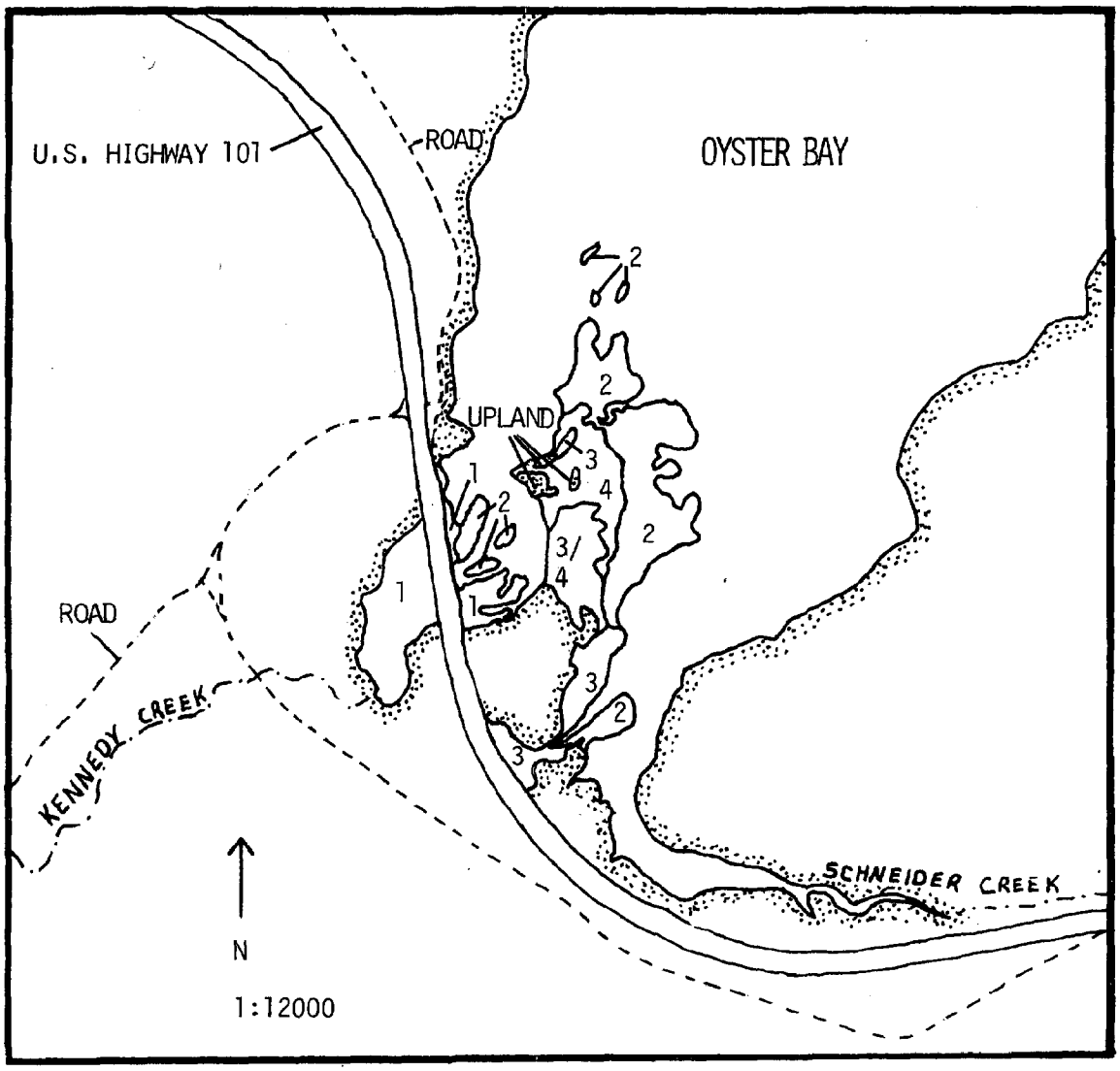

Figure 18. KENNEDY CREEK FEATURES MAP

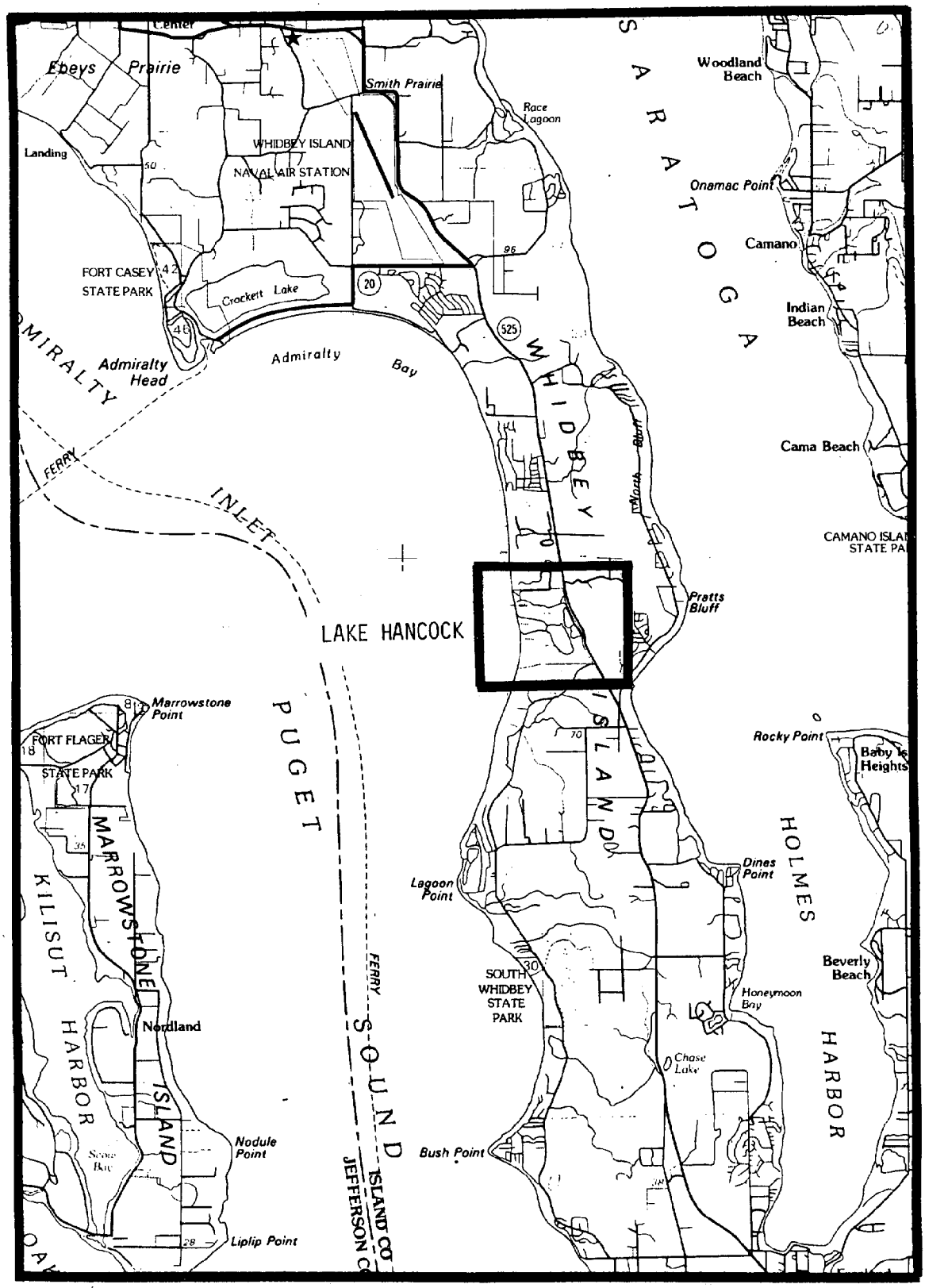

Figure 19. LAKE HANCOCK LOCATIONAL MAP

LAKE HANCOCK

LOCATION:

Island County; T30N, R2E, portions of sections 5, 6, 7 and 8. This site is located south of Admiralty Bay on the west side of Whidbey Island (Fig. 19).

SIGNIFICANCE:

Lake Hancock is an exceptionally large and diverse coastal lagoon system.

GENERAL DESCRIPTION:

Figure 20 illustrates the distribution of features at Lake Hancock. The features are:

1. a lagoon pond;
2. a sandy, high salinity, low intertidal marsh;
3. a sandy, high intertidal marsh;
4. a transition zone marsh; and
5. a freshwater wetland.

The area of interest is approximately 207 acres. Marine influence is restricted by the deposition of sands and gravels that form a berm across the bay mouth. A channel through the berm allows for marine influence. Substrates appear to be silty-sands throughout. Salinities range from freshwater to hyperhaline. There is considerable driftwood accumulation along the north and northeast wetland margin.

FEATURES:

I. Lagoon Pond

The lagoon pond is a shallow, permanent pond of approximately 37 acres. It is currently connected with marine waters of Puget Sound by a single channel. However, the berm topography indicates variability in channel location and numbers.

II. Sandy, High Salinity, Low Intertidal Marsh

This is the predominant marsh type at Lake Hancock. The lagoon system has little topographic relief and contains an extensive network of tidal channels which carry tidal waters throughout most of the marsh. Interstitial soil salinities in this area ranged from 27 to 46 ppt.

Salt pannes occur throughout this marsh type. The vegetation is a mosaic, primarily composed of a community codominated by Distichlis spicata and Salicornia virginica. Jaumea carnosa, Plantago martima and Triglochin maritimum may be codominants with D. spicata and S. virginica. In slightly lower areas, particularly around salt pannes and tidal channels, pure stands of Salicornia virginica occur.

Distichlis spicata-Salicornia virginica community (mapping symbol 1)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Subdominant Species

Jaumea carnosa (jaumea) (locally codominant)
Triglochin maritimum (seaside plantain) (locally codominant)

Minor Species

Atriplex patula var. hastata (saltbush)
Plantago maritima (seaside plantain) (locally codominant)
Puccinellia cf cusickii (Cusick's alkaligrass)
Puccinellia cf pumila (dwarf alkaligrass)
Spergularia canadensis (winged sandspurry)

III. Sandy, High Intertidal Marsh

Along the south side of the lagoon system, the vegetation grades gradually from low intertidal marsh to a high intertidal marsh and transition zone wetland before shifting to purely upland vegetation. The sandy, high intertidal marsh has a wide range of salinities, ranging from polyhaline to brackish. The lowest elevation community is codominated by Agrostis alba and Distichlis spicata. Agrostis alba is a non-native species indicative of past disturbance. This community may be considered transitional between low and high intertidal marsh. The highest elevational community of the marsh type is codominated by Juncus balticus and Potentilla pacifica.

Agrostis alba-Distichlis spicata community (mapping symbol 2)

Dominant Species

Agrostis alba (redtop) (non-native)
Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)
Spergularia canadensis (winged sandspurry)

Juncus balticus-Potentilla pacifica community (mapping symbol 3)

Dominant Species

Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Minor Species

Agrostis alba (redtop) (non-native) (locally subdominant)
Scirpus validus (softstem bulrush)
Typha latifolia (cattail)

IV. Transition Zone Marsh

A transition zone marsh occurs in the southeast portion of the lagoon system. While salinity measurements were not taken, plant species composition and the occurrence of driftwood indicate occasional marine influence. The community is codominated by Typha latifolia and Potentilla pacifica. The soil surface is composed of black, slightly anoxic organic matter.

Typha latifolia-Potentilla pacifica community (mapping symbol 4)

Dominant Species

Potentilla pacifica (Pacific silverweed)
Typha latifolia (cattail)

Minor Species

Atriplex patula var. hastata (saltbush)
Polypogon monospeliensis (rabbitfoot polypogon)
Rumex occidentalis (western dock)
Scirpus validus (softstem bulrush) (locally dominant)

V. Freshwater Wetland

In one area, high intertidal and transition zone marshes grade into a freshwater wetland. The species composition suggests that marine influence is minor. The wetland shifts from an outer shrub margin dominated by Myrica californica to a community codominated by Alnus rubra, Myrica californica and Carex obnupta.

Myrica californica community (mapping symbol 5)

Dominant Species

Myrica californica (Pacific wax-myrtle)

Minor Species

Typha latifolia (cattail) (locally subdominant)

Alnus rubra/Myrica california/Carex obnupta community (mapping symbol 6)

Dominant Species

Alnus rubra (red alder)
Carex obnupta (slough sedge)
Myrica californica (Pacific wax-myrtle)

Subdominant

Gaultheria shallon (salal)
Ledum groenlandicum (bog laurel)

Minor Species

Galium sp. (bedstraw)
Lonicera involucrata (black twinberry)
Lysichitum americanum (skunk cabbage)
Oenanthe sarmentosa (water parsley)
Picea sitchensis (Sitka spruce)
Pinus contorta (lodgepole pine)
Potentilla pacifica (Pacific silverweed)
Pteridium aquilinum (bracken fern)
Rosa nutkana (Nootka rose)
Rubus spectabilis (salmonberry)
Rubus ursinus (Pacific blackberry)
Spiraea douglasii (spirea)
Typha latifolia (cattail)

LAND USE HISTORY:

The Lake Hancock site is owned by the U.S. Navy. For many years the area has been used as a target range. During World War II, live ammunition was used. The marsh surface has been altered by this use. The large number of salt pannes may be due to impact and explosion of munitions. Some channels in the marsh are artificially straight. A small building and fence are located on the low intertidal marsh. The upland has been logged. Roads have been graded along the south, east and north upland margins of the lagoon system. Alnus rubra is invading portions of this upland region.

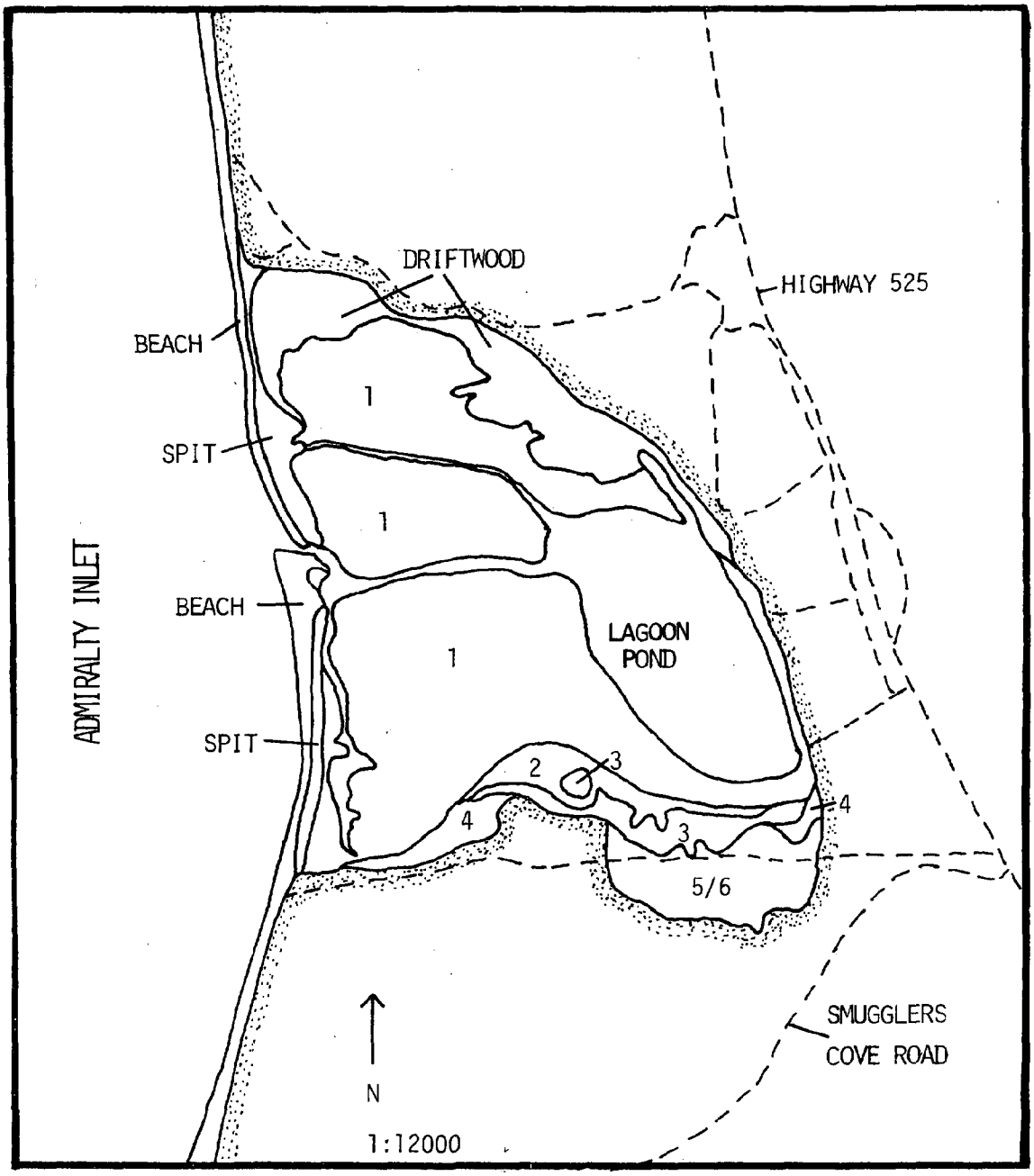

Figure 20. LAKE HANCOCK FEATURES MAP

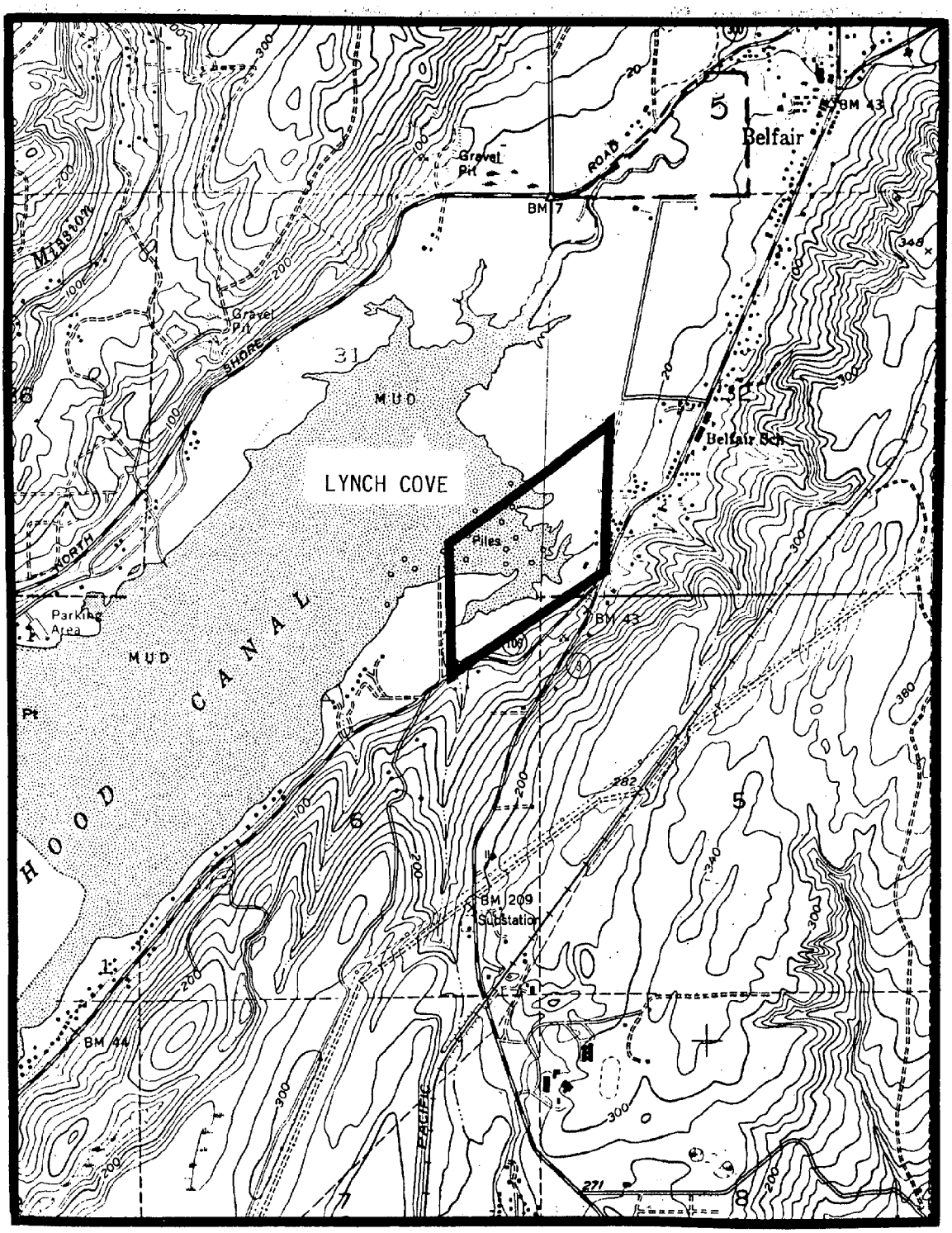

Figure 21. LYNCH COVE LOCATIONAL MAP

LYNCH COVE

LOCATION:

Mason County; T22N, R1W, portions of sections 5 and 6 and T23N, R1W, portions of sections 31 and 32. The site is located at the south end of Hood Canal, southwest of Belfair (Fig. 21).

SIGNIFICANCE:

The site is a large, relatively high quality fragment of a bayshore marsh.

GENERAL DESCRIPTION:

Figure 22 illustrates the distribution of features at Lynch Cove. The features are:

1. a silty, high salinity, low intertidal marsh;
2. a silty, high salinity, high intertidal marsh;
3. a silty, low salinity, high intertidal marsh; and
4. a transition zone marsh.

The area of interest is approximately 22 acres. The marsh has developed on clay terraces elevated about 1 to 1.5 meters above the tideflats. The marsh is highly dissected by tidal channels and several freshwater creeks.

The marsh is bounded to the north (northwest) by an old dike, ditch and fence system. To the northeast and east, it is bounded by young Alnus rubra (red alder) dominated woodlands. To the south, southeast and southwest, it is bounded by Picea sitchensis (Sitka spruce) forests.

FEATURES:

I. Silty, High Salinity, Low Intertidal Marsh

A silty, high salinity, low intertidal marsh occurs on the seaward marsh edges and along the margins of some tidal channels. A few salt pannes occur in this portion of marsh. There are two distinguishable communities within this marsh type at Lynch Cove. The first is a community with variable species composition, codominated by Distichlis spicata, Jaumea carnosa and Salicornia virginica. In areas with some freshwater influence, Carex lyngbyi is also codominant. In other areas, Plantago maritima may be codominant. The second community is dominated by Distichlis spicata.

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 1)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Subdominant Species

Carex lyngbyei (Lyngby's sedge) (locally codominant)
Triglochin maritimum (seaside arrowgrass)

Minor Species

Agrostis alba (redtop) (non-native)
Atriplex patula var. hastata (saltbush)
Deschampsia caespitosa (tufted hairgrass)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Hordeum brachyantherum (northern meadow barley)
Plantago maritima (seaside plantain) (locally codominant)
Puccinellia sp. (alkaligrass)
Spergularia cf canadensis (winged sandspurry)

Distichlis spicata community (mapping symbol 2)

Dominant Species

Distichlis spicata (saltgrass)

Minor Species

Agrostis alba (redtop) (non-native)
Atriplex patula var. hastata (saltbush)
Grindelia integrifolia (gumweed)
Hordeum brachyantherum (northern meadow barley)
Jaumea carnosa (jaumea)
Puccinellia sp. (alkaligrass)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

II. Silty, High Salinity, High Intertidal Marsh

The silty, high salinity, high intertidal marsh is intermediate between high intertidal and low intertidal marsh. It occurs on relatively high, seaward terrace edges or adjacent to, and inland of, low intertidal marsh. A single community, codominated by Distichlis spicata and Juncus gerardii, makes up this marsh type.

Distichlis spicata-Juncus gerardii community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)
Juncus gerardii (mud rush)

Subdominant Species

Glaux maritima (saltwort)

Minor Species

Agrostis alba (redtop) (non-native)
Aster subspicatus (Douglas' aster)
Atriplex patula var. hastata (saltbush)
Grindelia integrifolia (gumweed)
Hordeum brachyantherum (northern meadow barley)
Jaumea carnosa (jaumea)
Plantago maritima (seaside plantain)
Potentilla pacifica (Pacific silverweed)
Puccinellia sp. (alkaligrass)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

III. Silty, Low Salinity, High Intertidal Marsh

A silty, low salinity, high intertidal marsh occurs along the upland marsh edge and in one area of lower elevation which has freshwater seepage. The primary community within this marsh type is codominated by Aster subspicatus, Juncus balticus and Potentilla pacifica. A variant of this community is dominated by Carex lyngbyei with Aster subspicatus, Juncus balticus and Potentilla pacifica as subdominants. It occurs in a freshwater seep and creek drainage. A few low salinity, high intertidal areas are dominated or codominated by a non-native species, Agrostis alba, and are not described here.

Aster subspicatus-Juncus balticus-Potentilla pacifica community (mapping symbol 4)

Dominant Species

Aster subspicatus (Douglas' aster)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Minor Species

Achillea millefolium (yarrow)
Agrostis alba (redtop) (non-native) (locally codominant)
Carex lyngbyei (Lyngby's sedge)
Deschampsia caespitosa (tufted hairgrass)
Triglochin maritimum (seaside arrowgrass)

Carex lyngbyei community (mapping symbol 5)

Dominant Species

Carex lyngbyei (Lyngby's sedge)

Subdominant

Agrostis alba (redtop) (non-native)
Aster subspicatus (Douglas' aster)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Minor Species

Deschampsia caespitosa (tufted hairgrass)
Scirpus acutus (hardstem bulrush)
Triglochin maritimum (seaside arrowgrass)
Typha latifolia (cattail)

IV. Transition Marsh

Transition marsh occurs in the same freshwater seepage and creek area as the Carex lyngbyei dominated, low salinity, high intertidal marsh previously described. There is one marsh assemblage described here. It is a mosaic of Scirpus acutus and Typha latifolia.

Scirpus acutus (hardstem bulrush)-Typha latifolia (cattail) mosaic (mapping symbol 6)

LAND USE HISTORY:

This area is not pristine, but, relative to similar marsh systems in the Puget Trough region, is in good condition. The upland has been logged at least once. Large milled timbers along one stream channel in the marsh suggest past logging activities. An old road built on either a barge or bridge is still evident crossing the stream channel and tidelands at the far southwest end of the marsh. Past grazing was likely at the southwest and northeast ends of the marsh. Old fencing occurs at both ends. A home and pasture land abut the marsh on the northeast end. A fenced area and building abut the marsh near the transition zone marsh. An overgrown gravel road leading from a parking lot, approaches the marsh on the southeast side. The area may be used by hunters.

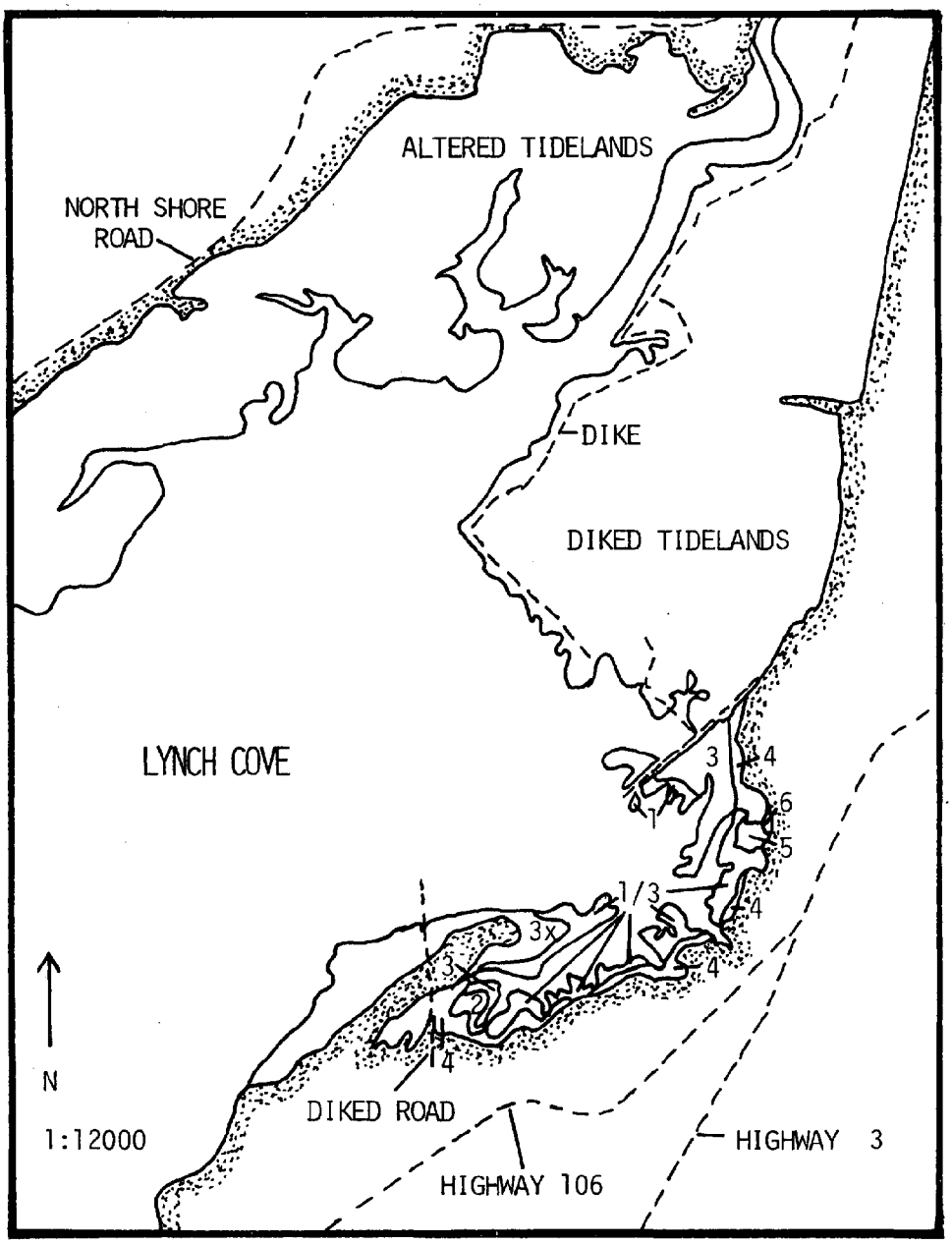

Figure 22. LYNCH COVE FEATURES MAP

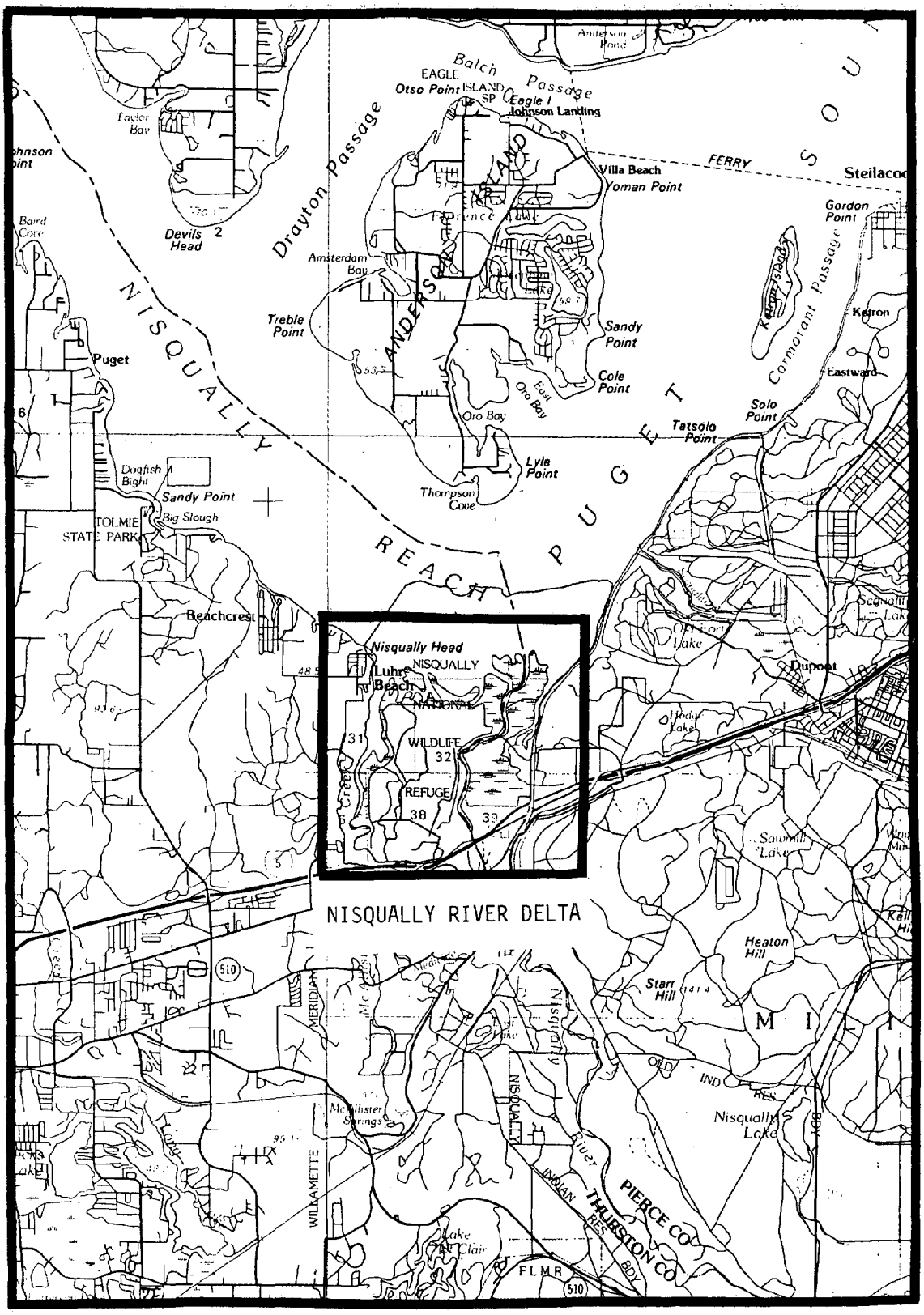

Figure 23. NISQUALLY RIVER DELTA LOCATIONAL MAP

NISQUALLY RIVER DELTA

LOCATION:

Pierce and Thurston Counties; T18N, R1E, portions of sections 6, 38 and 39 and T19N, R1E, portions of sections 28, 29, 30, 31, 32 and 33. The site includes the undiked lower tidal reaches and deltas of McAllister Creek and the Nisqually River (Fig. 23).

SIGNIFICANCE:

The Nisqually River Delta is a large diverse tidal marsh system grading from high salinity, low intertidal lands to a forested surge plain. The area is also significant for its use by wildlife.

GENERAL DESCRIPTION:

Figure 24 illustrates the distribution of features at Nisqually Delta. The features are:

1. a sandy, high salinity, low intertidal marsh;
2. a sandy, low salinity, low intertidal marsh;
3. a sandy, high intertidal marsh; and
4. a surge plain forest.

The area of interest lies seaward of extensive dike and ditch systems along the lower tidal reach of McAllister Creek and Nisqually River. It is developed on alluvium, primarily sands and silty-sands. Salinities were not measured, but based on the differing salt tolerances and distributions of plant species found in the area, salt and freshwater influences are variable, with salinities ranging from freshwater to euhaline.

Burg, Tripp and Rosenberg (1980) conducted a vegetation study of the Nisqually River Delta. The vegetation map and plant community descriptions in this report are based upon their work. Surveys were conducted throughout the area to calibrate their work with this study and to obtain additional data.

FEATURES:

I. Sandy, High Salinity, Low Intertidal Marsh:

Most of the delta has been diked, leaving an outer fringe of relatively unaltered tidal wetlands. This outer fringe of marsh is dominated by sandy, high salinity, low intertidal marsh. The area typically has numerous tidal channels and salt pannes. Substrates are sands to

silty-sands. A number of plant communities occur within this marsh type. The first is an infrequently occurring community composed solely of Salicornia virginica. This community is typically found on sands, particularly in depressions. The second community is dominated by Distichlis spicata. The third community is codominated by Distichlis spicata and Salicornia virginica.

Three additional communities were described by Burg, Tripp and Rosenberg (1980). One is a monospecific community composed of a non-native annual, Spergularia marina (saltmarsh sandspurry). The second is a community codominated by Distichlis spicata and Jaumea carnosa. Burg, et al. (1980) describe this community as occurring in depressional areas. In this study it was observed to occur in old tidal channels and on sandy road grades. The third community is an ecotone codominated by Carex lyngbyei, Distichlis spicata, Potentilla pacifica and Triglochin maritimum.

Salicornia virginica (pickleweed) monospecific community (mapping symbol 1)

Distichlis spicata community (mapping symbol 2)

Dominant Species

Distichlis spicata (saltgrass)

Minor Species

Carex lyngbyei (Lyngby's sedge)
Deschampsia caespitosa (tufted hairgrass)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)

Distichlis spicata-Salicornia virginica community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Subdominant Species

Triglochin maritimum (seaside arrowgrass)

Minor Species

Glaux maritima (saltwort) (locally codominant)
Plantago maritima (seaside plantain)

Distichlis spicata-Jaumea carnosa community (mapping symbol 4)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)

Subdominant Species

Plantago maritima (seaside plantain)

Minor Species

Atriplex patula var. hastata (saltbush)
Deschampsia caespitosa (tufted hairgrass)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Carex lyngbyei-Distichlis spicata-Potentilla pacifica-Triglochin maritimum community (mapping symbol 5)

Dominant Species

Carex lyngbyei (Lyngby's sedge)
Distichlis spicata (saltgrass)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Deschampsia caespitosa (tufted hairgrass)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)
Jaumea carnosa (jaumea)
Juncus balticus (Baltic rush)
Plantago maritima (seaside plantain)
Salicornia virginica (pickleweed)
Stellaria humifusa (low starwort)

II. Sandy, Low Salinity, Low Intertidal Marsh

This marsh type occurs on low terraces along river and stream channels. It is represented by a single plant community which is often composed solely of Carex lyngbyei.

Carex lyngbyei community (mapping symbol 6)

Dominant Species

Carex lyngbyei (Lyngby's sedge)

Minor Species

Deschampsia caespitosa (tufted hairgrass)
Eleocharis palustris (common spikerush)
Equisetum sp. (scouring rush)
Grindelia integrifolia (gumweed)
Lilaeopsis occidentalis (lilaeopsis)

III. Sandy, High Intertidal Marsh

This marsh type occurs on high terraces primarily along the main channel of the Nisqually River. Some deep tidal channels are found through these areas, but salinities are typically brackish. The marsh in these areas shows signs of disturbance. Vegetational patterns are somewhat obscure. Nonetheless, four plant communities are described. The first is dominated by Festuca rubra. The second is dominated by Juncus balticus. The third is dominated by Deschampsia caespitosa. The fourth community is dominated by a short growth form of Carex lyngbyei which occurs in slight depressions.

Festuca rubra community (mapping symbol 7)

Dominant Species

Festuca rubra (red fescue)

Minor Species

Agrostis alba (redtop) (non-native) (locally codominant)
Angelica lucida (seawatch)
Carex lyngbyei (Lyngby's sedge)
Deschampsia caespitosa (tufted hairgrass)
Equisetum sp. (scouring rush)
Grindelia integrifolia (gumweed)
Juncus balticus (Baltic rush)

Plantago lanceolata (English plantain) (non-native)
Rumex occidentalis (western dock)
Trifolium wormskjoldii (spring bank clover)
Triglochin maritimum (seaside arrowgrass)

Juncus balticus community (mapping symbol 8)

Dominant Species

Juncus balticus (Baltic rush)

Minor Species

Angelica lucida (seawatch)
Carex lyngbyei (Lyngby's sedge)
Deschampsia caespitosa (tufted hairgrass)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Lilaeopsis occidentalis (lilaeopsis)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)

Deschampsia caespitosa community (mapping symbol 9)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)

Minor Species

Agrostis alba (redtop) (non-native)
Carex lyngbyei (Lyngby's sedge)
Festuca rubra (red fescue)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)

Carex lyngbyei community (mapping symbol 10)

Dominant Species

Carex lyngbyei (Lyngby's sedge)

Minor Species

Agrostis alba (redtop) (non-native)
Eleocharis palustris (common spike-rush) (locally subdominant)
Lilaeopsis occidentalis (lilaeopsis)
Potentilla pacifica (Pacific silverweed)

IV. Surge Plain Wetland

The surge plain wetland is a forested riparian region along the Nisqually River which is infrequently influenced by tidal waters. Soils are sands and silty-sands. The overstory is relatively homogeneous, codominated by Populus trichocarpa and Alnus rubra. Two major communities can be distinguished, based on understory dominance. The first is dominated by Symphoricarpos albus, the second by Rubus spectabilis.

Populus trichocarpa-Alnus rubra/Symphoricarpos albus community (mapping symbol 11)

Dominant Species

Alnus rubra (red alder)
Populus trichocarpa (black cottonwood)
Symphoricarpos albus (snowberry)

Minor Species

Acer macrophyllum (bigleaf maple)
Equisetum hyemale (Dutch rush) (locally subdominant)
Oemleria cerasiformis (Indian plum)
Ribes cf divaricatum (gooseberry)
Rubus spectabilis (salmonberry)

Populus trichocarpa-Alnus rubra/Rubus spectabilis community (mapping symbol 12)

Dominant Species

Alnus rubra (red alder)
Populus trichocarpa (black cottonwood)
Rubus spectabilis (salmonberry)

Subdominant Species

Urtica sp. (nettle)

Minor Species

Acer circinatum (vine maple)
Acer macrophyllum (bigleaf maple)
Berberis aquifolium (shining Oregongrape)
Carex sp. (sedge)
Clematis vitalba (travelers-joy)
Cornus stolonifera (red-osier dogwood)
Corydalis scouleri (Scouler's corydalis)

Dicentra formosa (Pacific bleedingheart)
Galium sp. (bedstraw)
Glecoma hederacea (creeping Charlie) (non-native)
Montia sibirica (western springbeauty)
Oemleria cerasiformis (Indian plum)
Polystichum munitum (swordfern)
Ribes cf divaricatum (gooseberry)
Sambucus racemosa (red elderberry)

LAND USE HISTORY:

The Nisqually River Delta has had a long history of use by Indians. Since the late 1800s, white settlers have converted the tidelands and flood plains along the lower reaches of McAllister Creek and the Nisqually River into pasture and agricultural lands. In 1904, Alson L. Brown bought a large area of the delta and began building an extensive dike and ditch system, which make up what is currently known as the Brown Farm. Ditches, dikes and fence remnants on the tidelands seaward of the main dike indicate past use of some marsh areas. Old pilings and cable in the surge plain forest suggest past logging activities. In 1974, the Brown Farm area was acquired by the U.S. Fish and Wildlife Service. The area, including adjacent State Game Department lands, is managed as a wildlife refuge. It is open to the public for restricted day use, and to hunters during hunting season.

FIGURE 24 is located in the map pocket on the back cover.

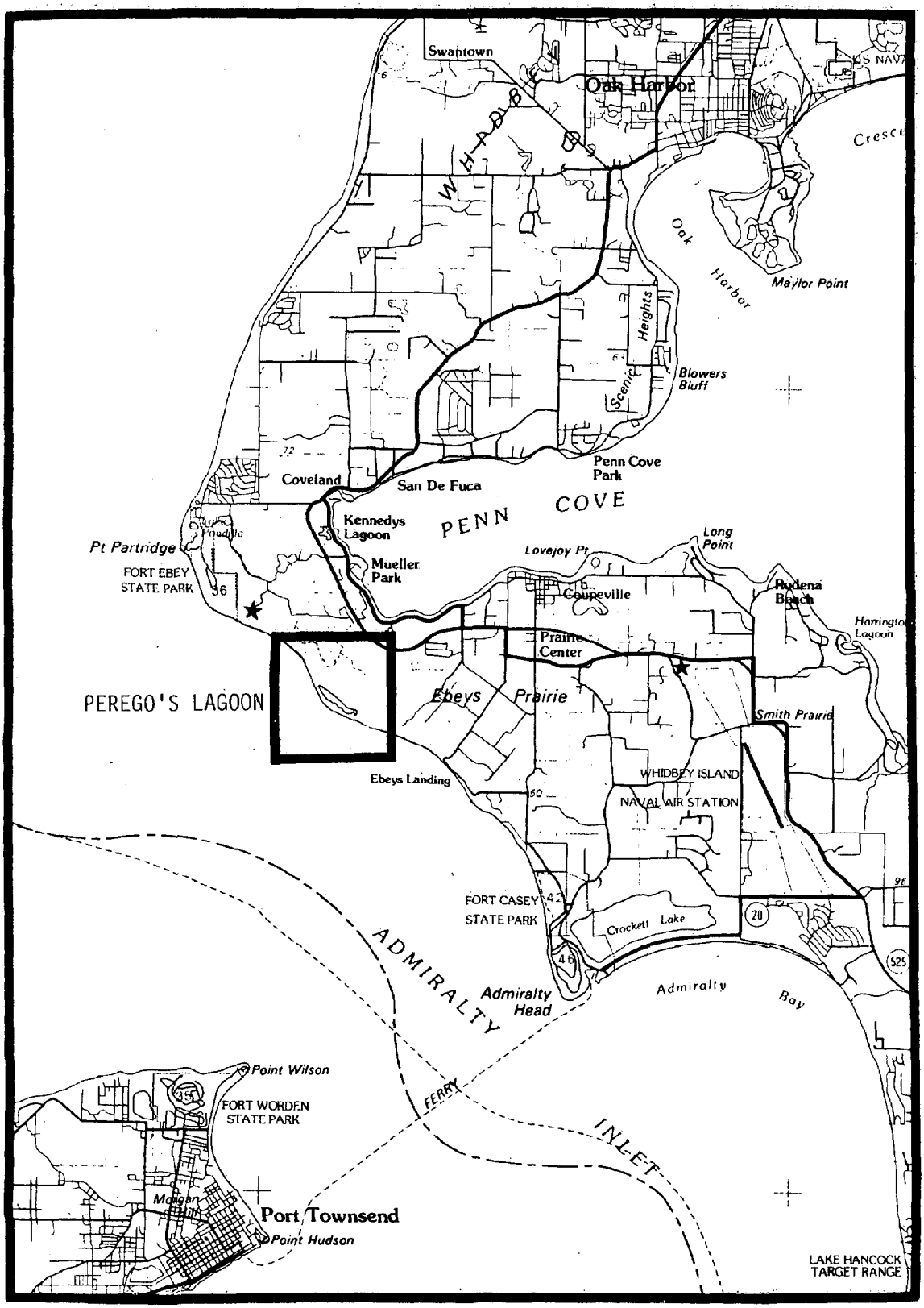

Figure 25. PEREGO'S LAGOON LOCATIONAL MAP

PEREGO'S LAGOON

LOCATION:

Island County; T31N, R1E, portions of section 6. The site is located on the west side of Whidbey Island between Admiralty Head and Point Partridge (Fig. 25).

SIGNIFICANCE:

Perego's Lagoon is a high quality berm and lagoon system.

GENERAL DESCRIPTION:

Figure 26 illustrates the distribution of features of Perego's Lagoon. The features are:

1. a berm;
2. a lagoon pond; and
3. a sandy, high salinity, low intertidal marsh.

The area is approximately 52 acres. The lagoon is behind a berm which extends along the base of a steep grassy bluff. Substrates of the lagoon system are primarily sandy gravels. At the southeast end of the lagoon pond, the substrate is overlain by black, sometimes anoxic organic matter. Driftwood has accumulated along the berm and at the southeast end of the lagoon.

The berm was breached at its northwest end by storm tides in December, 1982. A 1981 aerial photograph shows the berm intact, without a channel between the lagoon and the Strait of Juan de Fuca. A 1978 aerial photo also shows a series of small berms, lagoon ponds, lines of driftwood and salt marshes within and at the southeast end of Perego's Lagoon. This pattern indicates the predominance of northwest winds and waves which carry driftwood and debris into the lagoon.

Perego's Lagoon appears to receive heavy shorebird and waterfowl use.

FEATURES:

I. Berm

The berm forms an unvegetated, sand and gravel beach on the southwest side. Driftwood has accumulated along the top and leeward side of the berm. The leeward or lagoon side of the berm is vegetated with

typical sand dune species. The vegetation is diverse and apparently varies with substrate and the degree of natural disturbance. However, vegetational patterns are not distinct enough to define communities. The berm exhibits little evidence of human disturbance and non-native species have low cover values and frequency.

Berm vegetation (mapping symbol 1)

Dominant Species

Elymus mollis (dune wildrye)
Festuca rubra (red fescue)

Minor Species

Abronia latifolia (yellow sandverbena)
Achillea millefolium (yarrow)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Armeria maritima (thrift)
Atriplex patula var. hastata (saltbush)
Carex macrocephala (large headed sedge)
Convolvulus soldanella (beach morning-glory)
Grindelia integrifolia (gumweed)
Lepidium virginicum var. menziesii (tall pepperweed)
Lomatium nudicaule (barestem lomatium)
Lupinus littoralis (shore lupine)
Orobanche californica (California broomrape)
Plantago lanceolata (English plantain) (non-native)
Poa pratensis (Kentucky bluegrass) (non-native)
Polygonum paronychia (nailwort knotweed)
Rosa nutkana (Nootka rose)
Sambucus sp. (elderberry)
Vicia gigantea (giant vetch)

II. Lagoon Pond

Prior to December, 1982, the lagoon pond was completely enclosed by the berm and adjacent upland bluffs. It had been described by Cook (1973) as a brackish lake. From vegetation presently occurring around the pond's margins, it is probable that the lagoon, prior to breaching, was at least polyhaline and may have reached hyperhaline levels. Since the breaching, marine waters flood the lagoon with each high tide. Freshwater influence is limited to runoff from adjacent uplands. Salinities within the lagoon pond are now probably euhaline.

III. Sandy, High Salinity, Low Intertidal Marsh

Marsh development is primarily at the southeast end of the lagoon and along the southern lagoon margin. Areas of the marsh, particularly at the southeast end of the lagoon appear naturally disturbed or abraided, probably by driftwood. There is a large driftwood accumulation at the southeast end of the lagoon, but aerial photographs indicate this to have been more extensive in the past. Substrates are composed of sands overlain by organic matter. Two plant communities are present here. One is pure Salicornia virginica; the other is codominated by Distichlis spicata and Salicornia virginica.

Salicornia virginica (pickleweed) monospecific community (mapping symbol 2)

Distichlis spicata-Salicornia virginica community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Spergularia canadensis (winged sandspurry)

LAND USE HISTORY:

Perego's Lagoon is named after its first landowner, George W.S.H. Perego, who claimed the land about 1876. The lagoon appears to have received very little use since that time. The adjacent uplands have been heavily grazed in the past. Washington State Parks acquired the northern half of Perego's Lagoon in 1982. The National Park Service is in the process of buying the uplands adjacent to that portion of the lagoon newly acquired by State Parks. This area is to be managed as part of Fort Ebey State Park and Ebey's Landing National Historic Reserve. The remainder of the lagoon and adjacent uplands are privately owned with no apparent threat of development. Currently, day use is made of the site, though this appears somewhat limited by restricted access.

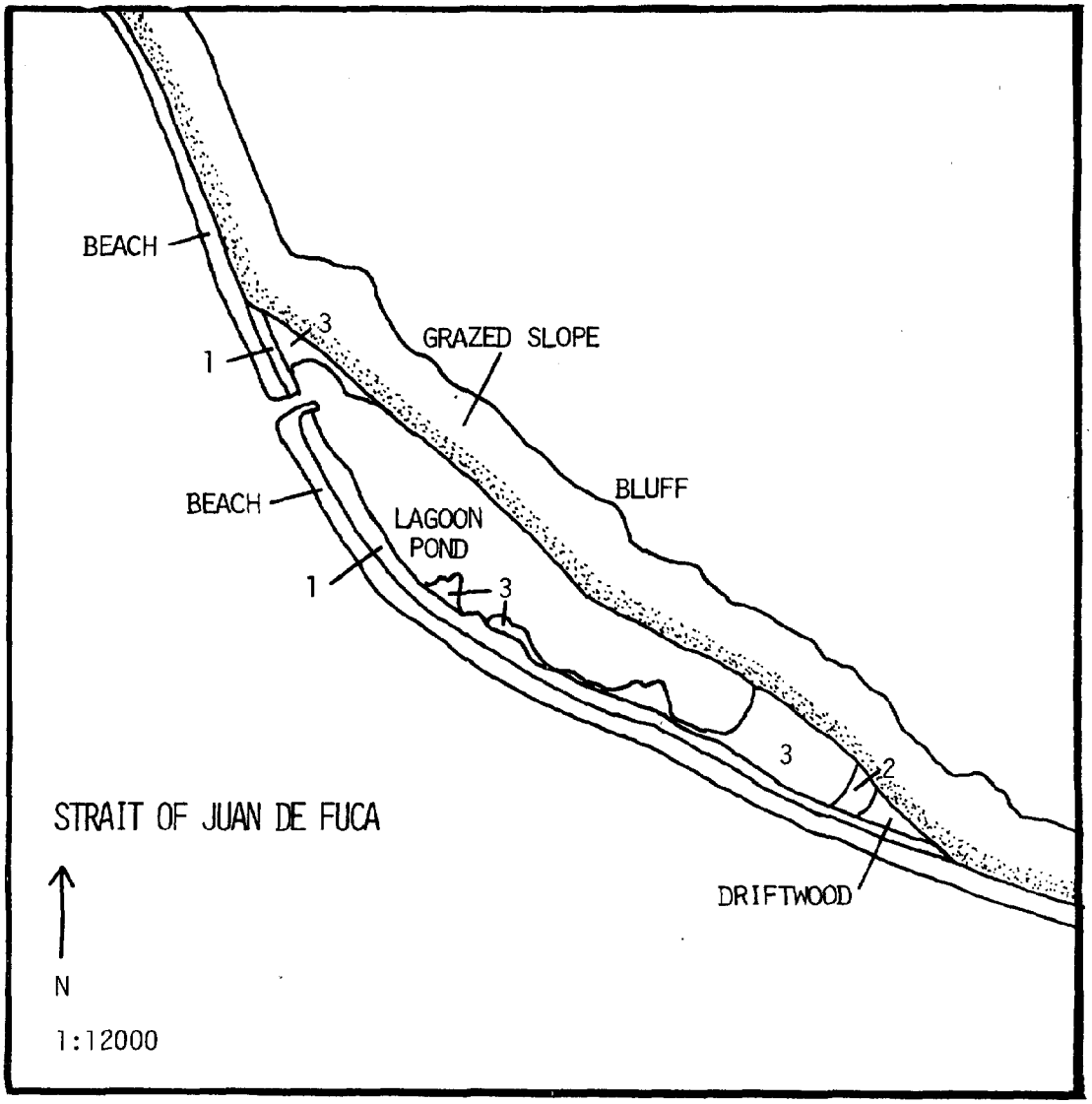

Figure 26. PEREGO'S LAGOON FEATURES MAP

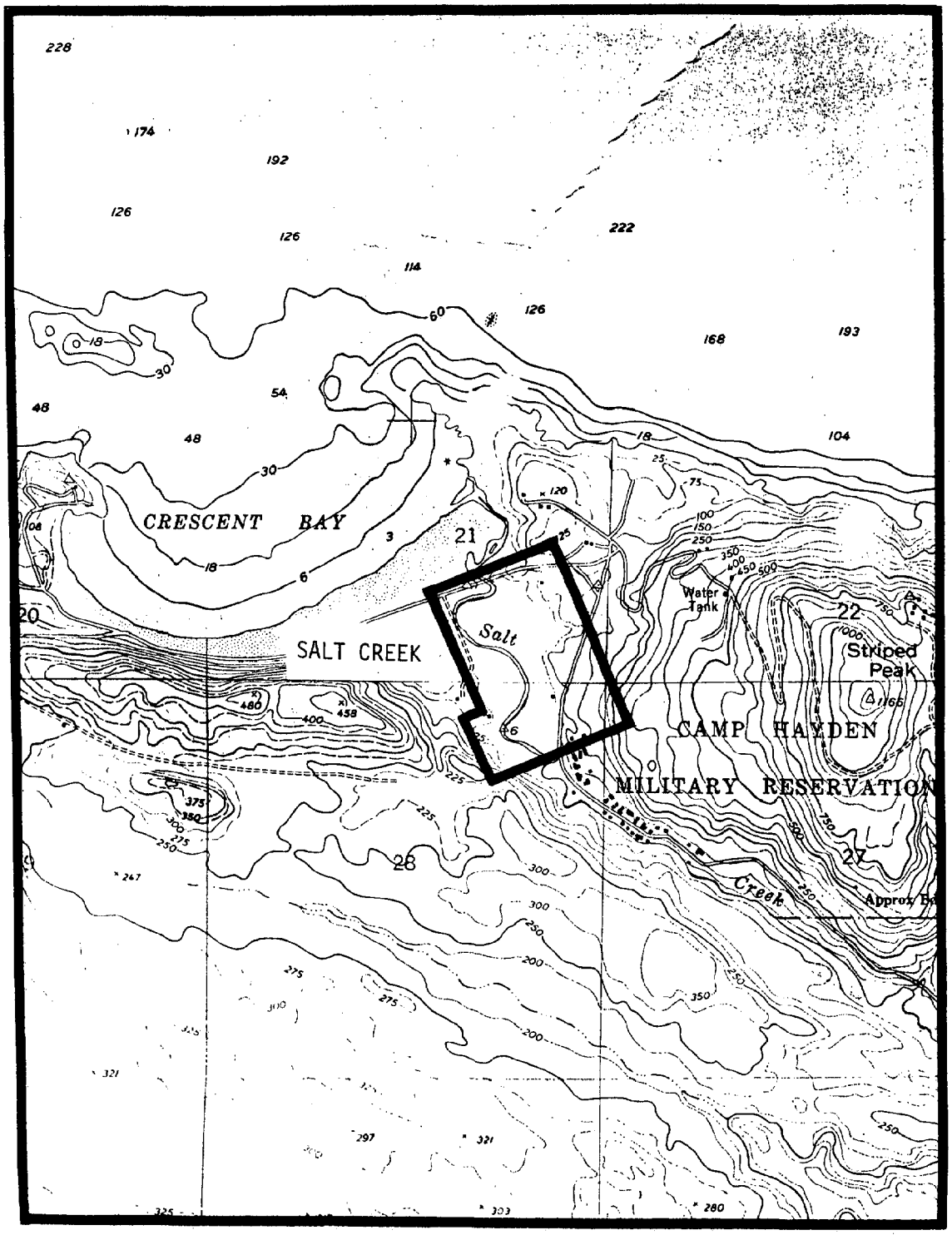

Figure 27. SALT CREEK LOCATIONAL MAP

SALT CREEK

LOCATION:

Clallam County; T31N, R8W, portions of sections 21 and 28. The site is located along the tidal reach of Salt Creek west of Salt Creek County Park (Fig. 27).

SIGNIFICANCE:

Salt Creek tidal river marsh is the highest quality, silty, high salinity, high intertidal, Deschampsia caespitosa-Salicornia virginica marsh known for the Puget Trough region. This is an unusual marsh type for the region.

GENERAL DESCRIPTION:

Figure 28 illustrates the distribution of features at Salt Creek. The features are:

1. a silty, polyhaline, low intertidal marsh; and
2. a silty, polyhaline, high intertidal marsh.

The marsh area of interest is approximately 23 acres. The marsh occurs on high terraces along the tidal reach of Salt Creek. Substrates are alluvial sand, silt and clay. Salinities range from 26 to 30 ppt in the two featured marsh types, but range from 36 to 0.5 ppt throughout the tidal area. The creek surface salinity is 6 ppt. The area of interest also includes low terraces along the creek channel dominated by Carex lyngbyei (Lyngby's sedge). A few high ridges along the creek are dominated by high intertidal plant species.

The area of interest is bounded to the north by fill, on which are built a campground and the Hayden Camp Road. To the northwest, it is bounded by a driveway built on fill. The rest of the marsh area is bordered by upland of second growth forest and rural, low density housing.

FEATURES:

I. Silty, Polyhaline, Low Intertidal Marsh

The silty, polyhaline, low intertidal marsh occurs in depressional areas and along tidal channels at Salt Creek. The marsh type is represented by a variable community which is dominated by Distichlis spicata with Jaumea carnosa and Salicornia virginica as sub- to codominants. In one small area, S. virginica occurs as a pure stand.

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 1)

Dominant Species

Distichlis spicata (saltgrass)

Subdominant Species

Jaumea carnosa (jaumea) (locally codominant)
Salicornia virginica (pickleweed) (locally codominant)

Minor Species

Deschampsia caespitosa (tufted hairgrass)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)
Puccinellia sp. (alkaligrass)
Stellaria humifusa (low starwort)
Triglochin maritimum (seaside arrowgrass)

Salicornia virginica (pickleweed) monospecific community (mapping symbol 2)

II. Silty, Polyhaline, High Intertidal Marsh

This silty, polyhaline, high intertidal marsh type is intermediate between a high and low intertidal marsh and could be placed in either category. This marsh type frequently occurs in Grays Harbor and Willapa Bay, but is rare in the Puget Trough region. At Salt Creek it occurs on high river terraces which contain a few tidal channels, yet which have salinities of about 26 ppt. Three communities comprise this marsh type. The first is codominated by Deschampsia caespitosa and Distichlis spicata. The second is codominated by Deschampsia caespitosa and Salicornia virginica. The third is dominated by Distichlis spicata. In places, the marsh shifts to nearly pure Deschampsia caespitosa.

Deschampsia caespitosa-Distichlis spicata community (mapping symbol 3)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)
Distichlis spicata (saltgrass)

Subdominant Species

Agrostis alba (redtop) (non-native) (locally codominant)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)
Jaumea carnosa (jaumea)
Potentilla pacifica (Pacific silverweed)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Deschampsia caespitosa-Salicornia virginica community (mapping symbol 4)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)
Salicornia virginica (pickleweed)

Minor Species

Agrostis alba (redtop) (non-native)
Atriplex patula var. hastata (saltbush)
Distichlis spicata (saltgrass)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)
Juncus balticus (Baltic rush)
Triglochin maritimum (seaside arrowgrass)

Distichlis spicata community (mapping symbol 5)

Dominant Species

Distichlis spicata (saltgrass)

Subdominant Species

Agrostis alba (redtop) (non-native)
Potentilla pacifica (Pacific silverweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Deschampsia caespitosa (tufted hairgrass)
cf Festuca arundinacea (alta fescue) (non-native)
Glaux maritima (saltwort)
Hordeum jubatum (foxtail barley)
Poa sp. (bluegrass)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

LAND USE HISTORY:

The Salt Creek tidal river marsh is located near the site of the old Camp Hayden. It apparently was not affected by the military reserve development. Camp Hayden Road crosses the mouth of Salt Creek on a piling-supported bridge. The seaward marsh edge was filled to accommodate the road, and later to provide space for a roadside campground. A private driveway was built on fill through the marsh. The driveway runs approximately north and south to the west of Salt Creek. The marsh area to the west of this driveway has been extensively altered and is not included in this site recommendation. Grazing apparently has been minimal throughout the recommended portion of the marsh. The creek channel in the upper tidal reach appears to have been channeled at some time with dredge spoils piled along the creek banks.

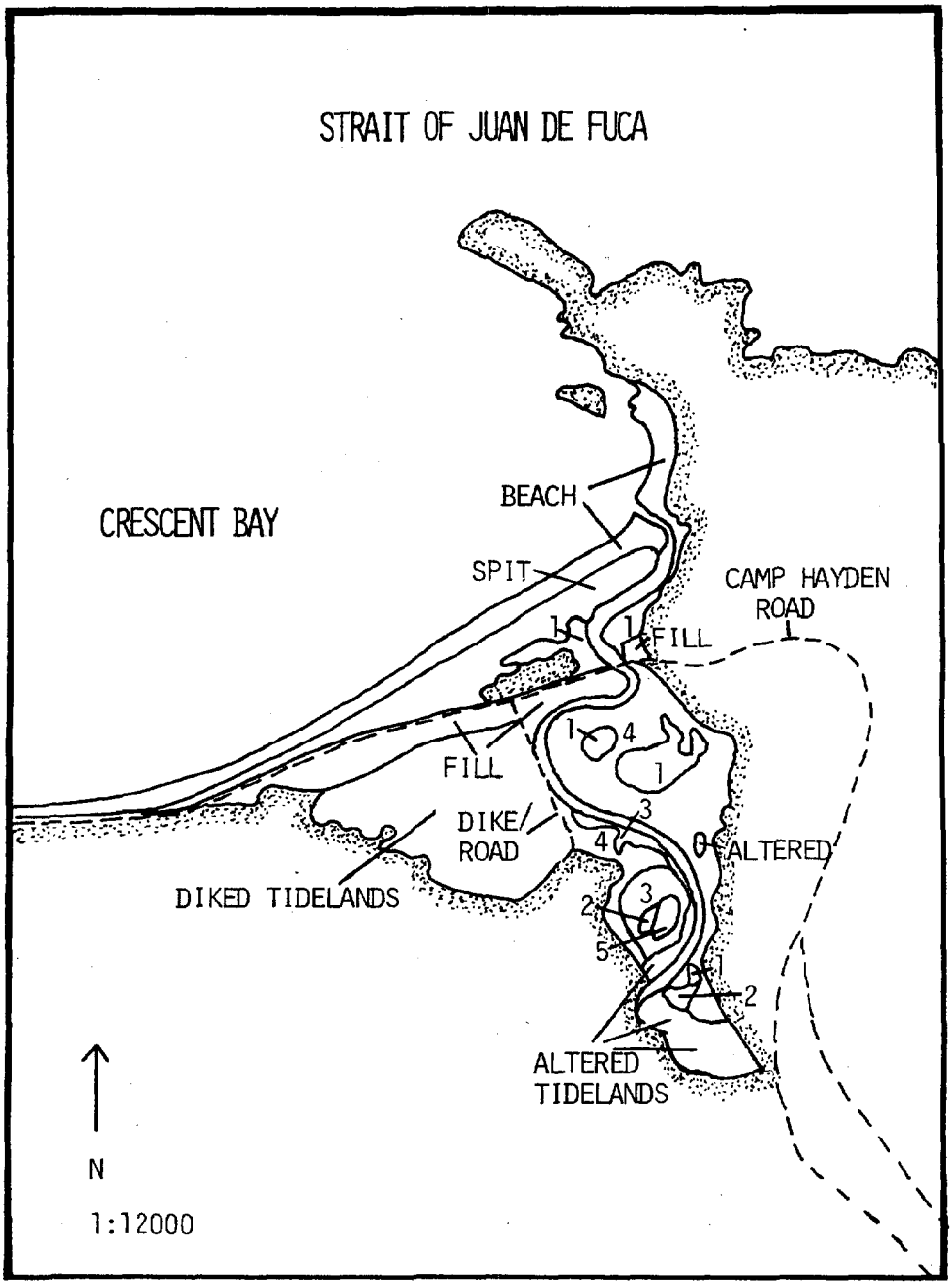

Figure 28. SALT CREEK FEATURES MAP

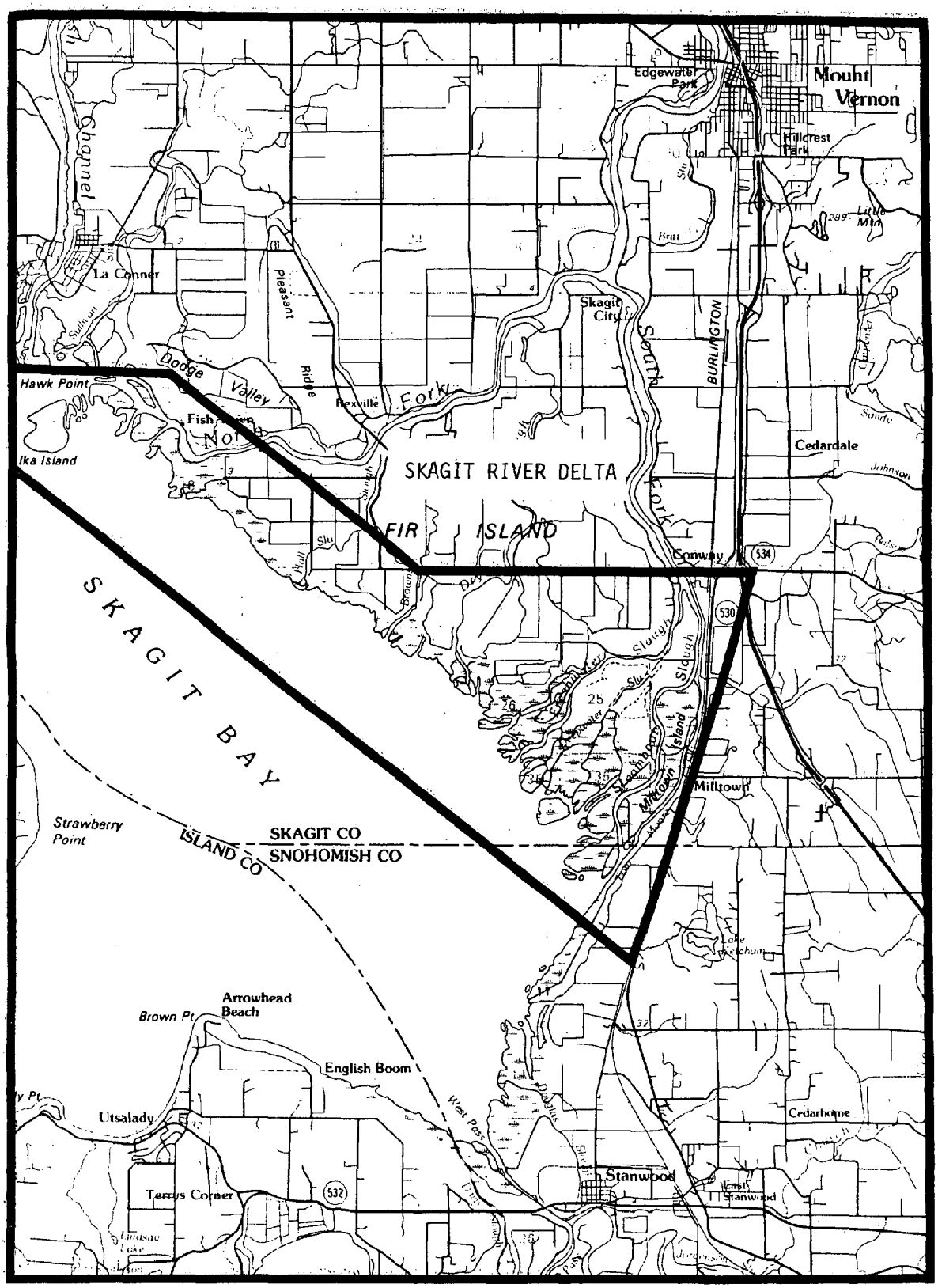

Figure 29. SKAGIT RIVER DELTA LOCATIONAL MAP

SKAGIT RIVER DELTA

LOCATION:

Skagit and Snohomish Counties, T32N, R3E, portions of section 1; T33N, R3E, portions of sections 7, 16, 17, 18, 20, 21, 22, 25, 26, 27, 35 and 36 and T33N, R4E, portions of sections 30 and 31. The site includes the undiked tidal marsh and surge plain on Fir Island. It is located on the Skagit River Delta between the North Fork Skagit River to the north and Tom Moore Slough to the south (Fig. 29).

SIGNIFICANCE:

This is the largest, relatively high quality brackish marsh of this type known in the Puget Trough Region. Included in the site is a bald eagle nest.

GENERAL DESCRIPTION:

Figure 30 illustrates the distribution of features of the Skagit Bay site. The features are:

1. a bald eagle nest;
2. a sandy, low salinity, low intertidal marsh;
3. a silty, low salinity, low intertidal marsh;
4. a low salinity, high intertidal marsh;
5. a transition marsh; and
6. a surge plain wetland.

The site extends for approximately 10 miles along the diked shoreline of Skagit Bay, between Tom Moore Slough to the south and the North Fork Skagit River to the north. Most of the Skagit Bay vegetated tidelands and Skagit River delta have been diked, ditched and filled. However, a narrow band of primarily brackish, low intertidal marsh occurs bayward of the dikes. Areas of undiked surge plain wetland occur along the distributaries of the South Fork Skagit River. Substrates are alluvial sands, silts and clays. Anoxic organic matter has accumulated in areas.

Ewing (1982) conducted a detailed ecophysiological study of the tidal marsh between Freshwater and Hall Sloughs. In his study, Ewing reported that water surface salinities ranged from 0 to 22 ppt. and soil salinities ranged between 0 and 15 ppt. Vegetational patterns suggest that similar salinities occur throughout the marsh.

FEATURES:

I. Bald Eagle (Haliaeetus leucocephalus)

Federal Status: Threatened in Washington State

State Status: Threatened

A nesting territory is located within the site. Several nests have been built within the territory. However, since 1975, young have been successfully fledged from only one of the nests (Nongame Data Systems).

II. Sandy, Low Salinity, Low Intertidal Marsh

A sandy, low salinity, low intertidal marsh has developed over well aerated sandy soils. The primary community making up this marsh type is dominated by and frequently solely composed of Scirpus americanus. It occurs mostly on the outer marsh flats. Carex lyngbyei forms nearly pure colonies along freshwater creek channels.

Scirpus americanus community (mapping symbol 1)

Dominant Species

Scirpus americanus (American bulrush)

Minor Species

Cotula coronopifolia (brass buttons) (non-native)
Eleocharis acicularis (needle spike-rush)
Spergularia marina (saltmarsh sandspurry) (non-native)

Carex lyngbyei (Lyngby's sedge) monospecific community (mapping symbol 2)

III. Silty, Low Salinity, Low Intertidal Marsh

A number of communities fall within this marsh type on the Skagit River delta. The first is dominated by Scirpus maritimus. It typically occurs on anoxic silts, frequently forming monospecific communities, either on outer marsh flats or in mosaic with other communities. The second community occurs on pedestals. It is species rich and variable, but is typically codominated by Triglochin maritimum and Scirpus americanus. The Scirpus maritimus community frequently occurs in the interpedestal areas. A third community is dominated by Carex lyngbyei. It may occur on soils ranging from silty-sands to clays. The fourth community is usually entirely composed of Scirpus validus. It appears most frequently on silts.

Scirpus maritimus community (mapping symbol 3)

Dominant Species

Scirpus maritimus (seacoast bulrush)

Minor Species

Cotula coronopifolia (brass buttons) (non-native)
Eleocharis acicularis (needle spike-rush)
Lilaeopsis occidentalis (lilaeopsis)
Spergularia marina (saltmarsh sandspurry) (non-native)
Triglochin maritimum (seaside arrowgrass)

Triglochin maritimum-Scirpus americanus community (mapping symbol 4)

Dominant Species

Scirpus americanus (American bulrush)
Triglochin maritimum (seaside arrowgrass)

Subdominant Species

Plantago maritima (seaside plantain) (locally codominant)

Minor Species

Agrostis alba (redtop) (non-native)
Carex lyngbyei (Lyngby's sedge)
Cotula coronopifolia (brass buttons) (non-native)
Deschampsia caespitosa (tufted hairgrass)
Eleocharis acicularis (needle spike-rush)
Eleocharis parvula (small spike-rush)
Glaux maritima (saltwort)
Juncus balticus (Baltic rush)
Lilaeopsis occidentalis (lilaeopsis)
Potentilla pacifica (Pacific silverweed)
Ranunculus cymbalaria (shore buttercup)
Spergularia marina (saltmarsh sandspurry) (non-native)

Carex lyngbyei community (mapping symbol 5)

Dominant Species

Carex lyngbyei (Lyngby's sedge)

Minor Species

Agrostis alba (redtop) (non-native)
Cotula coronopifolia (brass buttons) (non-native)
Deschampsia caespitosa (tufted hairgrass)
Eleocharis palustris (common spike-rush)
Potentilla pacifica (Pacific silverweed)
Ranunculus cymbalaria (shore buttercup)
Scirpus americanus (American bulrush)
Sium suave (hemlock waterparsnip)
Triglochin maritimum (seaside arrowgrass)

Scirpus validus (softstem bulrush) monospecific community (mapping symbol 6)

III. Low Salinity, High Intertidal Marsh

Very little low salinity, high intertidal marsh still occurs in this area. The areas surveyed had a high frequency of non-native plant species and show signs of trampling and grazing. An area south of the mouth of the North Fork Skagit River has an assemblage which is in relatively good condition. It is codominated by Aster subspicatus, Juncus balticus and Potentilla pacifica.

Aster subspicatus-Juncus balticus-Potentilla pacifica assemblage (mapping symbol 7)

Dominant Species

Aster subspicatus (Douglas' aster)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Minor Species

Achillea millefolium (yarrow)
Agrostis alba (redtop) (non-native) (locally codominant)
Atriplex patula var. hastata (saltbush)
Carex lyngbyei (Lyngby's sedge)
Distichlis spicata (saltgrass)
Festuca arundinacea (alta fescue) (non-native)
Glaux maritima (saltwort)
Heracleum lanatum (cow parsnip)
Hordeum brachyantherum (northern meadow barley)
Lathyrus palustris (marsh pea vine)
Rumex occidentalis (western dock)
Triglochin maritimum (seaside arrowgrass)
Vicia gigantea (giant vetch)

IV. Transition Marsh

Transition marsh may occur along the dike edge or the upper tidal reach of a freshwater drainage system. Soils are silts or sands with overlaying organic matter. A single community, usually composed entirely of Typha latifolia, makes up this community.

Typha latifolia (cattail) monospecific community (mapping symbol 8)

V. Surge Plain Wetland

Surge plain wetlands occur along the upper tidally influenced reaches of the South Fork Skagit River and its distributaries. During high tides, saltwater wedges form in the channels causing freshwater to flood out of the banks and onto the wetland (Ewing, 1982). Beyond a certain level, saltwater also flows out of the channel. This surge plain wetland is dominated by woody plant species. There appears to be a gradual shift from those tolerant of occasional brackish water influence to typically freshwater wetland species. A thorough vegetation survey was not possible; however, a partial species list follows.

Surge Plain Wetland (mapping symbol 9)

General Vegetation

Alnus rubra (red alder)
Athyrium filix-femina (lady fern)
Carex lyngbyei (Lyngby's sedge)
Cornus stolonifera (red-osier dogwood)
Epilobium sp. (fireweed)
Heracleum lanatum (cow parsnip)
Lonicera involurata (black twinberry)
Lysichitum americanum (skunk cabbage)
Myrica cf gale (wax-myrtle)
Picea sitchensis (Sitka spruce)
Populus trichocarpa (black cottonwood)
Rosa cf nutkana (Nootka rose)
Rumex cf occidentalis (dock)
Salix sp. (willow)
Salix hookeriana (Hooker willow)
Salix lasiandra (Pacific willow)
Scirpus validus (softstem bulrush)
Spiraea douglasii (spirea)
Tsuga heterophylla (western hemlock)
Typha latifolia (cattail)

LAND USE HISTORY:

Diking, ditching and filling of the tidelands began in the mid to late 1800s. Most of the vegetated tidelands associated with Skagit Bay and the Skagit River delta have been converted to agricultural and pasture land since that time. This diking and ditching has also altered drainage patterns and silt deposition in the remaining tidelands. Logging and log milling were once local activities; thriving mill towns were located along Tom Moore Slough. A jetty was built parallel to and northwest of Tom Moore Slough, probably in an attempt to keep the slough open for boat traffic. Pilings are found infrequently in the tideflats and marshes seaward of the dike system. Currently, most of the marsh and tidelands are owned and managed for wildlife by the Washington Department of Game. The area receives recreational day use and use by hunters. In some areas, cattle have access to the tidelands as well. Human and cattle use cause localized disturbance of soil structure and vegetation. These activities are probably responsible for the introduction and establishment of some non-native plant species.

A non-native species of cordgrass, Spartina townsendii, is beginning to spread into Skagit Bay. At present, it is only found in the vicinity of West Pass near Stanwood. However, this species is aggressive and poses a threat to the integrity of the native ecosystem.

FIGURE 30 is located in the map pocket on the back cover.

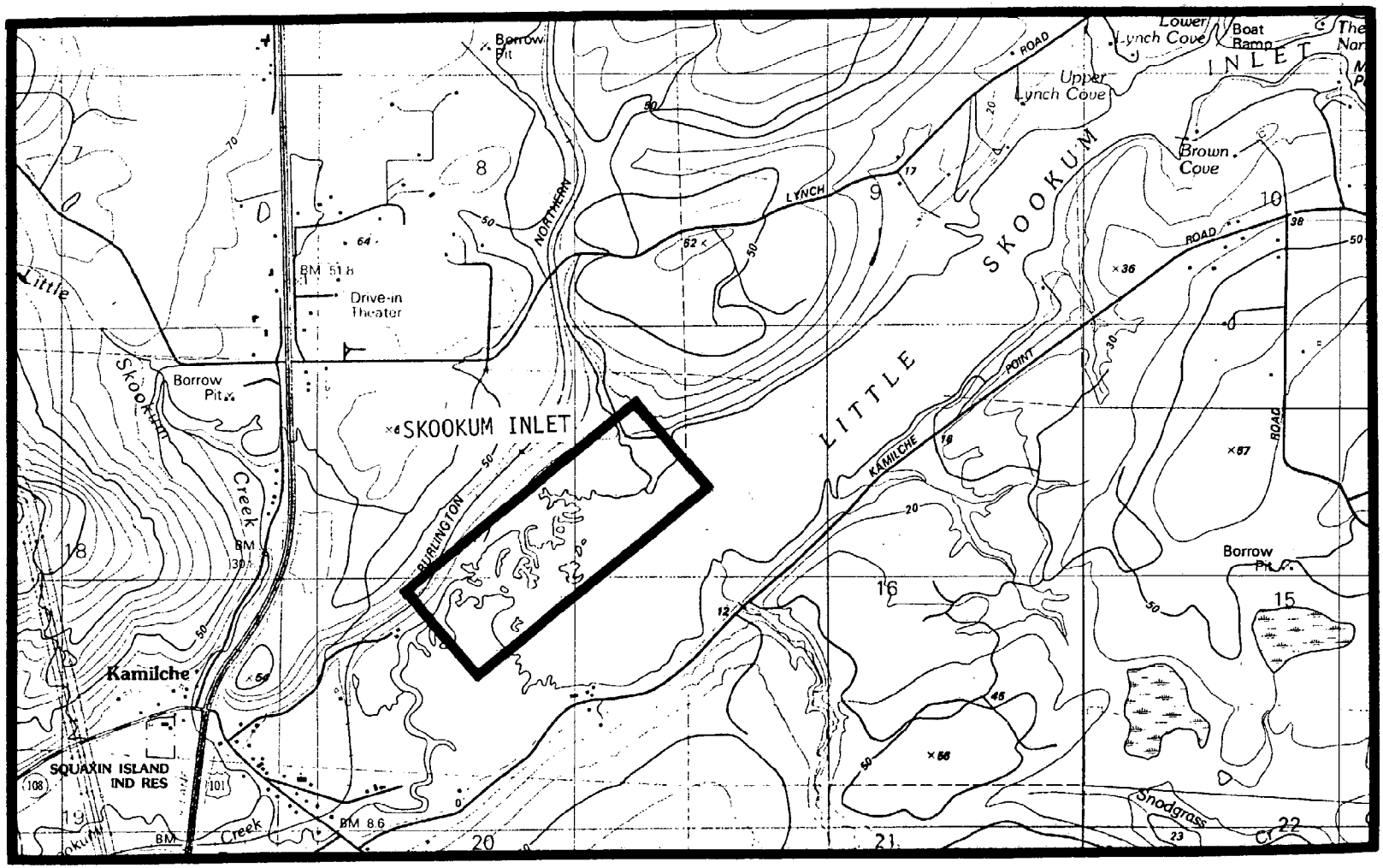

Figure 31. SKOOKUM INLET LOCATIONAL MAP

SKOOKUM INLET

LOCATION:

Mason County; T19N, R3W, portions of section 17. The site is located along the northern shore at the head of Skookum Inlet (Fig. 31).

SIGNIFICANCE:

The site is an isolated, high quality, marsh fragment which grades from a high salinity, low intertidal marsh to an old second growth forest.

GENERAL DESCRIPTION:

Figure 32 illustrates the distribution of features at Skookum Inlet. The features are:

1. a silty, high salinity, low intertidal marsh;
2. a silty, high salinity, high intertidal marsh; and
3. a silty, low salinity, high intertidal marsh.

The marsh fragment is approximately 15 acres. Marsh vegetation has developed on silty clay terraces and islands above the tideflats. The terraces are highly dissected by tidal and frequent freshwater channels.

The upland is mature old second growth forest dominated by Pseudotsuga menzeisii (Douglas fir) with a fringe along the marsh edge dominated by Picea sitchensis (Sitka spruce).

FEATURES:

I. Silty, High Salinity, Low Intertidal Marsh

Silty, high salinity, low intertidal marsh occurs along terrace edges, tidal channels and on low marsh islands. Salt pannes occur frequently. Two communities comprise this marsh type. The first occurs at the lowest marsh elevations and is codominated by Distichlis spicata, Jaumea carnosa, Plantago maritima and Salicornia virginica. The second community is intermediate between high and low intertidal salt marsh. It occurs at slightly higher elevations than the first community and is codominated by Distichlis spicata, Juncus gerardii and Salicornia virginica.

Distichlis spicata-Jaumea carnosa-Plantago maritima-Salicornia virginica community (mapping symbol 1)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Plantago maritima (seaside plantain)
Salicornia virginica (pickleweed)

Subdominant Species

Triglochin maritimum (seaside arrowgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Juncus gerardii (mud rush)

Distichlis spicata-Juncus gerardii-Salicornica virginica community (mapping symbol 2)

Dominant Species

Distichlis spicata (saltgrass)
Juncus gerardii (mud rush)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Triglochin maritimum (seaside arrowgrass) (locally subdominant)

II. Silty, High Salinity, High Intertidal Marsh

A silty, high salinity, high intertidal marsh occurs between the high salinity, high intertidal marsh and the high salinity, low intertidal marsh. Salt pannes occur within the area. One community makes up this marsh type. It is codominated by Deschampsia caespitosa and Distichlis spicata.

Deschampsia caespitosa-Distichlis spicata-Juncus gerardii community (mapping symbol 3)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)
Distichlis spicata (saltgrass)

Subdominant Species

Juncus gerardii (mud rush)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Triglochin maritimum (seaside arrowgrass)

III. Silty, Low Salinity, High Intertidal Marsh

Silty, low salinity, high intertidal marsh occurs along the upland marsh margin. It reaches its greatest extent on the high terraces nearest the mouth of Skookum Creek. Freshwater channels may occur through these areas of marsh. Two communities compose this marsh type. The first community is dominated by Deschampsia caespitosa and the second by Festuca rubra.

Deschampsia caespitosa community (mapping symbol 4)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)

Subdominant Species

Juncus balticus (Baltic rush)

Minor Species

Aster subspicatus (Douglas' aster)
Atriplex patula var. hastata (saltbush)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Potentilla pacific (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)

Festuca rubra community (mapping symbol 5)

Dominant Species

Festuca rubra (red fescue)

Minor Species

Aster subspicatus (Douglas' aster)
Deschampsia caespitosa (tufted hairgrass)
Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)
Triglochin maritimum (seaside arrowgrass)
Typha latifolia (cattail) (upland margin)

LAND USE HISTORY

This portion of marsh is quite isolated and receives only occasional use by hunters. The forests were selectively logged at least once, but now are old second growth.

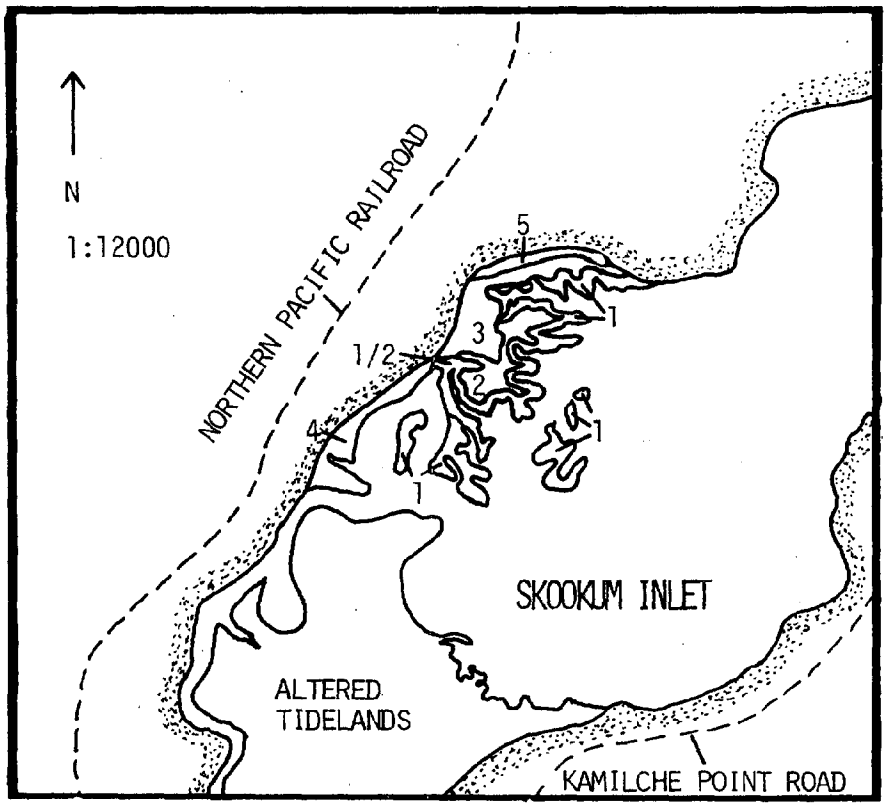

Figure 32. SKOOKUM INLET FEATURES MAP

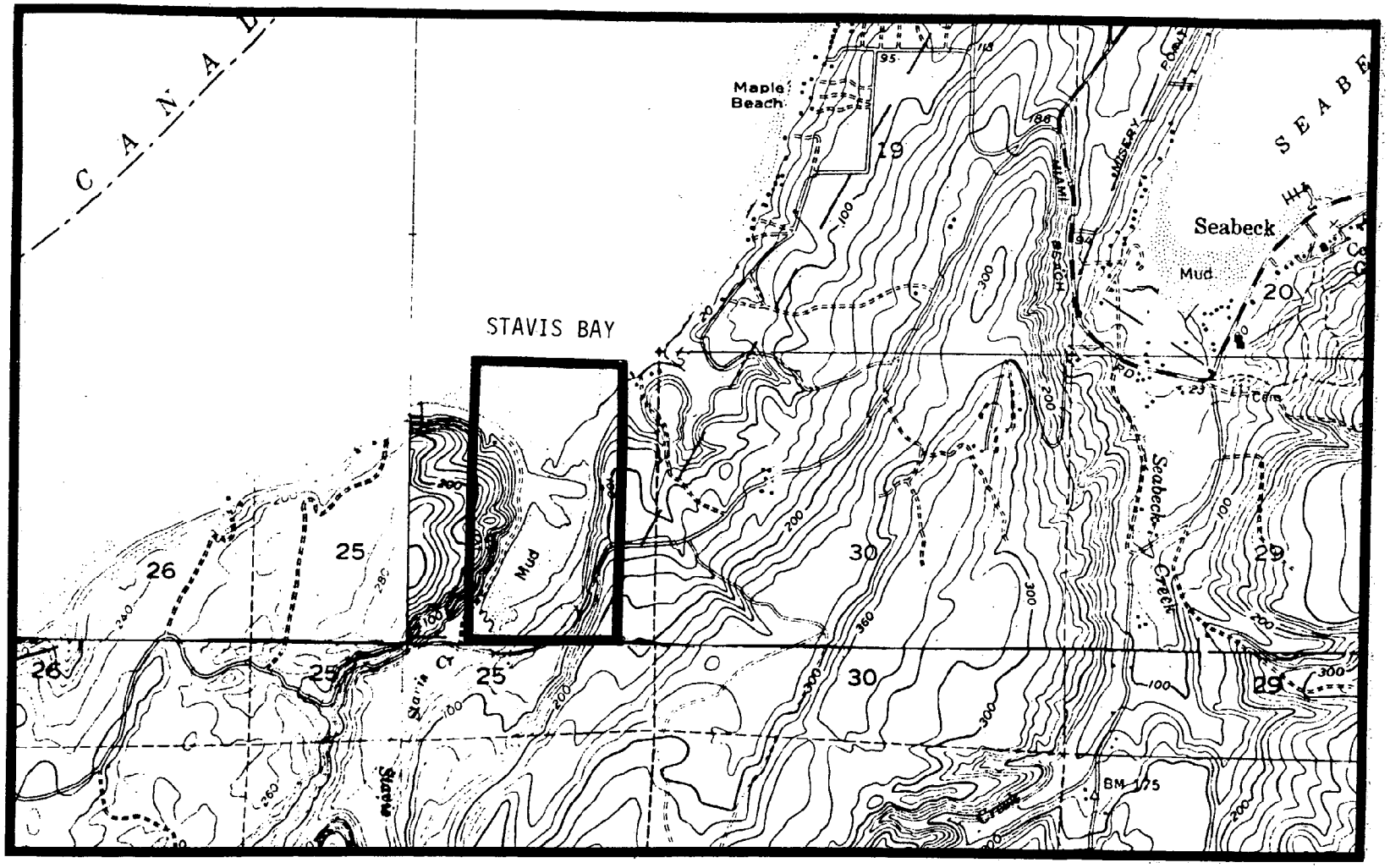

Figure 33. STAVIS BAY LOCATIONAL MAP

STAVIS BAY

LOCATION:

Kitsap County; T25N, R2W, portions of section 25. The area is located on the west side of the Kitsap Peninsula, approximately 2 miles southwest of the town of Seabeck (Fig. 33).

SIGNIFICANCE:

Stavis Bay is an open lagoon system of exceptionally high quality.

GENERAL DESCRIPTION:

Figure 34 illustrates the distribution of features at Stavis Bay. The features are:

1. tideflats;
2. coastal spits;
3. a sandy, low salinity, low intertidal marsh; and
4. a sandy, high salinity, low intertidal marsh.

Stavis Bay is approximately 61 acres. It is considered a lagoon system in this report because of the tidal restriction caused by the two offset spits at the lagoon mouth. Stavis Creek enters the Bay at its south end. The lagoon completely flushes with each tidal cycle, exposing sand, silt and clay tideflats at low tides. Marsh vegetation has developed primarily on the lower edges of the bay side of the spits and along the south end of the lagoon. Substrates are mostly sand, with some areas of silt and clay.

The uplands are covered by second growth forest dominated by Pseudotsuga menziesii (Douglas fir). Substrates are primarily an Indianola-Kitsap complex (S.C.S., 1980). Indianola loamy sand has developed over sandy glacial outwash on the upper slopes. Kitsap silty loam has developed over glacial lake sediments on the lower, steeper slopes. Soils along the south end of Stavis Bay and Stavis Creek channel are Norma fine sandy loams, which occur in mixed glacial alluvium.

FEATURES:

I. Tideflats

Stavis Bay flushes completely with each tidal cycle and contains no permanently ponded water. The tideflats are primarily sand overlain in areas by silts. The channel of Stavis Creek winds through the

tideflats. Near the spits at the lagoon mouth, the substrate of the channel is a mixture of sand, gravel and cobble. The lagoon margins are clay with areas of sand and gravel. Eelgrass occurs within the lagoon.

II. Coastal Spits

Two spits are located at the mouth of Stavis Bay. The first spit is "Y" shaped. It is connected to the western bay shore and is generally oriented east and west across the bay mouth. An arm of this spit extends southeast into the lagoon. The second spit is an extension of the Hood Canal shoreline to the northeast of Stavis Bay. It extends southwest towards the first spit. Both spits are composed of sands, deposited primarily by wave and tidal action. Cobbles and gravel make up the beaches facing Hood Canal. The spit ridges have driftwood accumulated on the Hood Canal side and dune vegetation on the leeward side. Dune vegetation on the first spit has been heavily disturbed. Vegetation on the second spit is in relatively good condition.

Dune vegetation (mapping symbol 1)

General Vegetation

Achillea millefolium (yarrow)
Agropyron repens (quackgrass) (non-native)
Agrostis alba (redtop) (non-native)
Aira praecox (early hairgrass) (non-native)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Asparagus officinalis (asparagus) (non-native)
Atriplex patula var. hastata (saltbush)
Bromus mollis (soft brome) (non-native)
Bromus sterilis (barren brome) (non-native)
Bromus tectorum (cheatgrass) (non-native)
Distichlis spicata (saltgrass)
Elymus mollis (dune wildrye)
Festuca rubra (red fescue)
Galium aparine (catchweed bedstraw)
Hordeum jubatum (foxtail barley)
Jaumea carnosa (jaumea)
Juncus gerardii (mud rush)
Plantago lanceolata (English plantain) (non-native)
Poa pratensis (Kentucky bluegrass) (non-native)
Polygonum paronychia (nailwort knotweed)
Rumex cf occidentalis (western dock)
Salicornia virginica (pickleweed)

III. Sandy, Brackish, Low Intertidal Marsh

At the south end and along the margins of Stavis Bay are localized areas that receive freshwater influence. These areas have vegetation typical of brackish conditions and are dominated by Carex lyngbyei.

Carex lyngbyei community (mapping symbol 2)

Dominant Species

Carex lyngbyei (Lyngby's sedge) (frequently monospecific)

Minor Species

Lilaeopsis occidentalis (lilaeopsis)

IV. Sandy, High Salinity, Low Intertidal Marsh

A sandy, high salinity, low intertidal marsh occurs along the leeward side of each spit. It also occurs to a limited extent at the south end and along the margins of the lagoon. Three primary communities compose this marsh type. The first is dominated by Distichlis spicata and occurs at the south end of the lagoon. This community is intermediate between a brackish and high salinity marsh. The second community is codominated by, and solely composed of, Jaumea carnosa and Salicornia virginica. This community occurs along the lowest vegetated margins of the spits. The third community is codominated by Grindelia integrifolia, Jaumea carnosa and Salicornia virginica. It occurs on the spits, intermediate in elevation between the Jaumea carnosa-Salicornia virginica community and dune vegetation.

Distichlis spicata community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)

Subdominant Species

Glaux maritima (saltwort)

Minor Species

Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Jaumea carnosa-(jaumea)-Salicornia virginica (pickleweed) community (mapping symbol 4)

Grindelia integrifolia-Jaumea carnosa-Salicornia virginica community (mapping symbol 5)

Dominant Species

Grindelia integrifolia (gumweed)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Subdominant Species

Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Juncus gerardii (mud rush)
Spergularia cf marina (saltmarsh sandspurry) (non-native)

LAND USE HISTORY

The uplands adjacent to Stavis Bay have been logged at least once. A number of old logging and access roads occur through the upland forest to the east of Stavis Bay. The access roads are used for hiking and parties. Remnants of two old homesteads were found on the east side of the lagoon. The first is located at the far south end and the second on the bluff overlooking the northernmost spit. There is a permanent residence on the bluff west of the bay mouth. A driveway to the residence runs near and parallel to the west shore of Stavis Bay. A powerline crosses the mouth of Stavis Bay. The powerline and an access road run the length of the western spit. Stavis Bay Road crosses the southernmost end of Stavis Bay on a piling supported bridge.

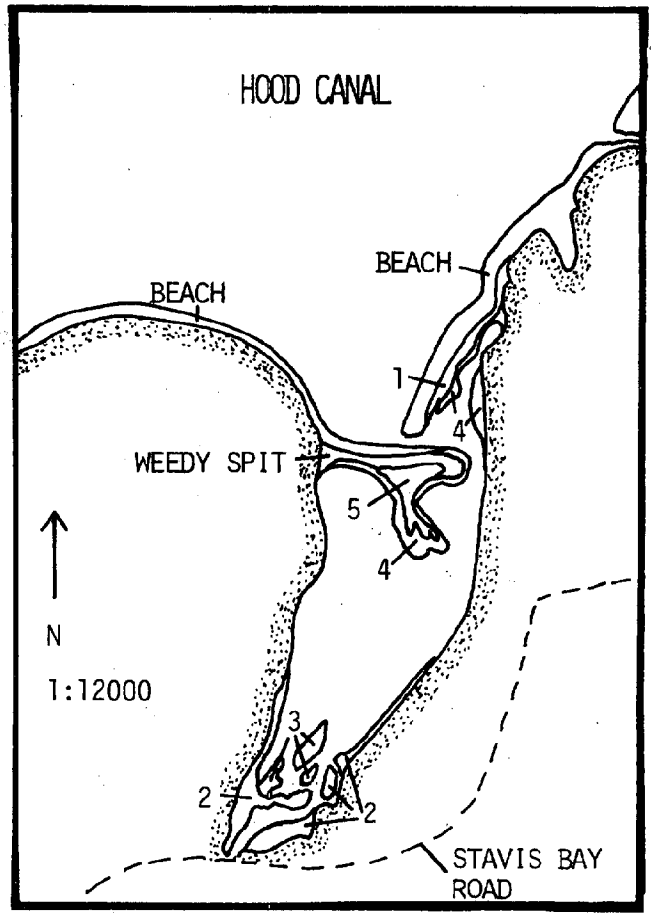

Figure 34. STAVIS BAY FEATURES MAP

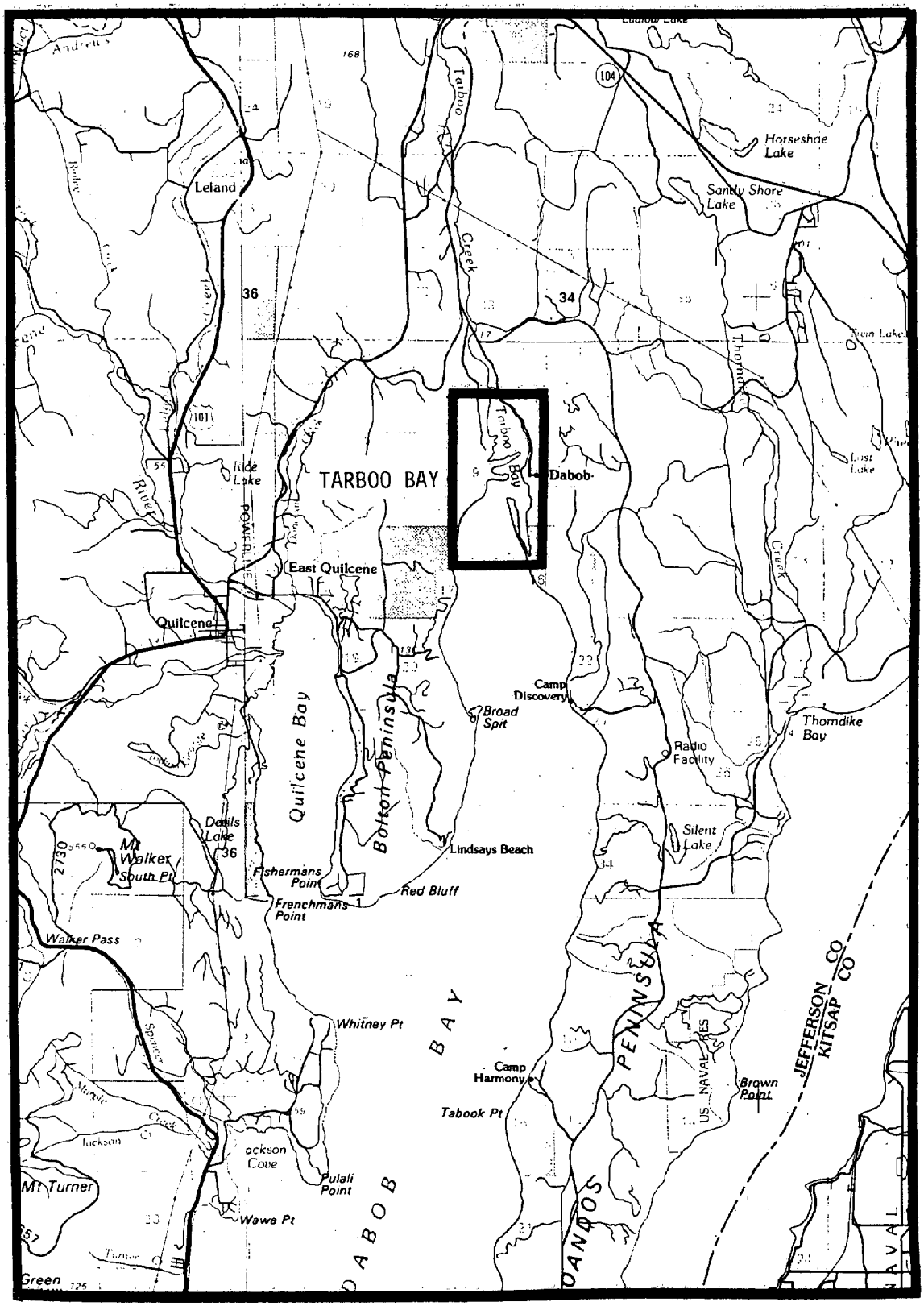

Figure 35. TARBOO BAY LOCATIONAL MAP

TARBOO BAY

LOCATION:

Jefferson County; T27N, R1W, portions of sections 4, 9 and 16. The site is located at the north end of Dabob Bay (Fig. 35).

SIGNIFICANCE:

The Tarboo Bay site contains high quality, sandy, high salinity, low intertidal marsh and coastal spits.

GENERAL DESCRIPTION:

Figure 36 illustrates the distribution of features at Tarboo Bay. The features are:

1. coastal spits;
2. sandy, high salinity, low intertidal marsh;
3. sandy, low salinity, low intertidal marsh;
4. sandy, high salinity, high intertidal marsh; and
5. sandy, low salinity, high intertidal marsh.

The marsh and spits of interest are approximately 74 acres. A series of spits extend into the bay from the western shore. A single spit, named Long Spit, extends northward from the east side of the bay. Long Spit and the two largest spits of the western bay shore have dune vegetation along their ridges. Salt marsh vegetation has developed along the bay margins north of the spits. Substrates are primarily sands. Some tideflats and marsh substrate along the shore and leeward side of Long Spit are silts and black anoxic organic matter. Uplands near the spits are second growth forest.

FEATURES:

I. Coastal Spits

Six spits of various sizes occur in the area. Three have developed coastal dune vegetation. The largest of the spits is Long Spit, which is approximately 0.75 miles long. Long Spit and the southernmost spit on the west side of the bay have steep sand and gravel beaches on the south sides with a line of driftwood along the spit ridges. A dune assemblage typified by Elymus mollis occurs on the spit ridge and leeward side of Long Spit. A second community, dominated by Festuca rubra, is found on all three spits.

Elymus mollis assemblage (mapping symbol 1)

General Vegetation

Achillea millefolium (yarrow)
Aira praecox (early hairgrass) (non-native)
Alnus rubra (red alder)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Distichlis spicata (saltgrass)
Elymus mollis (dune wildrye)
Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)
Lonicera involucrata (black twinberry)
Orobanche californica (California broomrape)
Picea sitchensis (Sitka spruce)
Plantago lanceolata (English plantain) (non-native)
Plantago maritima (seaside plantain)
Polygonum spergulariaeforme (fall knotweed)
Rosa nutkana (Nootka rose)
Vicia gigantea (giant vetch)

Festuca rubra community (mapping symbol 2)

Dominant Species

Festuca rubra (red fescue)

Subdominant Species

Grindelia integrifolia (gumweed)

Minor Species

Achillea millefolium (yarrow)
Agropyron repens (quackgrass) (non-native)
Aira praecox (early hairgrass) (non-native)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Asparagus cf officinalis (asparagus) (non-native)
Atriplex patula var. hastata (saltbush) (locally subdominant)
Distichlis spicata (saltgrass)
Elymus mollis (dune wildrye)
Lepidium virginicum var. menziesii (tall pepperweed)
Plantago lanceolata (English plantain) (non-native)
Plantago maritima (seaside plantain)
Poa pratensis (Kentucky bluegrass) (non-native)
Polygonum spergulariaeforme (fall knotweed)
Pyrus fusca (wild crabapple)
Salicornia virginica (pickleweed)

II. Sandy, High Salinity, Low Intertidal Marsh

A sandy, high salinity, low intertidal marsh is the predominant marsh type at this site. Tidal waters flooding the marsh at time of survey measured 28 ppt. The marsh has developed primarily on sands and, in a few cases, silty-sands. Four communities make up this marsh type at Tarboo Bay. The lowest elevational community is codominated by, and solely composed of, Distichlis spicata and Salicornia virginica. The second community occurs at slightly higher elevations and is codominated by Distichlis spicata, Jaumea carnosa and Salicornia virginica. The third community occurs on slightly higher marsh terraces on the leeward side of Long Spit. It is dominated by Distichlis spicata. The fourth community occurs in low areas adjacent to the spit ridge. It is codominated by Salicornia virginica and Grindelia integrifolia.

Distichlis spicata (saltgrass)-Salicornia virginica (pickleweed) community (mapping symbol 3)

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 4)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed)
Hordeum brachyantherum (northern meadow barley)
Plantago maritima (seaside plantain)
Puccinellia sp. (alkaligrass)
Puccinellia lucida (shining alkaligrass)
Spergularia canadensis (winged sandspurry)
Stellaria humifusa (low starwort)
Triglochin maritimum (seaside arrowgrass)

Distichlis spicata community (mapping symbol 5)

Dominant Species

Distichlis spicata (saltgrass)

Subdominant Species

Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)

Salicornia virginica-Grindelia integrifolia community (mapping symbol 6)

Dominant Species

Grindelia integrifolia (gumweed)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Hordeum jubatum (foxtail barley)
Jaumea carnosa (jaumea)
Plantago maritima (seaside plantain)
Puccinellia sp. (alkaligrass)
Spergularia canadensis (winged sandspurry)

III. Sandy, Low Salinity, Low Intertidal Marsh

A sandy, low salinity, low intertidal marsh is represented by pure stands of Carex lyngbyei. It occurs in and along freshwater channels entering the tidelands.

Carex lyngbyei (Lyngby's sedge) monospecific community (mapping symbol 7)

IV. Sandy, High Salinity, High Intertidal Marsh

The sandy, high salinity, high intertidal marsh at this site is intermediate between high salinity, low intertidal marsh and dune vegetation and occurs on old, low spit ridges. The community present is codominated by Salicornia virginica and Plantago maritima.

Salicornia virginica-Plantago maritima community (mapping symbol 8)

Dominant Species

Plantago maritima (seaside plantain)
Salicornia virginica (pickleweed)

Subdominant Species

Festuca rubra (red fescue)

Minor Species

Atriplex patula var. hastata (saltbush)
Grindelia integrifolia (gumweed)
Hordeum jubatum (foxtail barley)

V. Sandy, Low Salinity, High Intertidal Marsh

A sandy, low salinity, high intertidal marsh occurs as a narrow band along the upland marsh edge. It is represented by a single community which is codominated by Carex lyngbyei and Potentilla pacifica. The Carex lyngbyei indicates freshwater seepage or run-off.

Carex lyngbyei-Potentilla pacifica community (mapping symbol 9)

Dominant Species

Carex lyngbyei (Lyngby's sedge)
Potentilla pacifica (Pacific silverweed)

Subdominant Species

Agrostis alba (redtop) (non-native)
Distichlis spicata (saltgrass)

Minor Species

Aster subspicatus (Douglas' aster)
Hordeum brachyantherum (northern meadow barley)
Juncus balticus (Baltic rush)
Triglochin maritimum (seaside arrowgrass)

LAND USE HISTORY:

The uplands have been logged at least once. The forest on the west side of Tarboo Bay is old second growth. The three largest spits all have vehicle tracks along their ridges. A small house, probably built on fill, is located at the base (south end) of Long Spit. Two fairly new houses have been built on the upland adjacent to the spit. An unusual platform, tent and trail complex, perhaps a seasonal residence, is located along the upland shore in the lee of Long Spit. The oyster industry is important in Tarboo Bay. Several large oyster rafts are located in the bay. Some of these rafts are at the ends of two of the spits. Access to the rafts is by boat or via the spits.

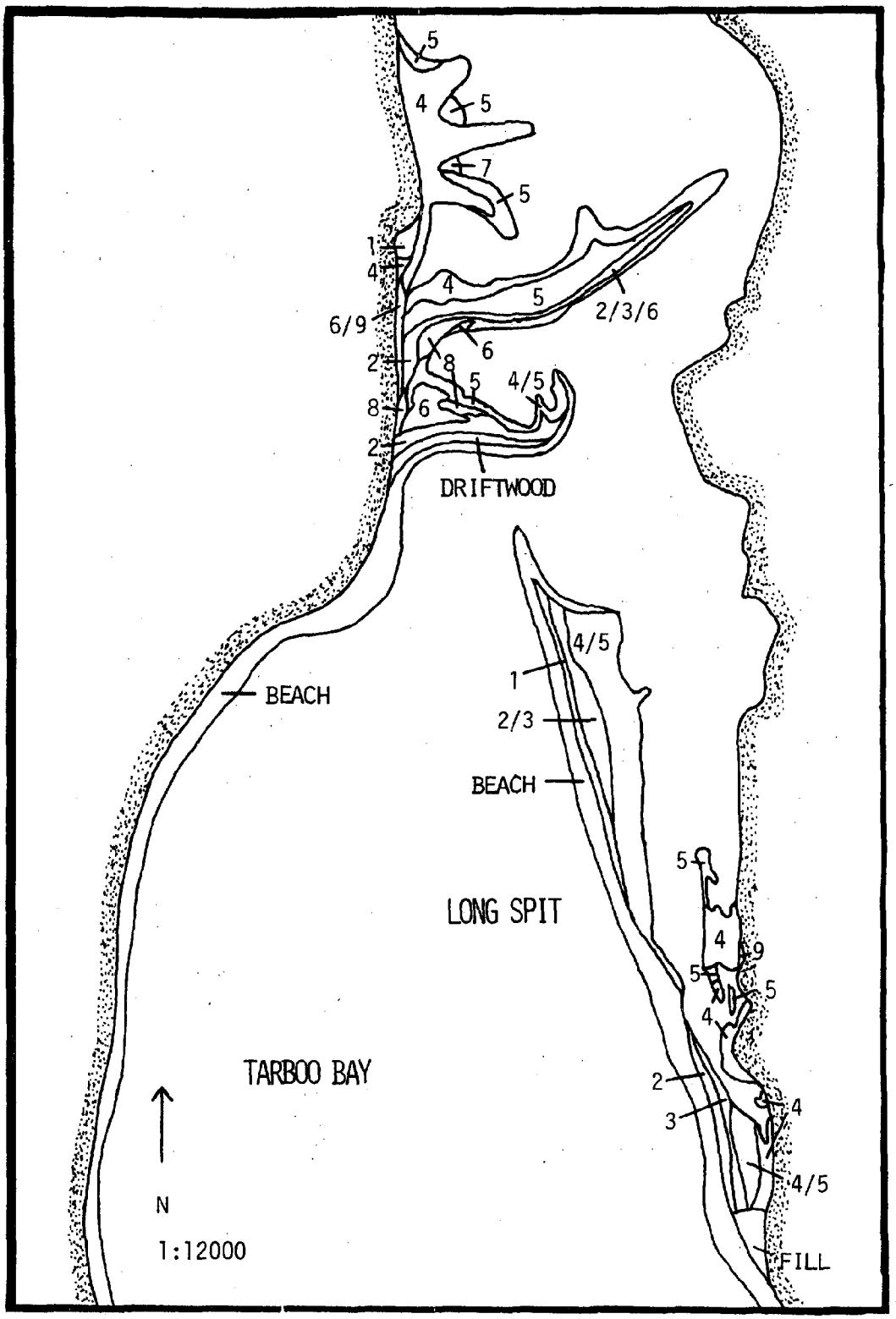

Figure 36. TARBOO BAY FEATURES MAP

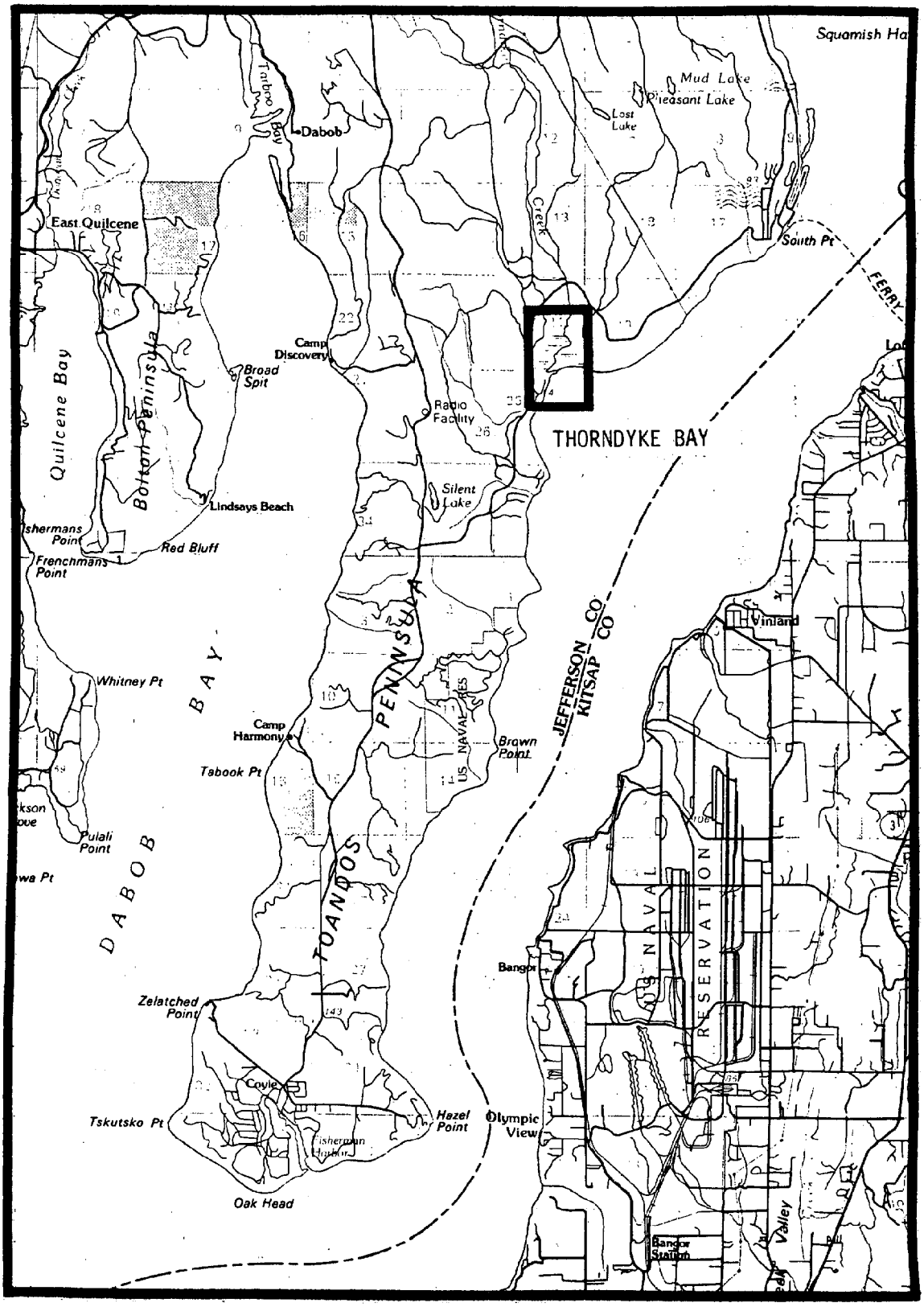

Figure 37. THORNDYKE BAY LOCATIONAL MAP

THORNDYKE BAY

LOCATION:

Jefferson County; T27N, R1E, portions of section 19 and T27N, R1W, portions of sections 24 and 25. The site is located on the northeast side of the Toandos Peninsula on Hood Canal (Fig. 37).

SIGNIFICANCE:

Thorndyke Bay is a large, diverse and relatively high quality lagoon system.

GENERAL DESCRIPTION:

Figure 38 illustrates the distribution of features at Thorndyke Bay. The features are:

1. lagoon tideflats;
2. a berm;
3. a sandy, high salinity, low intertidal marsh;
4. a sandy, high salinity, high intertidal marsh; and
5. a transition zone marsh.

Thorndyke Bay is approximately 85 acres. It is a shallow lagoon system in which tidal influence is restricted by the elevation of the system, the partial berm across the lagoon mouth and a sill where the channel breaches the berm. The channel passes through the west end of the berm, connecting the tidelands of Thorndyke Bay with Hood Canal. Tidal and freshwater creek channels cut through the tideflats and marsh. Tidal marsh has developed on clay terraces above the tideflats. The marsh primarily occurs on the leeward side of the berm and at the north end of the lagoon system. Narrow terraces of marsh occur along the east and west sides. Salinities ranged from 26 ppt to freshwater. The tidelands are bounded by second growth forest and freshwater wetlands.

Thorndyke Bay has been the focus of a number of studies. Vegetation studies have been conducted by Frenkel, Boss and Schuller (1978) and Northwest Environmental Consultants (1975). A team of biologists from the Washington Department of Game also studied this site and included it in their recommendations for salt marsh preservation (Hirschi, Vanbianchi and Albright, 1978).

FEATURES:

I. Lagoon Tideflats

There is no permanently ponded water in the lagoon. Substrates vary from firm sands, primarily in Thorndyke Creek channel, to deep anoxic silts. The flats appear to provide feeding areas for shorebirds and waterfowl.

II. Berm

The berm extends nearly the full width of the lagoon mouth. It is composed of sand, gravel and cobble deposited by wave and tidal action. It slopes steeply to a beach and tideflats to the south. To the north, it grades from dune vegetation to a sandy, high salinity, low intertidal marsh. Two communities make up the dune vegetation. The first occurs on the spit ridge and is codominated by Elymus mollis and Festuca rubra. The second occurs on the leeward side of the spit and is codominated by Festuca rubra and Grindelia integrifolia.

Elymus mollis-Festuca rubra community (mapping symbol 1)

Dominant Species

Elymus mollis (dune wildrye)
Festuca rubra (red fescue)

Minor Species

Achillea millefolium (yarrow)
Ambrosia chamissonis var. bipinnatisecta (silver bursage)
Amsinckia spectabilis (seaside amsinckia)
Angelica sp. (seawatch)
Galium aparine (catchweed bedstraw)
Grindelia integrifolia (gumweed)
Lepidium virginicum var. menziesii (tall pepperweed)
Lonicera involucrata (black twinberry)
Plantago lanceolata (English plantain) (non-native)
Poa pratensis (Kentucky bluegrass) (non-native)
Rumex occidentalis (western dock)
Vicia gigantea (giant vetch)

Festuca rubra-Grindelia integrifolia community (mapping symbol 2)

Dominant Species

Festuca rubra (red fescue)
Grindelia integrifolia (gumweed)

Minor Species

Achillea millefolium (yarrow)
Ambrosia chamissonis var. bipinnatisecta (silver bursage) (locally subdominant)
Armeria maritima (thrift)
Atriplex patula var. hastata (saltbush)
Poa pratensis (Kentucky bluegrass) (non-native)
Polygonum spergulariaeforme (fall knotweed)

III. Sandy, High Salinity, Low Intertidal Marsh

Sandy, high salinity, low intertidal marsh occurs on terraces leeward of the berm, on marsh islands in the tideflats and along the leading marsh edge of the north end of the lagoon. This marsh type is composed of three communities. The first is dominated by Salicornia virginica and occurs at the lowest marsh elevations. The second is codominated by Jaumea carnosa and Salicornia virginica. The third community is co-dominated by Distichlis spicata, Jaumea carnosa and Salicornia virginica.

Salicornia virginica community (mapping symbol 3)

Dominant Species

Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Distichlis spicata (saltgrass)
Spergularia marina (saltmarsh sandspurry) (non-native)

Jaumea carnosa-Salicornia virginica community (mapping symbol 4)

Dominant Species

Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Subdominant Species

Grindelia integrifolia (gumweed)
Puccinellia sp. (alkaligrass)

Minor Species

Atriplex patula var. hastata (saltbush) (locally subdominant)
Distichlis spicata (saltgrass)

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 5)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Glaux maritima (saltwort)
Grindelia integrifolia (gumweed) (locally subdominant)
Juncus gerardii (mud rush)
Plantago maritima (seaside plantain)
Puccinellia sp. (alkaligrass)

IV. Sandy, High Salinity, High Intertidal Marsh

Sandy, high salinity, high intertidal marsh is an intermediate marsh type between high and low intertidal marshes. There are two communities which compose this marsh type. The first community is codominated by Distichlis spicata and Juncus gerardii. The second community occurs along creek channels and is codominated by Deschampsia caespitosa and Distichlis spicata.

Distichlis spicata-Juncus gerardii community (mapping symbol 6)

Dominant Species

Distichlis spicata (saltgrass)
Juncus gerardii (mud rush)

Minor Species

Agrostis alba (redtop) (non-native)
Atriplex patula var. hastata (saltbush) (locally subdominant)
Hordeum jubatum (foxtail barley)
Salicornia virginica (pickleweed)

Deschampsia caespitosa-Distichlis spicata community (mapping symbol 7)

Dominant Species

Deschampsia caespitosa (tufted hairgrass)
Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Hordeum brachyantherum (northern meadow barley)

V. Brackish, High Intertidal Marsh

Most of the brackish, high intertidal marsh is dominated by a non-native grass, Agrostis alba. Only one of the four communities composing this marsh type at Thorndyke Bay is not dominated or codominated by Agrostis alba. This community is codominated by Juncus balticus and Potentilla pacifica.

Juncus balticus-Potentilla pacifica community (mapping symbol 8)

Dominant Species

Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Minor Species

Agrostis alba (redtop) (non-native)
Aster subspicatus (Douglas' aster)
Juncus gerardii (mud rush)
Scirpus acutus (hardstem bulrush)
Triglochin maritimum (seaside arrowgrass)

VI. Transition Marsh

Typha latifolia and Scirpus acutus occur in the ecotone between tidal marsh and freshwater marsh or upland. The two species occur as a mosaic, forming a narrow zone on the east side of Thorndyke Bay and a much larger area at the north end of the tidelands.

Scirpus acutus (hardstem bulrush)-Typha latifolia (cattail) mosaic (mapping symbol 9)

LAND USE HISTORY

The Thorndyke Bay area has a long history of logging activity and grazing. The abandoned logging town of Thorndyke was located on the upland at the southwest end of the lagoon. The upland around the lagoon has been logged at least once, with areas currently receiving a second cutting. The lagoon was apparently used in the transportation and storage of logs. An old homestead is located on the upland at the southeast end of the lagoon. Fences and other signs of grazing occur in the eastern and northern portion of the tidal marsh. Currently the area receives use for duck hunting, day use recreation and bird watching. Reportedly, in an effort to improve duck habitat, a number of plant species were introduced into the marsh. Spartina alterniflora, an east coast species of cordgrass, became established in this way. Spartina alterniflora poses a threat to the quality and integrity of the Thorndyke Bay system.

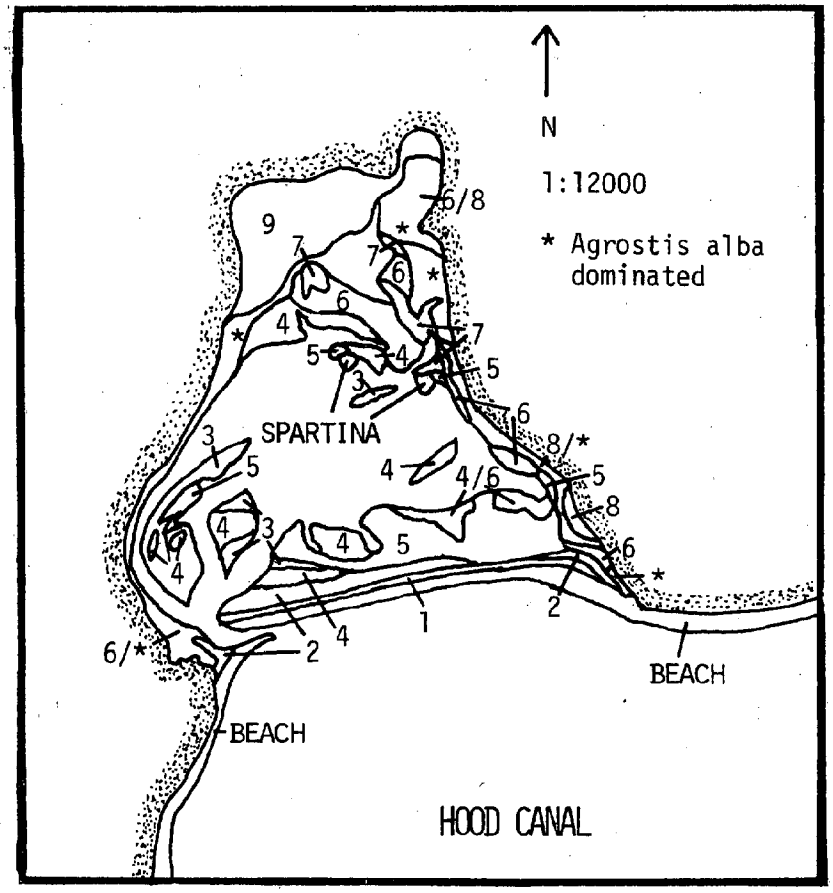

Figure 38. THORNDYKE BAY FEATURES MAP

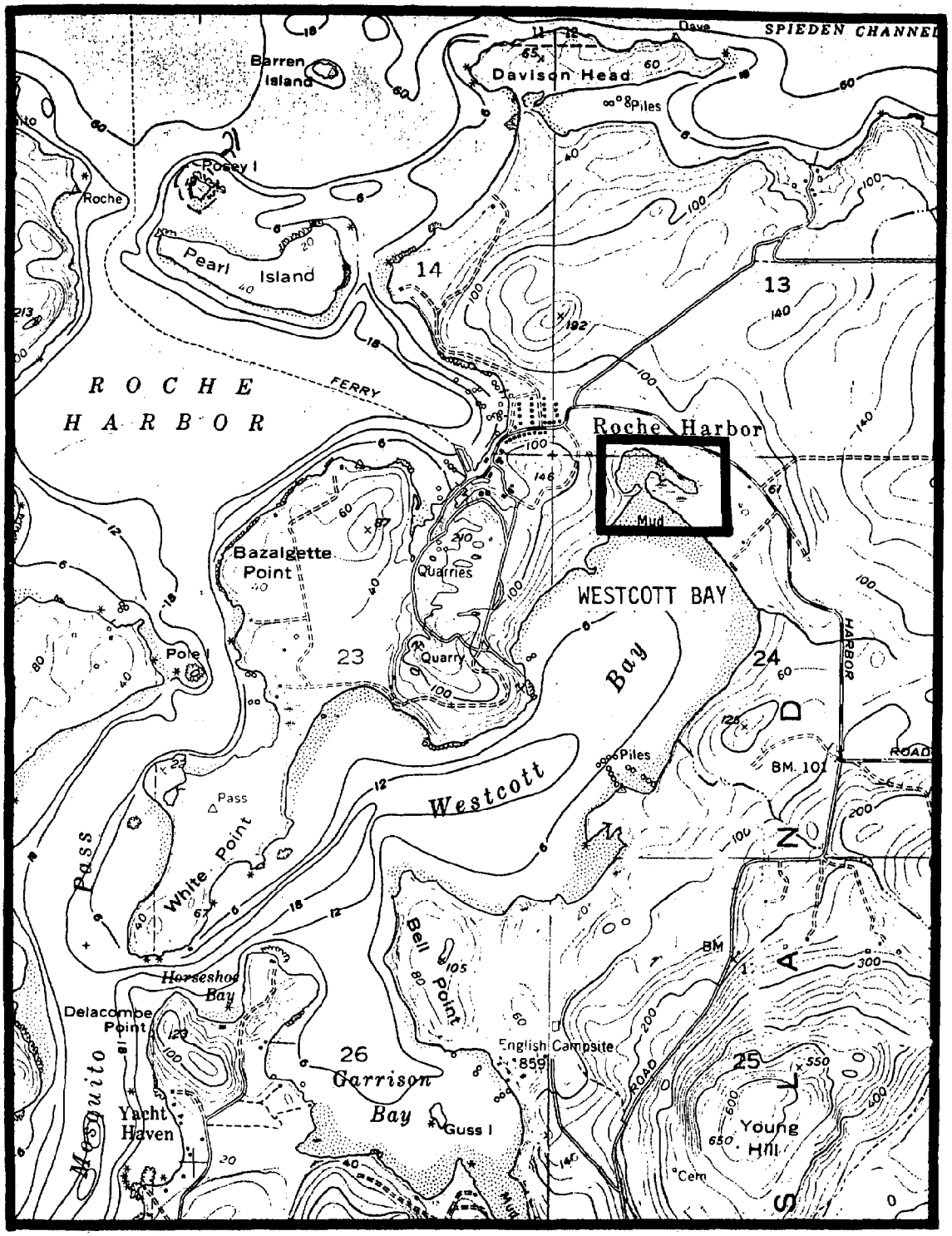

Figure 39. WESTCOTT BAY LOCATIONAL MAP

WESCOTT BAY

LOCATION:

San Juan County; T36N, R4W, portions of sections 13 and 24. The site occurs at the north end of Westcott Bay, just southeast of Roche Harbor, on San Juan Island (Fig. 39).

SIGNIFICANCE:

Westcott Bay marsh is a relatively high quality coastal lagoon system which reaches hyperhaline levels.

GENERAL DESCRIPTION:

Figure 40 illustrates the distribution of features at Westcott Bay. The features are:

1. lagoon tideflats;
2. a hyperhaline, low intertidal marsh;
3. a euhaline, low intertidal marsh;
4. a silty, brackish, low intertidal marsh; and
5. a brackish, high intertidal marsh.

The lagoon system is approximately 11 acres. There is a single centrally located channel between the lagoon and Wescott Bay. The channel is flanked by sand and gravel bars. Marsh vegetation has developed on clay terraces on the leeward side of the bars and along the east and northeast end of the lagoon. Two small freshwater streams flow into the the north and east ends of the lagoon. Substrates are primarily clay. Salinities range from freshwater to 56 ppt.

The uplands surrounding the lagoon are a combination of second growth forest, agricultural land and pasture.

FEATURES:

I. Lagoon Tideflats

Westcott Bay is a small shallow lagoon system with no permanently ponded water. The tideflats are clay, with an intricate network of creek and tidal channels. Salicornia virginica forms patches on some of the raised interchannel areas.

WESTCOTT BAY

LOCATION:

San Juan County; T36N, R4W, portions of sections 13 and 24. The site occurs at the north end of Westcott Bay, just southeast of Roche Harbor, on San Juan Island (Fig. 39).

SIGNIFICANCE:

Westcott Bay marsh is a relatively high quality coastal lagoon system which reaches hyperhaline levels.

GENERAL DESCRIPTION:

Figure 40 illustrates the distribution of features at Westcott Bay. The features are:

1. lagoon tideflats;
2. a hyperhaline, low intertidal marsh;
3. a euhaline, low intertidal marsh;
4. a silty, brackish, low intertidal marsh; and
5. a brackish, high intertidal marsh.

The lagoon system is approximately 11 acres. There is a single centrally located channel between the lagoon and Westcott Bay. The channel is flanked by sand and gravel bars. Marsh vegetation has developed on clay terraces on the leeward side of the bars and along the east and northeast end of the lagoon. Two small freshwater streams flow into the the north and east ends of the lagoon. Substrates are primarily clay. Salinities range from freshwater to 56 ppt.

The uplands surrounding the lagoon are a combination of second growth forest, agricultural land and pasture.

FEATURES:

I. Lagoon Tideflats

Westcott Bay is a small shallow lagoon system with no permanently ponded water. The tideflats are clay, with an intricate network of creek and tidal channels. Salicornia virginica forms patches on some of the raised interchannel areas.

II. Hyperhaline, Low Intertidal Marsh

The hyperhaline, low intertidal marsh occurs in depressions and along tidal channels on the low intertidal marsh terraces. Salinities ranged from 44 to 56 ppt. Substrates are probably clay. Salicornia virginica is dominant and commonly forms monospecific colonies, particularly at the higher salinities.

Salicornia virginica community (mapping symbol 1)

Dominant Species

Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Puccinellia cusickii (Cusick's alkaligrass)
Spergularia marina (saltmarsh sandspurry) (non-native)
Triglochin maritimum (seaside arrowgrass)

III. Euhaline, Low Intertidal Marsh

The euhaline, low intertidal marsh occurs on low tidal terraces. The terraces are probably composed of clay. Salinities measure 38 ppt. Distichlis spicata, Jaumea carnosa and Salicornia virginica are generally codominant. In one small area, Distichlis spicata is dominant and in a second, Jaumea carnosa forms a pure colony.

Distichlis spicata-Jaumea carnosa-Salicornia virginica community (mapping symbol 2)

Dominant Species

Distichlis spicata (saltgrass)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)

Minor Species

Atriplex patula var. hastata (saltbush)
Hordeum brachyantherum (northern meadow barley)
Plantago maritima (seaside plantain)
Puccinellia sp. (alkaligrass)
Triglochin maritimum (seaside plantain)

Distichlis spicata community (mapping symbol 3)

Dominant Species

Distichlis spicata (saltgrass)

Minor Species

Atriplex patula var. hastata (saltbush)
Jaumea carnosa (jaumea)
Salicornia virginica (pickleweed)
Triglochin maritimum (seaside arrowgrass)

Jaumea carnosa (jaumea) monospecific community (mapping symbol 4)

IV. Silty, Brackish, Low Intertidal Marsh

Silty, brackish, low intertidal marsh occurs where each of two freshwater streams enter the lagoon. Only the brackish marsh at the northwest end of the lagoon is large enough, and of sufficient quality, to be included in this survey. This brackish marsh is a narrow margin of pure Scirpus acutus. The tideflats in this area are clay, with relatively deep silt accumulation.

Scirpus acutus (hardstem bulrush) monospecific community (mapping symbol 5)

V. Brackish, High Intertidal Marsh

A brackish, high intertidal marsh forms the upper wetland margin on the east side of the lagoon. The upland margin of the brackish, high intertidal marsh on the southeast side is marked by a fence and adjacent agricultural lands. To the northeast, the marsh grades into a Salix sp. (willow) and Rosa nutkana (Nootka rose) thicket. The marsh is codominated by Juncus balticus and Potentilla pacifica.

Juncus balticus-Potentilla pacifica community (mapping symbol 6)

Dominant Species

Juncus balticus (Baltic rush)
Potentilla pacifica (Pacific silverweed)

Subdominant Species

Atriplex patula var. hastata (saltbush)

Minor Species

Achillea millefolium (yarrow)
Agrostis alba (redtop) (non-native)
Distichlis spicata (saltgrass)
Hordeum brachyantherum (northern meadow barley)
Plantago major (common plantain)
Rumex cf occidentalis (western dock)
Triglochin maritimum (seaside arrowgrass)

LAND USE HISTORY:

The uplands adjacent to the lagoon were logged in the past. Some of the uplands are used as agricultural land and pasture. Old and newer fence lines bound the lagoon and occur within portions of the marsh. Grazing may also have occurred in portions of the marsh. The freshwater stream at the northwest end of the lagoon originates from an artificial reservoir. The second stream at the eastern end of the lagoon drains agricultural and pasture lands and is partially dammed to provide water for livestock.

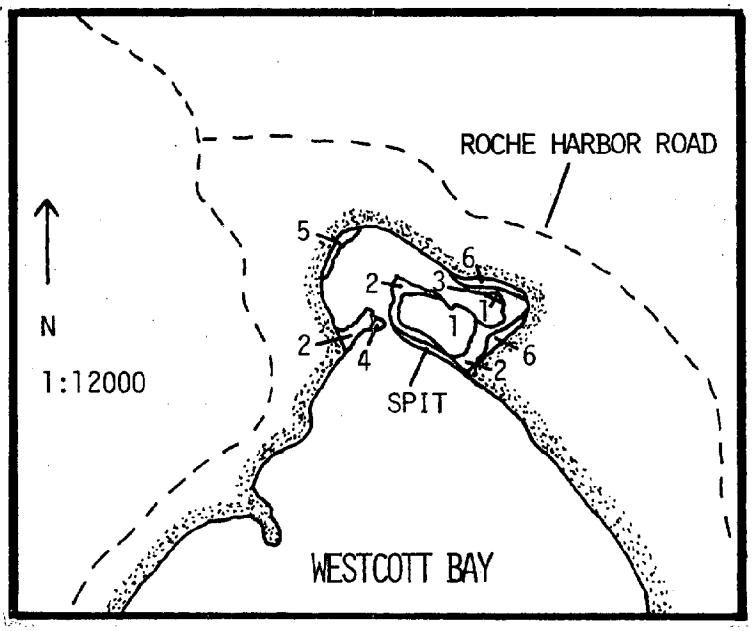

Figure 40. WESTCOTT BAY FEATURES MAP

APPENDIX II

SITES SURVEYED BUT NOT RECOMMENDED

APPENDIX II

SITES SURVEYED BUT NOT RECOMMENDED

CLALLAM COUNTY:

Agate Bay - T31N, R8W, S20
Dungeness-Jamestown Marsh - T30N, R3W, S6; T31N, R3W, S30, 31, 32, 36, 37 and 38
Elwha River Delta - T31N, R7W, S27 and 34
Gibson Spit and Lagoon - T29N, R3W, S15 and 22
Grays Marsh - T29N, R3W, S4, 9 and 10
Pitship Point Marsh - T29N, R3W, S27 and 34
Pysht River Delta - T31N, R11W, S3, 4, 9 and 10
Travis Spit - T29N, R3W, S22 and 23

ISLAND COUNTY:

Cultus Bay - T28N, R3E, S11
Deer Lagoon - T29N, R2E, S13 and 24; T29N, R3E, S18 and 19
Dugualla Bay - T33N, R2E, S7 and 18
Elger Bay - T31N, R3E, S31
Livingston Bay - T32N, R3E, S32
North Bluff Marsh - T31N, R2E, S21 and 28
Race Lagoon - T31N, R2E, S37
Triangle Cove - T31N, R3E, S6 and 7

JEFFERSON COUNTY:

Dosewallips River Delta - T25N, R2W, S2; T26N, R2W, S35
Duckabush River Delta - T25N, R2W, S16 and 21
Kala Point - T30N, R1W, S26
Oak Bay - T29N, R1E, S7
Port Discovery - T29N, R2W, S23 and 38
Port Townsend - T29N, R1W, S1 and 12
Quilcene Bay - T29N, R1W, S18 and 19; T27N, R2W, S24 and 25
Scow Bay - T29N, R1E, S8

KING COUNTY:

None

KITSAP COUNTY:

Anderson Cove - T24N, R2W, S17 and 18
Anderson Creek - T25N, R1W, S11, 12, 13 and 14
Appletree Cove - T27N, R2E, S26 and 35
Big Beef Harbor - T25N, R1W, S15
Burley Lagoon - T22N, R1E, S11 and 12

Chico Bay - T24N, R1E, S5
Curley Creek/Yukon Harbor - T23N, R2E, S4; T24N, R2E, S33
Little Clam Bay - T24N, R2E, S15, 16, 21 and 22
Misery Point - T25N, R1W, S17
Port Gamble - T27N, R2E, S20
Seabeck Bay - T25N, R1W, S20
Silverdale Marsh - T25N, R1E, S21
Unnamed lagoon northeast of Stavis Bay - T25N, R1W, S30

MASON COUNTY:

Chapman Bay - T20N, R3W, S14 and 15
North Bay - T22N, R1W, S8, 9, 16 and 17
Oakland Bay - T21N, R3W, S36
Skokomish River Delta - T21N, R3W, S6; T21N, R4W, S1 and 2; T22N, R4W, S35

PIERCE COUNTY:

Camp Wakoma Marsh - R20N, R1W, S36
Dutcher Cove - T21N, R1W, S15
Minter Creek Bay - T22N, R1E, S28, 29 and 32
Unnamed lagoon between Taylor Bay and Devils Head - T20N, R1W, S35.

SAN JUAN COUNTY:

Alec Bay - T34N, R1W, S19; T34N, R2W, S24
Crescent Bay - T37N, R2W, S13
Davison Head - T36N, R4W, S13 and 14
Fisherman Bay - T35N, R2W, S22 and 28
Flat Point - T35N, R2W, S10
Garrison Bay (south end) - T36N, R4W, S26 and 35
Reid Harbor - T36N, R4W, S28
Shoal Bight/Mud Bay - T34N, R1W, S8 and 9
Spencer Spit - T35N, R1W, S7 and 18
Watmough Bay - T34N, R1W, S21
White Point - T36N, R4W, S23

SKAGIT COUNTY:

LaConner - T33N, R2E, S1; T33N, R3E, S6 and 7

SNOHOMISH COUNTY:

Hat Slough - T31N, R3E, S1 and 12; T31N, R4E, S7
South Pass - T31N, R3E, S1; T32N, R3E, S26, 27, 35 and 36
West Pass - T32N, R3E, S1, 11, 12, 14, 16, 22 and 23

THURSTON COUNTY:

Big Fishtrap - T19N, R1W, S6 and 7; T19N, R2W, S1
Butterball Cove - T19N, R1W, S23
Mill Bight - T19N, R1W, S10
Unnamed site east of Beach Crest - T19N, R1W, S25

WHATCOM COUNTY:

Tongue Point - T40N, R1W, S2

GLOSSARY

ANOXIC: Lacking oxygen.

BRACKISH: Concentration of marine derived salts greater than or equal to 0.5 ppt and less than 18.0 ppt.

CF: Compared with or similar to; used with uncertain plant identifications.

DISTRIBUTARY: A stream or river branch flowing away from a main stream or river channel and not rejoining.

DOMINANT SPECIES: A plant species which has a cover value of greater than or equal to 20% of the total area covered by the plant community of which it is a component.

ECOTONE: Vegetation or an area which consists of the overlap of two or more distinct plant communities or ecological areas.

ESTUARINE SYSTEM: The area (and all its biotic and abiotic features) in which seawater is measurably diluted by fresh water. The system extends upstream and landward to the limit of tidal influence, e.g. to mean higher high water (MHHW) or to a point at which ocean-derived salts measure less than 0.5 ppt. Seaward limits are defined by a line closing the mouth of a bay or river, including "off-shore" areas of continuously diluted seawater (Cowardin, et al., 1979). The degree of enclosure is widely variable, from nearly open coastal areas to lands periodically occluded from oceanic influence. Salinity may increase above that of open coastal water by evaporation.

ESTUARY: "A semi-enclosed coastal body of water which has free connection with the open sea and within which seawater is measurably diluted with freshwater derived from land drainage" (Pritchard, 1967).

EUHALINE: Concentration of marine derived salts greater than or equal to 20.0 ppt and less than 40.0 ppt.

HIGH INTERTIDAL: Intertidal lands between low high water (LHW) and mean high water (MHW). The upper limit is also defined by 5% cover or greater of typically fresh water marsh or upland plant species.

HIGH SALINITY: A non-technical term indicating concentration of marine derived salts ranging from polyhaline through hyperline levels.

HYPERHALINE: Concentration of marine derived salts greater than or equal to 40 ppt. Hyperhaline salinities are reached through evaporation of closed or semi-enclosed marine or estuarine systems.

INTERTIDAL: Tidelands between extreme low water (ELW) and mean higher high water (MHHW).

LOW INTERTIDAL: Intertidal lands between extreme low water (ELW) and low high water (LHW).

LOW SALINITY: A non-technical term indicating concentration of marine derived salts greater than or equal to 0.5 ppt and less than 18.0 ppt. The term is analogous to "brackish".

MINOR SPECIES: A plant species which has a cover value of less than or equal to 5% of the total area covered by the plant community of which it is a component.

PEDESTALS: Microtopographic features formed by the erosion of adjacent lands.

POLYHALINE: Concentration of marine derived salts greater than or equal to 18.0 ppt and less than 30.0 ppt.

PPT: An acronym for parts per thousand.

SALT MARSH: Intertidal lands vegetated by herbaceous (non-woody) plant species. Plant species are typically halophytic, adapted to growth in saline environments.

SALT PANNES: Depressional areas, of varied origin, within salt marshes. Marine derived salts typically become highly concentrated and inhibit vascular plant growth.

SUBDOMINANT SPECIES: A plant species which has a cover value greater than 5% and less than 20% of the total area covered by the plant community of which it is a component.

SURGE PLAIN: The flood plain of the upper tidal reaches of stream and river systems where freshwater is backed up by incoming tidal water. Freshwater and at times saltwater, spill out of the stream and river channels and inundate the flood plain vegetation.

TRANSITION ZONE: Intertidal lands between approximately mean high water (MHW) and mean higher high water (MHHW). The lower tidal limit is also defined by 5% cover of typically freshwater or upland species.

WETLAND: "Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." (Cowardin et. al., 1979).

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