WESTERN WASHINGTON FRESHWATER WETLANDS

Phase V: Western Clallam County

by

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ABSTRACT

This study identifies high quality native wetlands which occur in the lowlands of western Clallam County, Washington. It focuses on impounded sphagnum and non-sphagnum freshwater wetlands which have rooted vascular plant vegetation. The report includes:

1. A list and descriptions of relatively pristine native wetlands.

2. A list and descriptions of wetlands which have been disturbed but have been or may be restored.

3. A classification of native vegetated wetlands in the area.

ACKNOWLEDGMENTS

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I appreciated the support and interest of the Department of Natural Resources, Olympic Region staff. I was impressed with the interest in wetlands shown by the technical staff and appreciate the staff support provided me by the mechanics and office workers.

Special recognition is due those brave souls who spent time in the field with me. First, Bill Leonard who went waist deep in water looking for the elusive spotted frog, then spent a day thrashing through and crawling under evergreen huckleberry and salal in search of equally elusive forested wetlands. Second, to Andy McMillan, Washington Department of Ecology contract officer for this project, who decided to get his feet wet and gain firsthand knowledge of the field effort for this project. Third, to Mark Sheehan, Program Manager for the Washington Natural Heritage Program, and John Gamon, the Program's rare plant specialist, who spent a day helping me conduct rare plant inventories.

I admiringly acknowledge those researchers whose work in this region precedes mine. Although beautiful and rewarding to work in, this region requires dedication and perseverance to survey. Particularly I acknowledge the omnipresent Nelsa and Buck Buckingham.

My grateful thanks to Janet Anthony, Barry Troutman and Lisa Egtvedt for good company and conversation a long way from home. And to Gordon White, my husband, for his acceptance and support of my work and transient field biologist's life style.

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INTRODUCTION

Over the last several years, the public has become more aware of the values and functions of wetlands. At the same time, information has become available on the amount and rate of destruction of these systems. The result has been a heightened public concern about the protection and rehabilitation of wetland systems.

The Washington Department of Ecology determined a need for wetland studies which would classify and describe wetland types, identify high quality native systems, and identify wetlands which, though disturbed, have the potential to be restored. To satisfy part of this need, the Department of Ecology contracted with the Department of Natural Resources, Natural Heritage Program to inventory wetlands located on the Olympic Peninsula.

This study focuses on native, freshwater, sphagnum and non-sphagnum wetlands which are vegetated by rooted vascular plants. It concentrates on ponded and semi-impounded systems. The report provides a list and descriptions of "pristine" native wetlands (first tier), that is, those sites which most resemble wetlands which occupied the area prior to European settlement. It also provides a list and descriptions of wetlands which have been disturbed but which have been, or may be able to be restored (second tier). These are wetlands which still resemble and function as presettlement systems but have been altered or disturbed. The disturbance may affect only an isolated portion of the wetland, or the wetland may have recovered (or be in the process of recovering).

A classification of native, vegetated wetland communities was developed based on a compilation of data in the Natural Heritage Information System, in the literature and from this field study.

Although a large percentage of the impounded wetlands located in western Clallam County were reviewed, not all could be surveyed within the scope of this study. With further work, it is probable that more sites could be added to this list of high quality wetlands.

STUDY AREA

The study area includes the lands below 2,000 feet in western Clallam County. It includes state, private and National Park lands and excludes Indian and National Forest lands (figure 1).

The study area falls within the Coast Range, which is defined as occurring between the Strait of Juan de Fuca to the north, and the Klamath Mountains to the south, the Pacific Ocean to the west, and the Puget-Willamette Lowlands to the east (McKee, 1972). This portion of the Coast Range is primarily different aged marine sedimentary rock, alluvium, differentiated glacial outwash, and undifferentiated glacial till. The terrain within the study area is uneven, composed of river valleys, terraces and rolling to steep hills. The northern and northwestern portions of Clallam County were overridden by

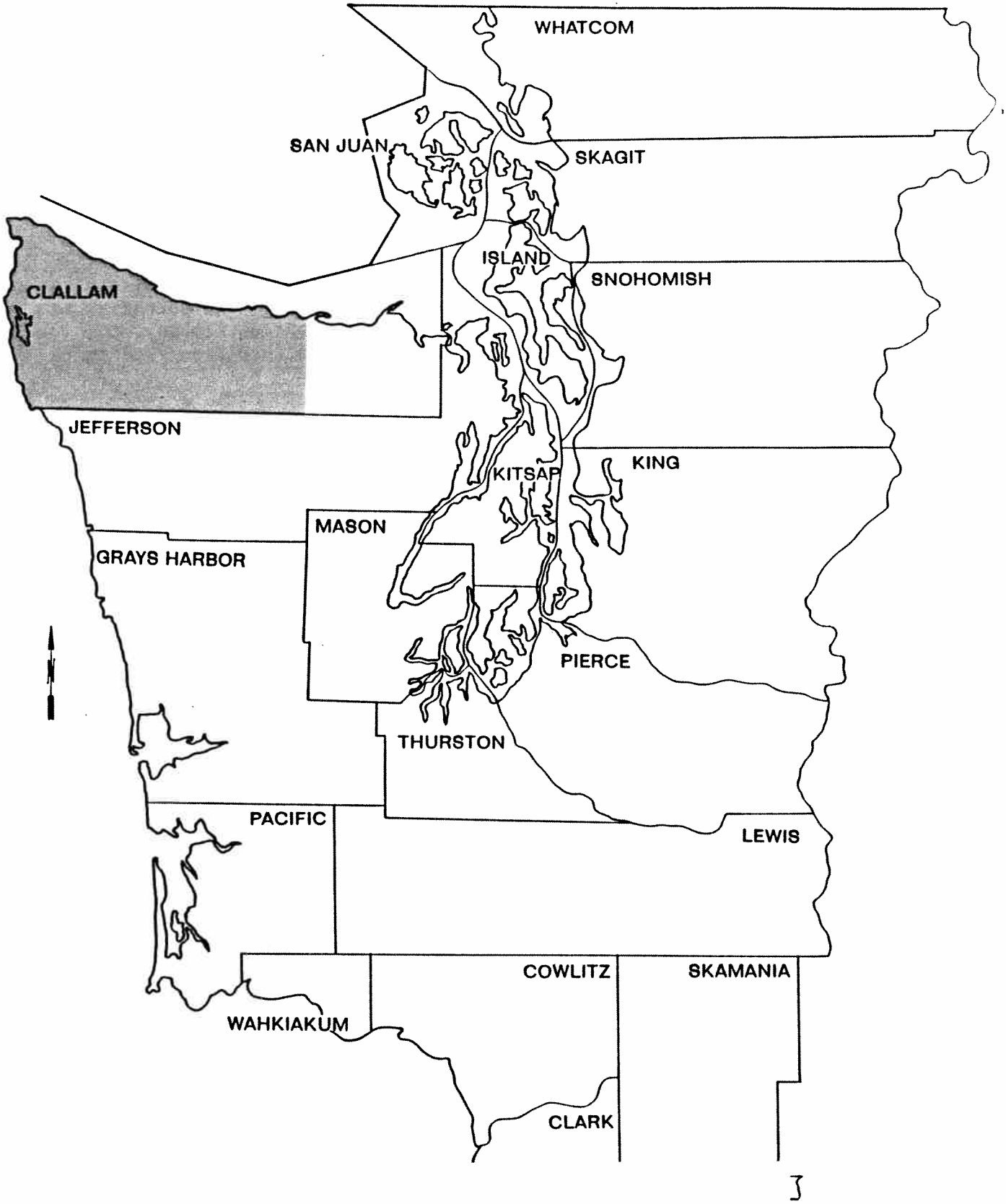


Figure 1: Study Area

continental glaciers which terminated to the south at the Quileute River. South of the continental glaciers, the lowlands were affected by alpine glaciers (Tabor and Cady, 1978).

Western Jefferson County has a mild marine climate. Annual average daily minimum and maximum temperatures for Forks are 41° and 58° F respectively (range 33° to 72° F). It is part of the wettest area in the continental U.S., with up to 180 inches of rain annually (average 118 inches). The eastern end of the study area receives about 60 inches of rain annually.

METHODOLOGY

INITIAL SITE SELECTION:

Sites for study were initially selected by: 1) reviewing U.S.G.S. 7.5 and 15 minute quadrangle maps; 2) reviewing the latest available aerial photographs printed at a scale of 1:12,000; 3) retrieval of data already contained within the Natural Heritage Information System; and 4) reviewing leads provided by researchers and knowledgeable landowners.

The criteria that were used in this initial site selection were:

1. The degree of human-related physical disturbances. Disturbances included: damming, diking, ditching, filling, draining, logging, other vegetation removal or mining of the substrate. A site continued to be considered for survey if the disturbance appeared to be relatively minor or isolated. Otherwise, the existence of any of these disturbances resulted in the elimination of a site from further consideration.

2. Adjacent land use. Some adjacent land uses are more disruptive of wetlands than are others. Adjacent land uses include: timber production, pasture, agriculture, industry, powerline right-of-ways, roads, railroads, recreational development, urban development, and rural development. If an adjacent land use was highly disruptive, the wetland may have been eliminated from further consideration.

3. The presence and quality of an upland buffer. Assessment of the quality of a buffer was based on 1) the width of the buffer in relationship to adjacent land uses, 2) the composition and age of the buffer, and 3) current uses within the buffer. If a buffer did not exist between a wetland and a disruptive adjacent land use, and the wetland appeared disturbed, then the site was usually eliminated from further consideration for field survey. If, on the other hand, the site appeared undisturbed, it continued to be considered for field surveys, despite the absence of a buffer.

4. The minimum size for sites to be considered was arbitrarily set at two acres.

Sites selected through this process were then ranked according to their apparent quality, and scheduled for field surveys.

FIELD SURVEYS:

Field surveys were conducted during the summer of 1989. Existing data from the Natural Heritage Information System were collected in previous years.

Upon visiting a site, a preliminary determination was made to include or eliminate the site from further consideration. Site inclusion was based on the cover and frequency values of non-native plant species, apparent historical use of the wetland (for instance as pasture or for timber harvest), along with the criteria for initial site selection outlined above. Degraded sites were surveyed if they represented relatively better examples of wetland types that have been degraded throughout the region.

For all survey sites, data were collected on physical and biotic features, hydrology, soils, adjacent land use, and historic use. Physical features included topography, elevation, exposure, special climatic conditions, kind or means of impoundment, and wetland configuration. Data on hydrology included water depth, apparent water level fluctuation, drainage patterns within the wetland's basin, and water source.

Soils generally were classified in the field as: sphagnum peat, fibrous peat, heath peat, woody peat, muck, clays, silts, sands, glacial till, or outwash. Soils data were also gathered from the U.S. Soil Conservation Service (1987). Peat soil definitions follow Rigg (1958).

Adjacent land use and historic uses were determined through site observation, talking with owners of a site and adjacent areas, agency personnel, people involved with the timber industry, historical records, and aerial photographs. Of particular use were studies by the National Park Service of the settlement history of park lands on the Olympic Peninsula.

The biologic evaluation of a site included a detailed description of the vegetation. Assemblages of native plant species were identified during a reconnaissance of each wetland. Lists of species and their percent cover values were recorded for each assemblage. Plant species nomenclature follows Hitchcock and Cronquist (1973). Wildlife species or their sign were noted.

CLASSIFICATION:

An initial classification of relatively undisturbed, native, wetland vegetation was developed for the lowlands of the western Olympic Peninsula, between Grays Harbor and the Strait of Juan de Fuca (Appendix A). It synthesized the data from the field surveys, the Natural Heritage Information System, and the literature.

Species cover values were entered by stand in condensed format and analyzed using TWINSPAN (Hill, 1979). Stands were the assemblages identified in the reconnaissance surveys.

A wetland community was considered to be recurring in the landscape if three or more stands had similar species composition and cover values. A wetland

community was identified as not recurring in the landscape if 1) only two stands had similar species composition and cover values, 2) a stand had a species composition dissimilar from any other, or 3) two or more communities had similar dominant species but otherwise very different species composition and cover values. Communities identified in this way were compared with those described in the literature. Recurring and non-recurring communities are described in Appendix B.

FINAL SITE SELECTION CRITERIA:

The following criteria were applied to "first tier" sites, that is, those sites which are the most pristine examples of native wetland systems:

1. No evidence of human-caused topographic or hydrologic alteration of the wetland.

2. Exotic plant species occurred infrequently if at all.

3. Relatively little known or apparent human-caused disturbance of the native vegetation.

4. Existence of an adequate buffer at sites where adjacent land use was potentially degrading.

5. No known major water quality problems.

If a site did not meet these criteria, it could still be listed as a "first tier" site if it was the highest quality known example of a community, or contained particularly important populations of plant or animal species listed as endangered, threatened or sensitive in Washington (Washington Natural Heritage Program, 1990 and Washington Department of Wildlife, Nongame Program, 1988).

The following criteria were applied to "second tier" sites, that is, those sites which were disturbed but have good potential for restoration:

1. No, or isolated, human alteration of the wetland topography.

2. No human caused alteration of the hydrology of the wetland, or else the wetland appeared to have recovered from the alteration.

3. Low cover and frequency of exotic plant species.

4. Relatively little human-related disturbance of the native vegetation, or excellent recovery from past disturbance.

5. If the wetland system was degraded, it still contained a viable and high quality example of a wetland community.

6. No known major water quality problems.

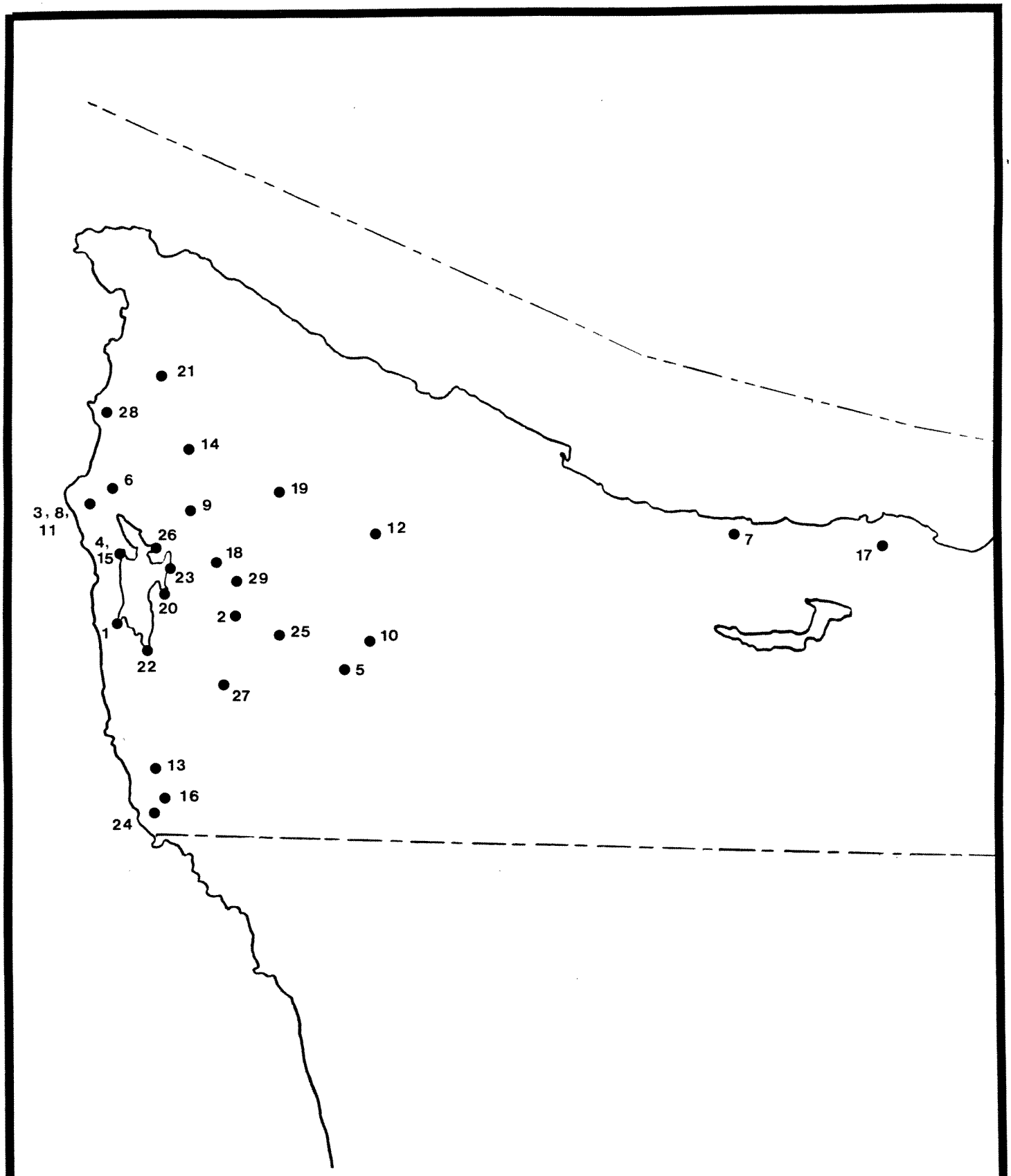


Figure 2: Location of First and Second Tier Sites

SITE LISTS

FIRST TIER SITES:

1. Allens Slough
2. Big Joes Lake
3. Cape Alava Prairie
4. Ericsons Lagoon
5. Iverson Bog
6. Mannys Prairie
7. Murdock Bog
8. Rooses Prairie
9. Trout Creek Bog
10. Tyee Bogs

SECOND TIER SITES:

11. Ahlstrom's Prairie
12. Cub Creek
13. Dickey Flats
14. Elk Lake
15. Ericsons Pond
16. James Pond
17. Joyce Scour
18. North Fork Crooked Creek
19. Old Royal Pond
20. Quinn Creek
21. Sooes Marsh
22. South End
23. Swan Bay
24. Thunder Bench
25. Thunder Lake
26. Umbrella Bay
27. Wentworth Lake
28. Willoughby Lake
29. Wool-grass Marsh

CONDITION

The wetlands of western Clallam County have received a surprising degree of use. Most of the flood plains along the major rivers were settled and farmed or used to pasture livestock in the past. Many of the sphagnum bogs and "prairies" were also homesteaded and used for pasture. Most of the forested wetlands have been clearcut or selectively logged. As a result, there are few of these kinds of wetland systems which are in "pristine" condition.

The riparian and oxbow wetlands are in poor condition. Past uses introduced exotic (non-native) weedy plant species which are wide spread and persistent in the environment even where uses were discontinued as much as 30 years ago. Selected surveys of these wetlands indicate that very few still resemble native systems.

Sphagnum bogs and "prairies" were used for pasture and homesteads because they were some of the few natural clearings within a land of once vast forests of giant trees. Many of these homesteads were short lived and abandoned more than 30 years ago. Although there were physical disturbances to the bogs (grazing, trampling and attempted draining mostly), few exotic species were introduced. The lack of exotic species and the general failure to substantially alter the hydrology of some of these wetlands leaves hope that they may recover. Recent logging activities have introduced and spread some tenacious exotic species which pose a threat to the wetlands in this area.

There are two general categories of forested wetlands: 1) those with commercial timber values; and 2) those without commercial value. Most of the former wetland forests have been logged. Many of the latter have been selectively logged. It maybe a century or more before it is known whether these systems can recover.

Most wetlands which are still in relatively good condition in western Clallam County are located within the National Park and blocks of land used for timber production. In most other areas, the wetlands have been highly disturbed through development and agriculture.

Wetlands within timber blocks have been affected by the introduction of exotic plant species, logging of small or forested wetlands, sedimentation, alteration of their hydrology, and application of biocides and nutrients.

Tier One Sites

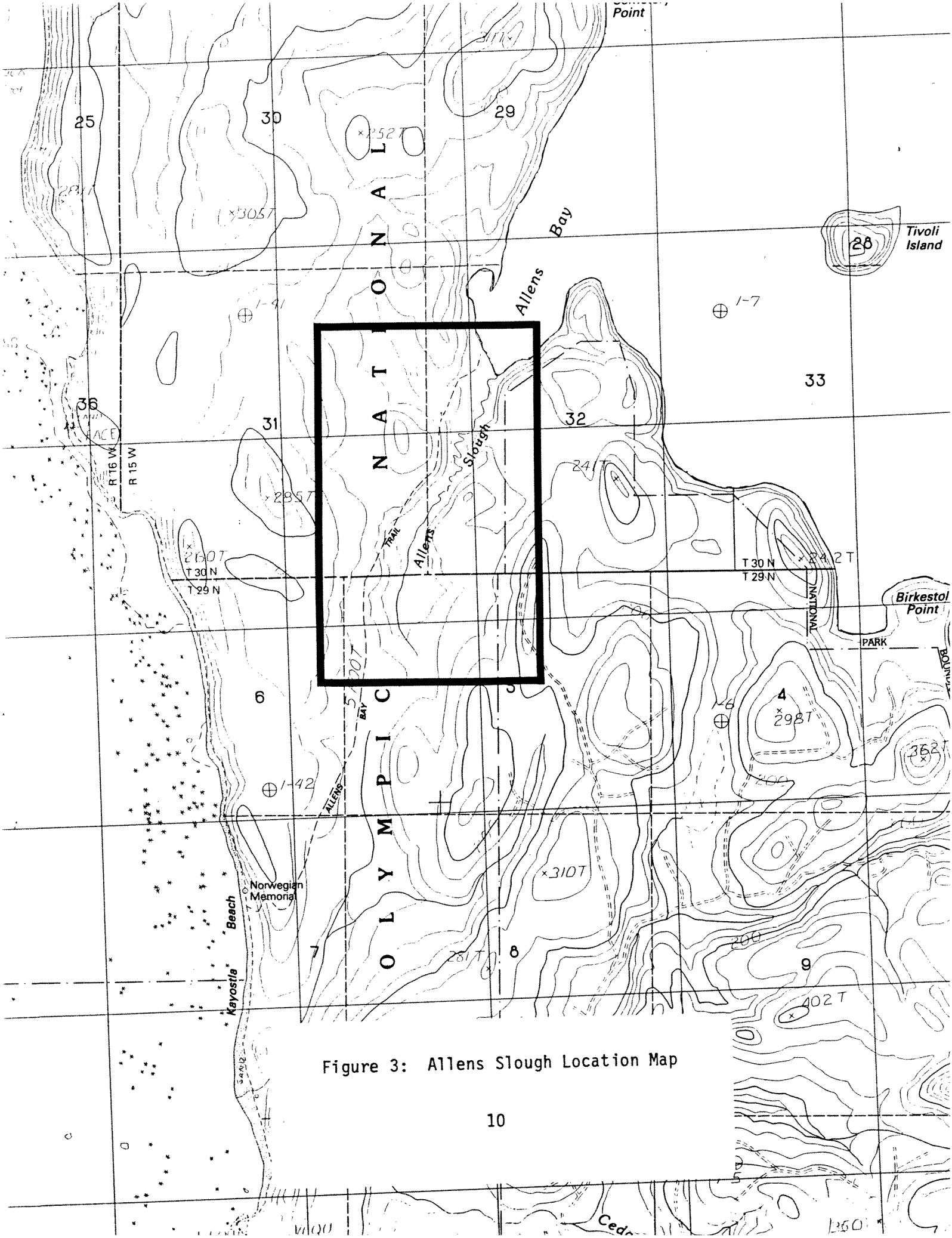


Figure 3: Allens Slough Location Map

ALLENS SLOUGH

LOCATION:

Western Clallam County; Sections 31 and 32, Township 30 North, Range 15 West and Section 5, Township 29 North, Range 15 West, Willamette Meridian. Allens Slough is part of the Olympic National Park.

SIGNIFICANCE:

Allens Slough is a first tier site. It is in excellent condition, contains populations of 3 state list plant species, and examples of 2 sphagnum bog and 3 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Myrica gale/Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community.
2. Pinus contorta-Thuja plicata/Myrica gale/Sphagnum spp. community.

Freshwater Wetland:

1. Myrica gale-Spiraea douglasii/Carex obnupta community.
2. Spiraea douglasii community.
3. Pyrus fusca community.

DESCRIPTION:

Physical: Allens Slough is located at the southwest end of Lake Ozette at an elevation of about 40 feet. It occurs along most of the length of a low gradient stream and includes a small pocket bog adjacent to a tributary of the stream. The main wetland is composed of 27 acres of shrub dominated wetlands and 26 acres of bog forest. The pocket bog is about one acre.

The main wetland receives water from precipitation, groundwater discharge and surface sheet flow. Seasonally, the area is flooded with a mixture of lake water and water from the immediate area. The pocket bog mostly receives water from precipitation. The whole system is wet year round.

The soils vary, but mostly are composed of sphagnum, fibrous and heath peat. The forested wetlands also have woody material and areas of muck.

Biological: Most of the shrub dominated wetland is a mosaic of the tall and short forms of the Myrica gale/Carex sitchensis-Sanguisorba officinalis/Sphagnum spp. community. The short form of the community is about one foot tall, species rich and is dominated by Myrica gale, Sanguisorba officinalis, Carex livida and Sphagnum spp. In areas, Carex sitchensis is tall, lush and codominant. The tall form reaches a height of six feet and is dominated by Myrica gale and Sphagnum spp. consistently, and Sanguisorba officinalis, Trientalis arctica, Spiraea douglasii and Carex sitchensis in places. The tall form grades into a community codominated by Pyrus fusca, Myrica gale, Spiraea douglasii, Carex sitchensis and Sphagnum spp.

Towards the mouth of the slough, the vegetation is a mosaic of the tall form of the Myrica gale/Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community and a non-sphagnum community codominated by tall, dense Spiraea douglasii and Carex obnupta.

Around most of the east and northwest sides of the wetland, the vegetation is dominated by Picea sitchensis, Pyrus fusca and Carex obnupta. Around the rest of the wetland the vegetation is a bog forest dominated by Thuja plicata, Pinus contorta, Myrica gale, Gaultheria shallon and Sphagnum spp. Tsuga heterophylla, Vaccinium ovatum, Ledum groenlandicum, Kalmia occidentalis, Carex phyllomanica and Lysichitum americanum are abundant throughout and codominant in places.

CONDITION:

Allens Slough is in excellent condition. There are almost no occurrences of non-native plant species and the only signs of human disturbance are three east-west lines of cut vegetation and shallow "ditches" attributed to surveys of the township line. Most of the drainage basin for this site falls within the National Park boundary and the wetland receives very little recreational use.

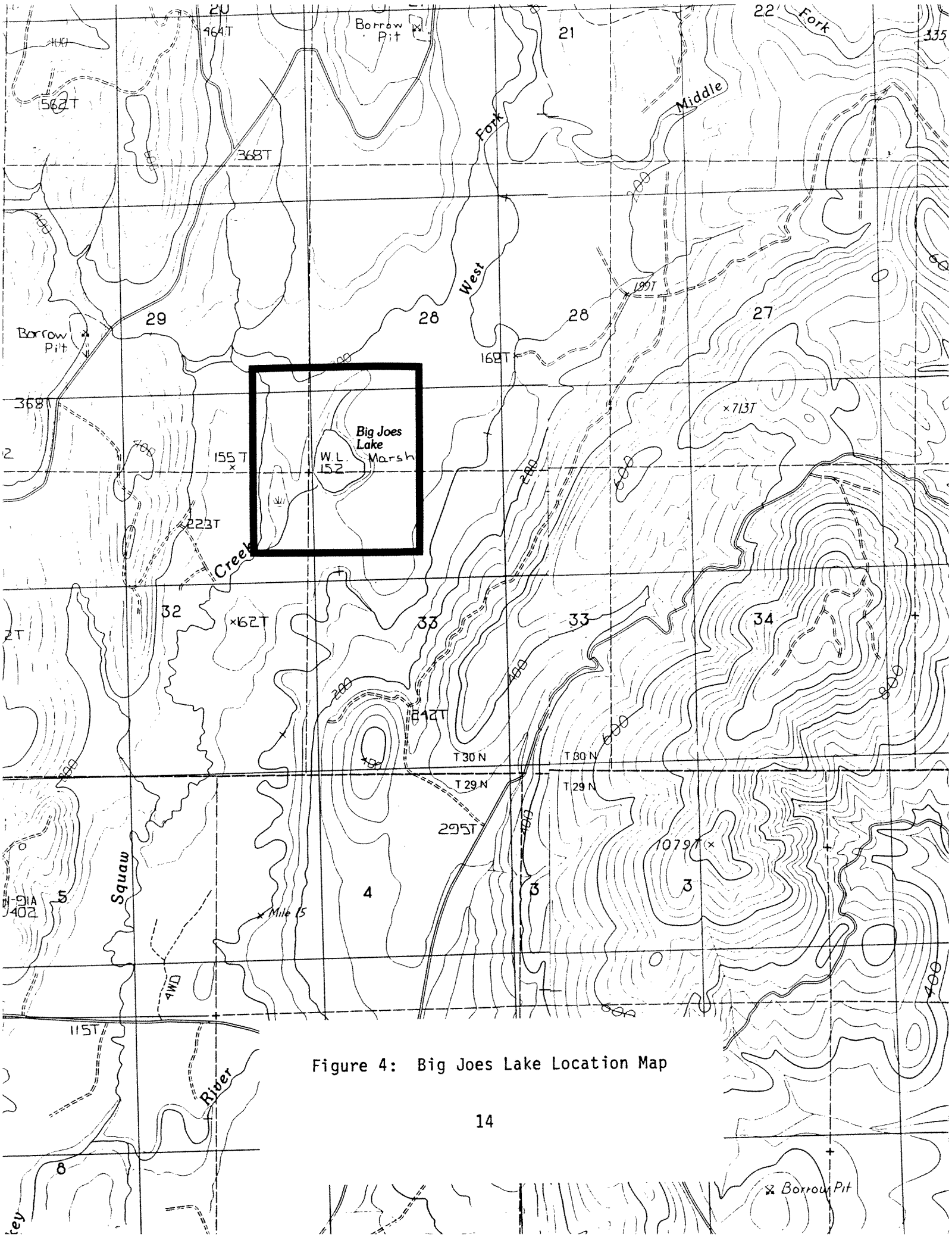


Figure 4: Big Joes Lake Location Map

BIG JOES LAKE

LOCATION:

Western Clallam County; Sections 28, 29, 32 and 33, Township 30 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

Big Joes Lake is a first tier site. Although the uplands along the east side of the lake were recently clearcut, a buffer was left and the wetland vegetation still appears to be in good condition. The site contains examples of 3 sphagnum bog and 1 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Rhynchospora alba/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community.
3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

Freshwater Wetland:

1. Carex sitchensis community.

DESCRIPTION:

Physical: Big Joes Lake is located at an elevation of 152 feet near the headwaters of a tributary of Squaw Creek. The site is composed of a 13-acre lake surrounded by a 6.5 acre band of herb and shrub dominated wetlands.

The system as a whole receives water from precipitation, sheet flow and channeled surface flow. The wetland is a floating bog mat that is perennially saturated and receives water from precipitation. The margin is in contact with minerotrophic water from the lake and inflow stream. The inflow stream is perennial and originates a short distance to the northeast of the lake. The water is very slow moving. The outflow stream exits the lake to the southwest.

Most of the wetland soils are composed of sphagnum, fibrous and heath peat. Along the inflow stream and the waterward edge of the bog mat the soils are mostly fibrous peat and are perennially flooded. The surrounding upland soils are mapped as Klone-Ozette-Tealwhit complex and Ozette silt loam.

Biological: The vegetation on the bog mat is dominated by Kalmia occidentalis, Ledum groenlandicum and Sphagnum spp. The shrubs are moderately low growing, up to about 3 feet tall, and form an open canopy. Vaccinium oxycoccos occurs throughout and is codominant in places. At the north end of the lake, near the inlet stream, is an area of very soft, supersaturated peat dominated by Rhynchospora alba. Inland from this area is an area of stunted Thuja plicata and Tsuga heterophylla with Kalmia occidentalis and Ledum groenlandicum dominating the understory.

The vegetation along the lake margin of the bog mat and along the inlet stream is in contact with minerotrophic water. There is no sphagnum in these areas and the vegetation is codominated by Carex sitchensis and Potentilla palustris.

CONDITION:

The wetland vegetation is in good condition. There are only minor occurrences of weedy plant species. The uplands along the entire east side of the lake were recently clearcut leaving a very narrow buffer from which trees were removed. The uplands along the west side are mature second growth. Access into the lake is difficult and the area appears to receive very little human use.

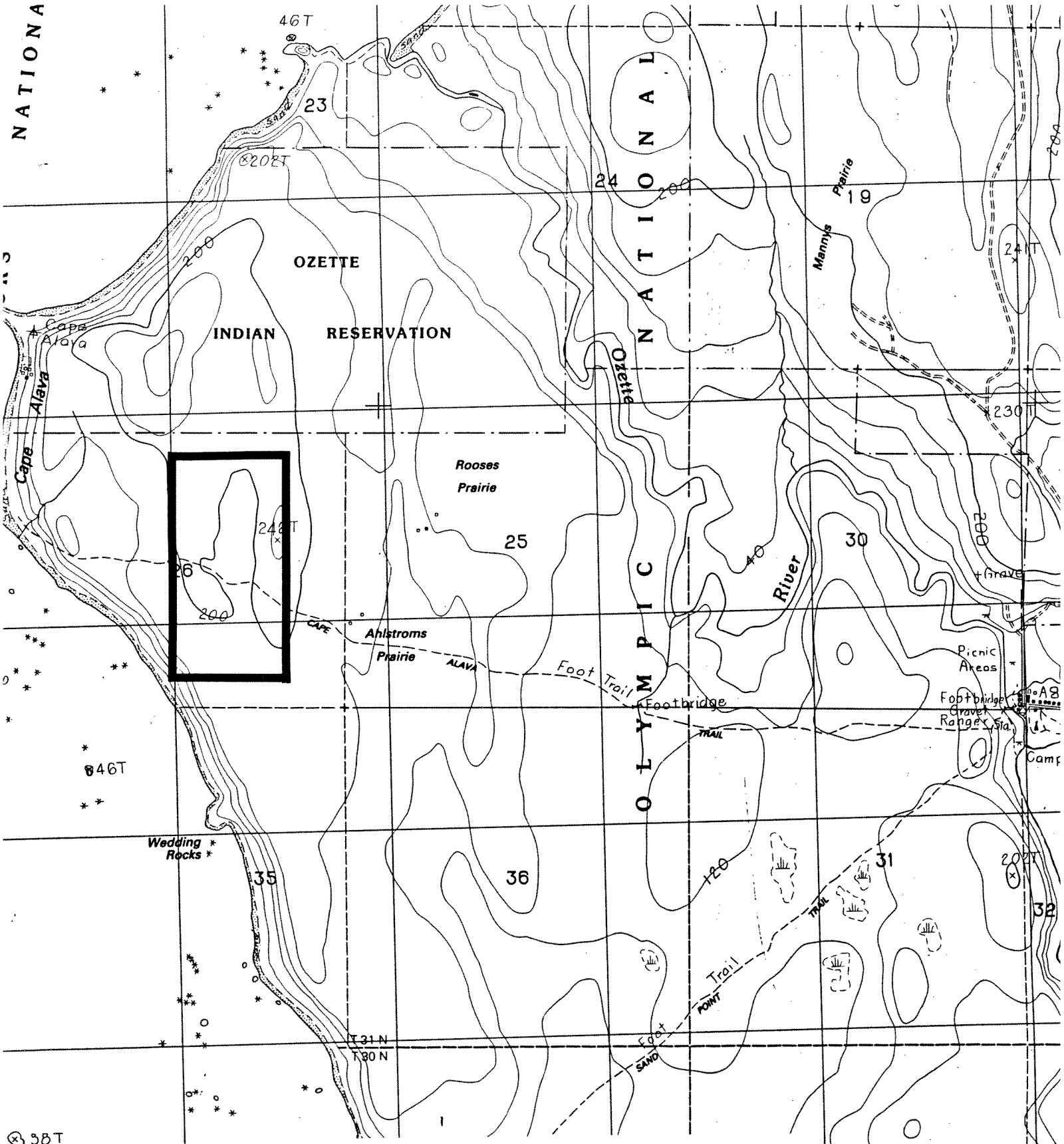


Figure 5: Cape Alava Prairie Location Map

CAPE ALAVA PRAIRIE

LOCATION:

Western Clallam County; Section 26, Township 31 North, Range 16 West, Willamette Meridian. Cape Alava Prairie is part of the Olympic National Park.

SIGNIFICANCE:

Cape Alava Prairie is a first tier site. It contains examples of 3 sphagnum bog communities and populations of 2 state-listed plant species.

FEATURES:

Sphagnum Bog:

1. Carex livida-Sanguisorba officinalis/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/ Carex obnupta/Sphagnum spp. community.
3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Cape Alava Prairie is located on a moraine at an elevation of about 200 feet. It is rectangular, oriented north-south between two ridges. It is about 19 acres and is composed of a small drainage and a larger relatively flat area.

The site receives most of its water from precipitation and a little from sheet flow. There is no channeled inflow. The flat area is wet year round. The drainage area is supersaturated year round and seasonally flooded. It contains a discontinuous channel and carries water from the site to the south.

The soils are sphagnum, fibrous and heath peat with some woody material. The flat area has well developed peat hummocks.

Biological: The drainage area has diverse vegetation. It is characterized by an abundance of Carex pluriflora, Carex livida and Rhynchospora alba. Low growing Empetrum nigrum, Kalmia occidentalis and Ledum groenlandicum are abundant in places. One small area that is permanently flooded is dominated by Eriophorum chamissonis.

The flat area has highly stunted Tsuga heterophylla and Thuja plicata scattered through a low growing shrub land dominated by Kalmia occidentalis, Ledum groenlandicum and Carex obnupta. Empetrum nigrum and Vaccinium oxycoccos have high percent cover values in places.

CONDITION:

Cape Alava Prairie appears to be in good condition. The vegetation appears undisturbed and only one occurrence of an exotic plant species was found. The wetland and hillside to the northwest burned in the past. Burned snags and stumps occur in the bog as well as a few relictual big trees. The hillside to the northwest may have been logged in the past. This site is only one quarter mile from an old homestead, and it is possible that this area was used to graze sheep.

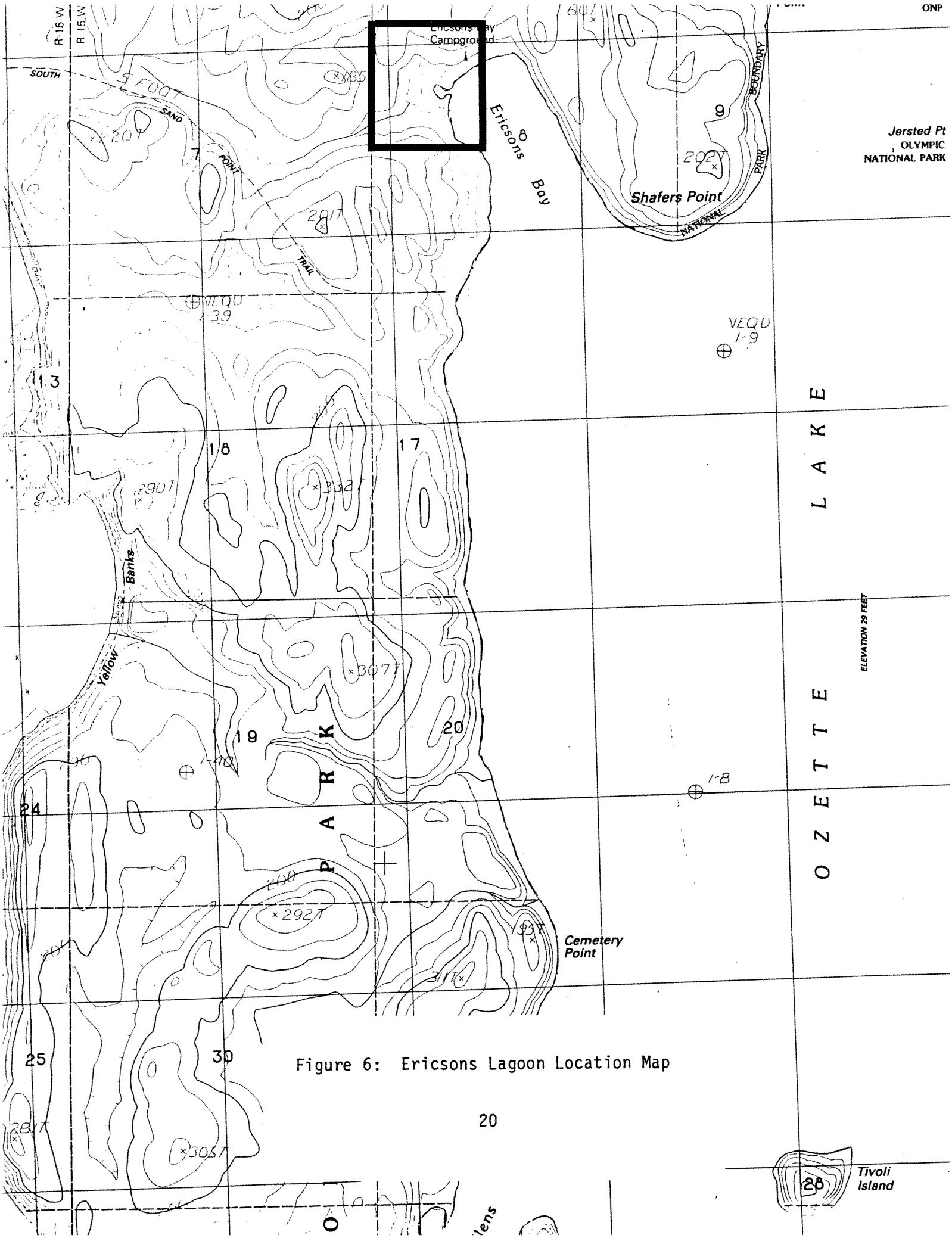


Figure 6: Ericsons Lagoon Location Map

ERICSONS LAGOON

LOCATION:

Western Clallam County; Section 8, Township 30 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Ericsons Lagoon is a first tier site. Although there was a homestead in this area, there are no signs of disturbance to the site. The site contains populations of 6 state-listed plant species and has examples of 2 sphagnum bog and 5 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Myrica gale/Calamagrostis canadensis/Sphagnum spp. community.
2. Myrica gale/Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community.

Freshwater Wetland:

1. Carex obnupta-Juncus nevadensis-Ranunculus flammula community.
2. Carex sitchensis community.
3. Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community.
4. Pyrus fusca community.
5. Pyrus fusca/Calamagrostis canadensis community.

DESCRIPTION:

Physical: Ericsons Lagoon is a small lagoon and wetland system located at the northwest end of Ericsons Bay, on the northwest side of Lake Ozette. It occurs at an elevation of about 30 feet. The site consists of a shallow 1-acre pond flanked lakeward by two spits that combined are 0.5 acres. Landward, the pond is surrounded by 11 acres of wetlands which are a mixture of sphagnum and freshwater wetland communities.

The wetland system is fed by three streams, water from the lake, precipitation and surface sheet flow. The water level fluctuates widely with the seasons. The pond is flooded year round, but is shallow during the summer. The northernmost stream is braided and keeps the wetlands it flows through flooded year round. The rest of the wetland appears to be flooded seasonally, but soils are wet year round.

The lagoon bottom is sand gravel and cobble overlain by varying depths of organic material and in some places soft muck. The spits and lake shore are mineral soil overlain with a thin discontinuous layer of peat. The rest of the wetland is a mixture of sphagnum, fibrous and heath peat with some woody material.

Biological: The pond is dominated by Scirpus subterminalis. The eastern lagoon margins and the waterward zone of seasonally flooded wetlands along the lake shore have firm substrates and are dominated by Juncus balticus, Ranunculus flammula, Carex obnupta and Juncus nevadensis. On

the west side of the lagoon, where substrates are soft silts and peat, the vegetation is dominated by Carex sitchensis and in places Menyathes trifoliata. Around the lagoon is a zone dominated by Myrica gale, Calamagrostis canadensis and, in places, Sphagnum spp.

The lower portion of the northern stream corridor is dominated by Carex sitchensis. Farther upslope, the stream corridor is dominated by Calamagrostis canadensis. To the north, the wetland makes a sharp transition to a highly trampled area dominated by small Thuja plicata, Pyrus fusca, Carex sitchensis or Carex obnupta and Sphagnum spp. To the northwest, the wetland shifts to vegetation dominated by Pyrus fusca and Calamagrostis canadensis. On the west side of the wetland is an area of low growing vegetation dominated by Myrica gale, Carex livida, Dodecatheon jeffreyi and either Carex sitchensis or Carex rostrata. Although there is very little living sphagnum in this area, the soils are in part sphagnum peat.

The spits are species rich and characterized by stunted vegetation including Deschampsia caespitosa, Aster sp., Lycopus uniflorus, Boykinia major, Panicum occidentalis and Plantago macrocarpa.

CONDITION:

Ericsons Lagoon appears to be in excellent condition. There are very few occurrences of non-native plant species and no signs of human disturbance except for one trail through a small portion of the area. There was a homestead in the general vicinity in the late 1800s and early 1900s, and it is probable that the area received some use. Some of the vegetation in the area is unusual, but may be due to the unusual physical characteristic of Ericsons Lagoon.

There is a campground nearby (boat access only). Activities of campground users are a small threat to the system at this time.

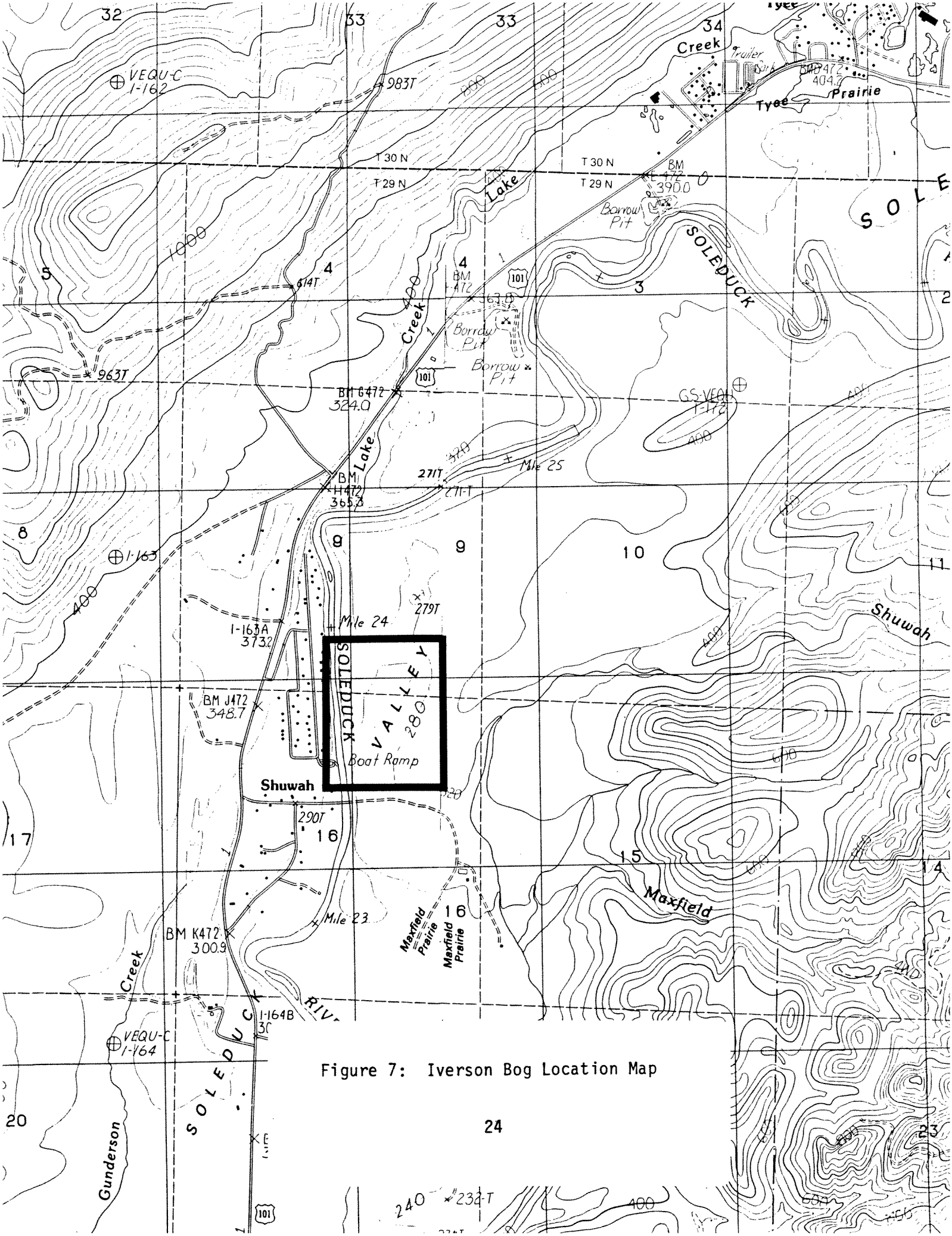


Figure 7: Iverson Bog Location Map

IVERSON BOG

LOCATION:

Western Clallam County; Sections 9 and 16, Township 29 North, Range 13 West, Willamette Meridian.

SIGNIFICANCE:

Iverson Bog is a first tier site. It is a good example of an unusual sphagnum bog system and contains examples of 2 sphagnum bog and 1 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum/ Xeriophyllum tenax/ Sphagnum spp. community.
2. Spiraea douglasii/Sphagnum spp. community.

Freshwater Wetland:

1. Pyrus fusca community.

DESCRIPTION:

Physical: Iverson Bog is located at an elevation of 240 feet on a bench above the Soleduck River. The wetland is oval shaped. The central portion of the wetland is raised above the surrounding perimeter. The wetland consists of a central 3 acre dry bog (on the raised portion of the wetland), a 1 acre Spiraea douglasii dominated lagg, and a surrounding 8 acre Pyrus fusca thicket.

The wetland receives water from precipitation and surface flow. There is neither a channeled inflow nor outflow. The lagg and part of the thicket are seasonally flooded and then remain wet year round. The rest of the wetland appears to be seasonally flooded and then seasonally dry.

The soils in the area are mapped as Klone-Ozette-Tealwhit complex. The wetland soils are composed of sphagnum, fibrous and heath peat and woody material throughout. There is evidence of fire at least in the central dry bog area.

Biological: The raised central portion of the wetland is dominated by Kalmia occidentalis, Ledum groenlandicum and Xeriophyllum tenax. There are dense patches of Pteridium aquilinum. There is very little living sphagnum, instead, several other species of moss dominate the cryptogam layer. Small Picea sitchensis are scattered throughout. This area burned in the past, and contains burned stumps and logs.

The lagg to the north is dominated by low growing Spiraea douglasii, Carex obnupta, Gentiana sceptrum and dead Sphagnum spp.

Most of the wetland's perimeter is dominated by Pyrus fusca. In some places the understory is dominated by Ledum groenlandicum. In others Gaultheria shallon, Maianthemum dilatata, Spiraea douglasii and pole size

Tsuga heterophylla variously codominate the understory. This zone is highly trampled and grazed/browsed by wildlife.

CONDITION:

Iverson Bog appears unusually undisturbed by humans. The surrounding uplands have been recently clearcut, but a buffer was maintained around the wetland edge. The fire within the bog is of unknown origin, but may well have been a natural fire. A trail into the wetland was flagged during the summer of 1989, probably by beargrass pickers.

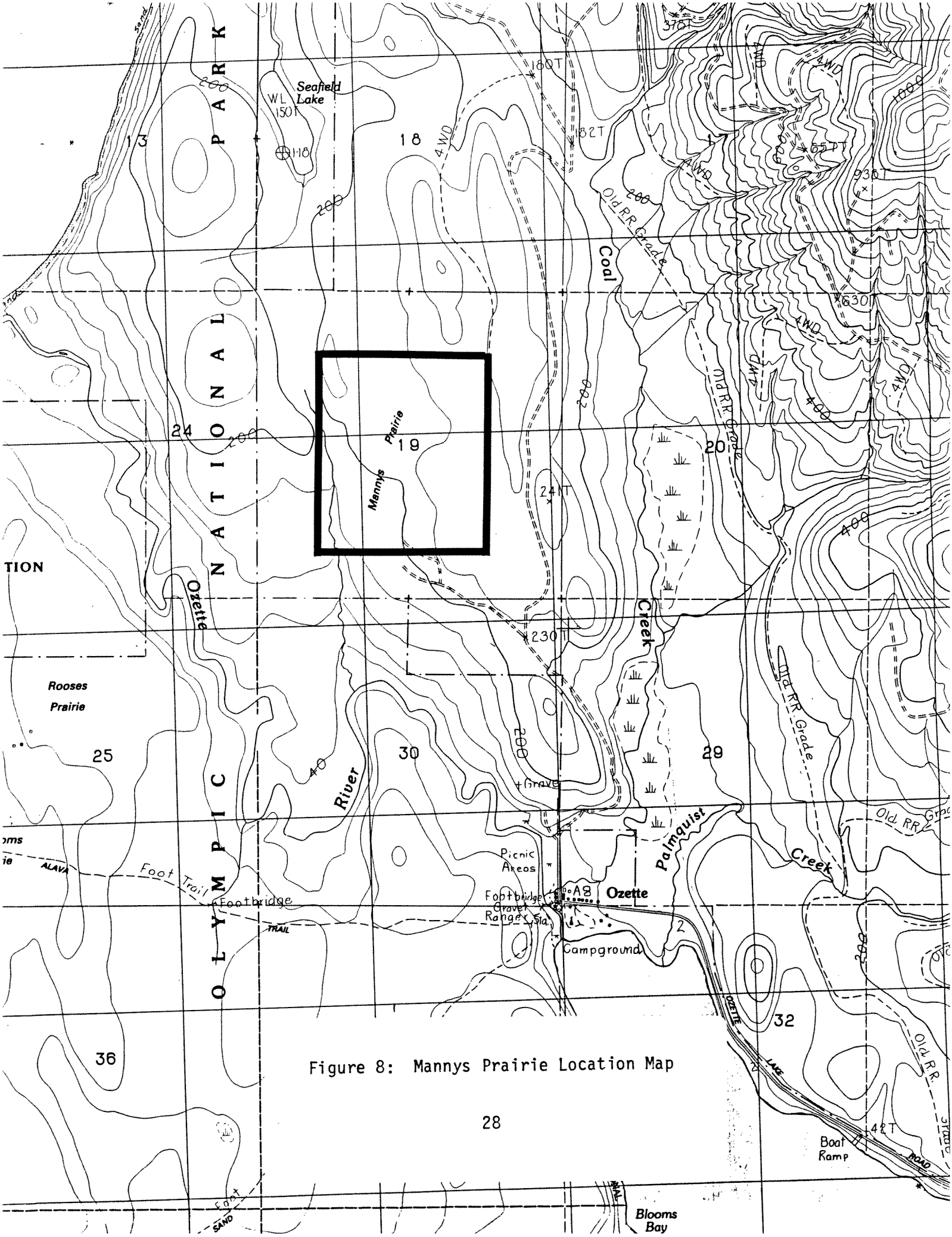


Figure 8: Mannys Prairie Location Map

MANNYS PRAIRIE

LOCATION:

Western Clallam County; Section 19, Township 31 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Mannys Prairie is a first tier site. It contains examples of 2 sphagnum bog communities and a population of 1 state-listed plant species.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum/Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community.
2. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Mannys Prairie is located on a glacial moraine at an elevation between 200 and 240 feet. It is a 56-acre "prairie" with a combination of shrub dominated and stunted tree dominated sphagnum bog communities.

Mannys Prairie is located over compacted glacial till. The soils are mapped as Kydaka silty clay loam. Soils over most of the area are a mixture of sphagnum, fibrous and heath peat and have some woody material. In areas along the crest of the site, the soils are thin and mineral soils are visible.

The site receives water from precipitation. Areas that have moderately well developed peat soils are wet year round. Areas that have thin soils are seasonally dry. The site may have a perched water table. There is no inflow, but the site feeds at least one seasonal stream.

Biological: Most of the site has somewhat stunted Tsuga heterophylla and Thuja plicata and a few Picea sitchensis. The shrub layer is less than 2 feet tall in most cases but in a few areas reaches 4 feet. It is generally dominated by Kalmia occidentalis, Ledum groenlandicum, Pteridium aquilinum, Carex obnupta and Sphagnum spp. Blechnum spicant and low growing Gaultheria shallon are abundant.

CONDITION:

Mannys Prairie appears to be in good condition. The vegetation is composed almost completely of native plant species. The area burned in the past and there are burned snags up to 18 inches dbh. There are a few stumps that appear to have been cut. In 1989, a tracked vehicle was driven across the northern end of the prairie, damaging the vegetation and disturbing the soil. The possible introduction and spread of exotic plant species should be monitored carefully along the vehicle's path.

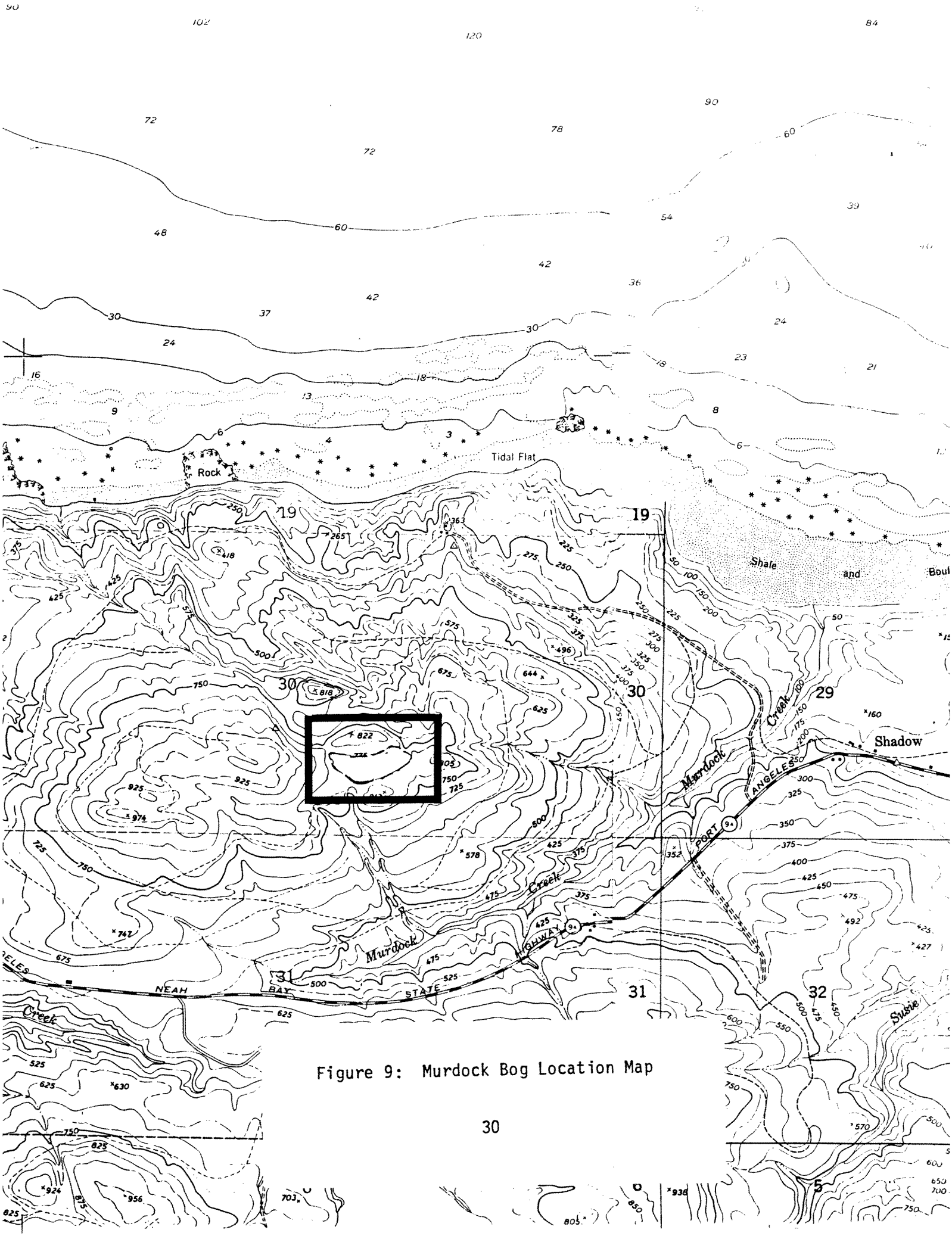


Figure 9: Murdock Bog Location Map

MURDOCK BOG

LOCATION:

Western Clallam County; Section 30, Township 31 North, Range 9 West, Willamette Meridian.

SIGNIFICANCE:

Murdock Bog is a first tier site. The site contains high quality examples of 1 sphagnum bog and 1 freshwater wetland plant communities, and a population of 1 state-listed plant species.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/ Sphagnum spp. community.
2. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

Freshwater Wetland:

1. Spiraea douglasii-Salix spp./Carex obnupta community.

DESCRIPTION:

Physical: Murdock Bog is the headwaters of a tributary of Murdock Creek. It is located in a basin between four hills at an elevation of about 775 feet. It consists of a 4-acre sphagnum bog and 1-acre lagg.

The site receives water from precipitation and surface runoff from surrounding slopes. The lagg surrounds the bog and is mostly permanently flooded. The bog shifts from a floating bog mat that is easily submerged and always supersaturated, to drier ground that is wet year round and may be seasonally flooded. The channeled outflow is seasonal.

The soils in the area are mapped as Mukilteo muck. The soils in the lagg are mostly very soft muck but there is also fibrous peat, heath material and large woody material. The soils in the bog are sphagnum, fibrous and heath peat and some large woody material.

Biological: The lagg is dominated by Oenanthe sarmentosa throughout, and in places by Spiraea douglasii and Carex obnupta.

The floating bog mat is characterized by low growing, scraggly, scattered Ledum groenlandicum, Vaccinium oxycoccos, Eriophorum chamissonis, Carex pluriflora and Sphagnum spp. This shifts to firm ground dominated by somewhat stunted Tsuga heterophylla, Ledum groenlandicum, Gaultheria shallon, Eriophorum chamissonis and Sphagnum spp.

CONDITION:

The wetland appears to be in excellent condition. No exotic plant species were observed, and there were no signs of human-caused disturbance. The surrounding uplands are flagged, either for roads or logging activities, so this site is threatened.

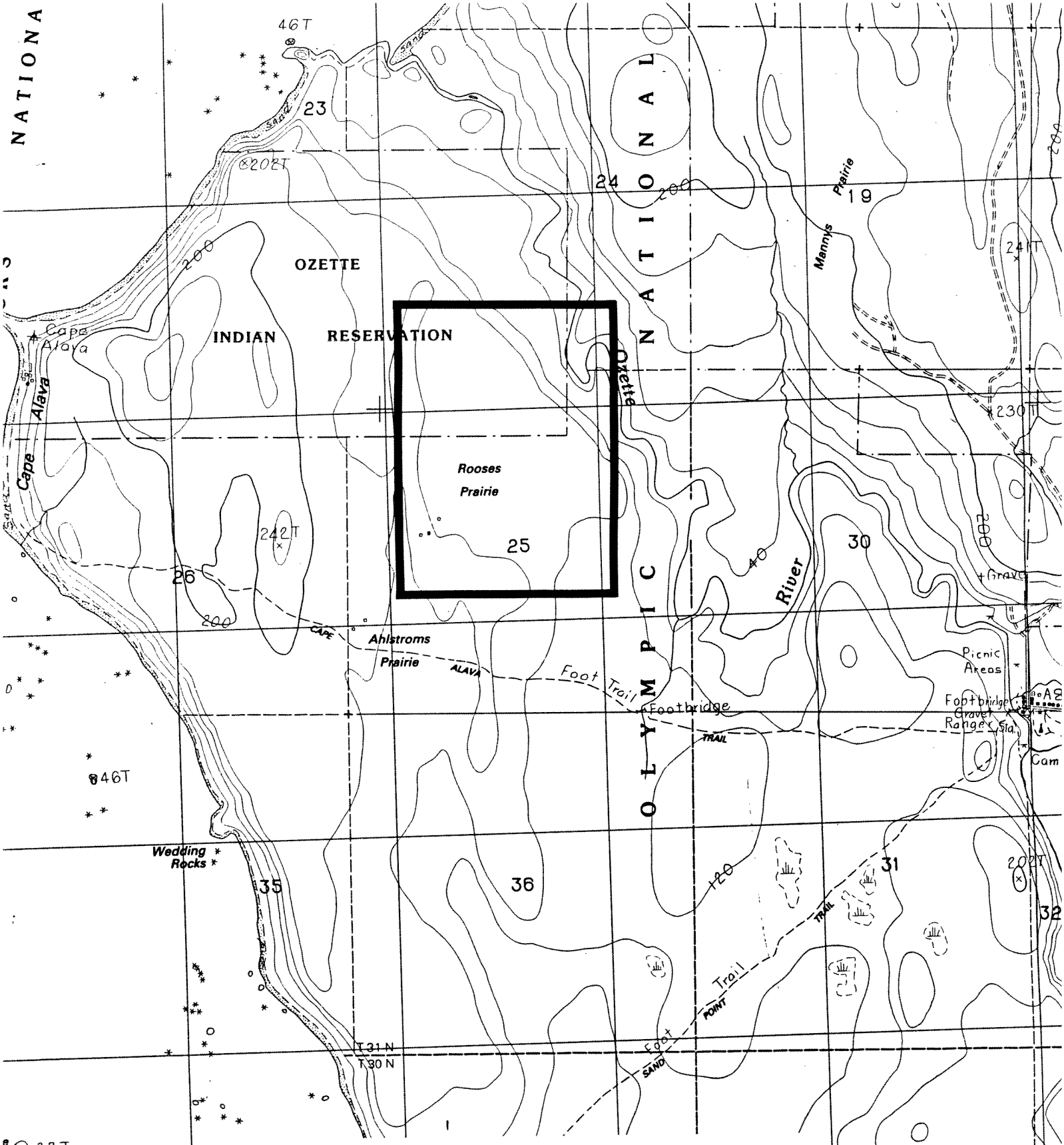


Figure 10: Rooses Prairie Location Map

ROOSES PRAIRIE

LOCATION:

Western Clallam County; Sections 24 and 25, Township 31 North, Range 16 West, Willamette Meridian. Rooses Prairie is part of the Olympic National Park.

SIGNIFICANCE:

Rooses Prairie is a first tier site. It is the highest quality example of this kind of system known to still exist in Washington. It contains examples of 4 sphagnum bog communities and populations of 2 state-listed plant species.

FEATURES:

Sphagnum Bog:

1. Carex livida-Sanguisorba officinalis/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community.
3. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Carex obnupta/Sphagnum spp. community.
4. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Rooses Prairie is located on a glacial moraine at an elevation of about 160 feet. It is about 74 acres and includes a large flat terrace, an area of shallow troughs and ridges, and a small drainage area.

The area receives most of its water from precipitation. There is no channeled inflow or outflow. The drainage area also receives water from sheet flow and may receive some groundwater. The flat terrace is wet year round. The drainage area is supersaturated year round and seasonally flooded. The area of ridges is seasonally dry.

The ridge and trough area has thin soils, glacial till or outwash is visible at the ground surface. There is some sphagnum, fibrous and heath peat in this area. The terrace and drainage have well developed peat hummocks composed of sphagnum, fibrous and heath peat with some woody material.

Biological: The drainage area is dominated by Carex phyllomanica and Sphagnum spp. Kalmia occidentalis, Sanguisorba officinalis and Carex pluriflora are abundant.

The flat terrace has highly stunted Tsuga heterophylla and Thuja plicata scattered through a low growing shrubland dominated by Empetrum nigrum, Kalmia occidentalis, Ledum groenlandicum and Pteridium aquilinum.

The ridge area has somewhat stunted Tsuga heterophylla and Thuja plicata. Kalmia occidentalis, Ledum groenlandicum, Empetrum nigrum, Gaultheria

shallon, Pteridium aquilinum, Blechnum spicant and Carex obnupta are variously codominant in this area.

CONDITION:

Rooses Prairie appears to be in good condition. The flat terrace in particular appears to be in excellent condition. The drainage area is adjacent to Roose's homestead and outbuildings and received some use and effects from the homestead. The ridge area has cut stumps and was burned in the past. Roose grazed sheep in the area.

In the absence of fire, the ridge area may recover to an example of the Thuja plicata-Tsuga heterophylla/Gaultheria shallon-Vaccinium ovatum wet forest.

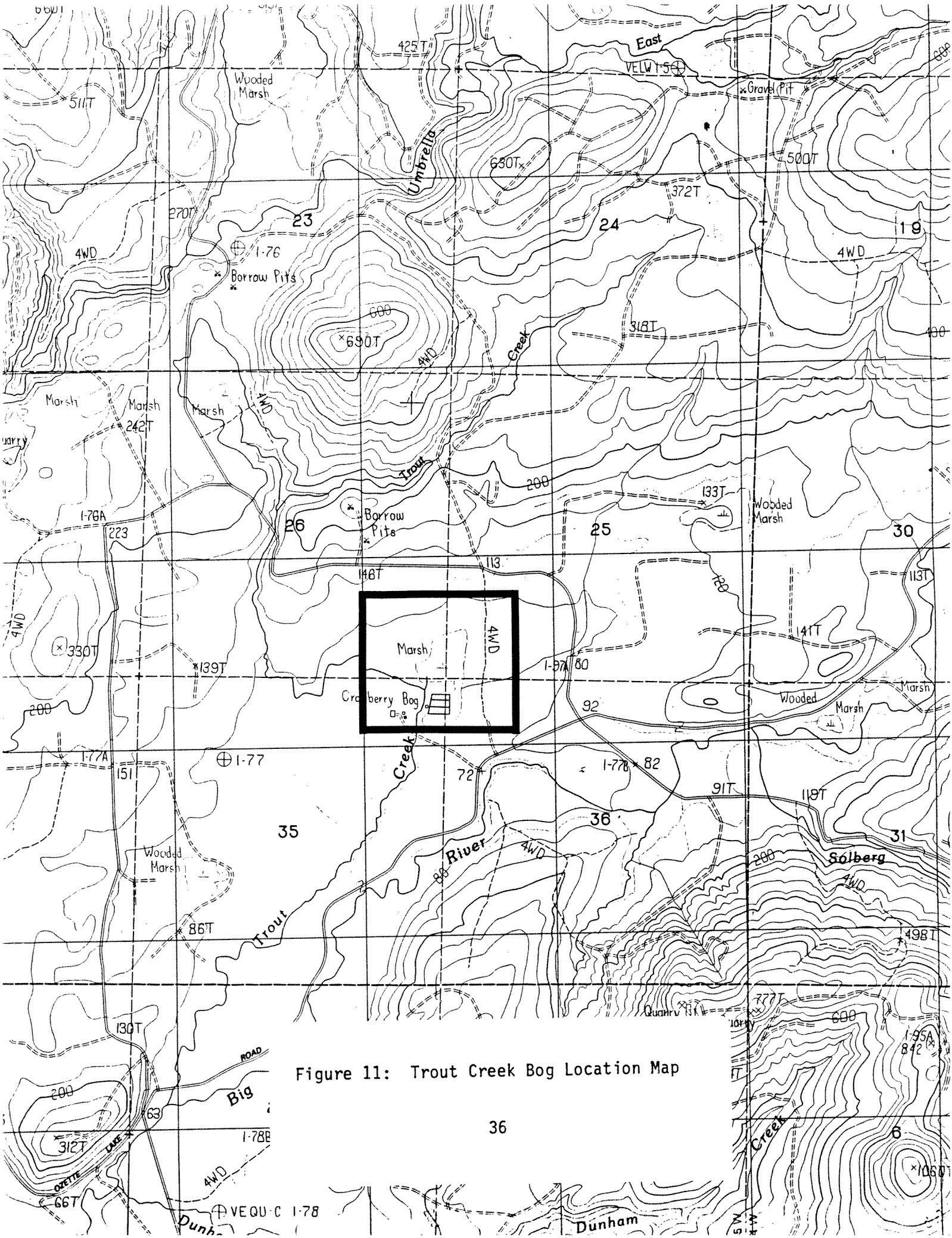


Figure 11: Trout Creek Bog Location Map

TROUT CREEK BOG

LOCATION:

Western Clallam County; Sections 25, 26, 35 and 36, Township 31 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Trout Creek Bog is a first tier site, but if further disturbed, would need to be reduced to a second tier site. It contains examples of 3 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Rhynchospora alba/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/ Sphagnum spp. community.
3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Trout Creek Bog is located on an old alluvial terrace along Trout Creek. It occurs at an elevation of about 70 feet and is oval in shape. The bog is about 12 acres total: Four acres are dominated by herbaceous plant species and low growing shrubs; the remainder is dominated by stunted conifers.

The wetland receives water from precipitation and possibly groundwater or surface sheet flow. It has no channeled inflow or outflow, but the main stream channel and a tributary channel of Trout Creek flow along its southern downstream margin. The site is supersaturated year round, and may be flooded seasonally.

Soils in the area are mapped as Tealwhit silt loam. The wetland soils are sphagnum, fibrous and heath peat with some woody material.

Biological: The central portion of the bog is dominated by Vaccinium oxycoccos and Sphagnum spp. Rhynchospora alba, Carex livida, Carex rostrata and Empetrum nigrum are alternately dominant species. Kalmia occidentalis and Ledum groenlandicum, less than 2 feet tall, are abundant throughout the site and are codominant in places.

The stunted bog forest is dominated by Tsuga heterophylla, Ledum groenlandicum and Sphagnum spp. Gaultheria shallon, Lysichitum americanum, Drosera rotundifolia and stunted Thuja plicata have high percent cover values.

CONDITION:

Trout Creek Bog is in good condition. Livestock from property to the south, occasionally cross Trout Creek and enter the southern edge of the bog. They have highly degraded a portion of Trout Creek, but the creek appears to deter most animals. Exotic and weedy plant species are

abundant south of the creek but thus far are limited to the southern edge of the bog and are not abundant.

A second bog, located southeast of Trout Creek, has been partially converted to cranberry fields. There is a potential that cultivated cranberries could spread to the northern bog, but the greater threat is that the northern bog may be converted for growing cranberries.

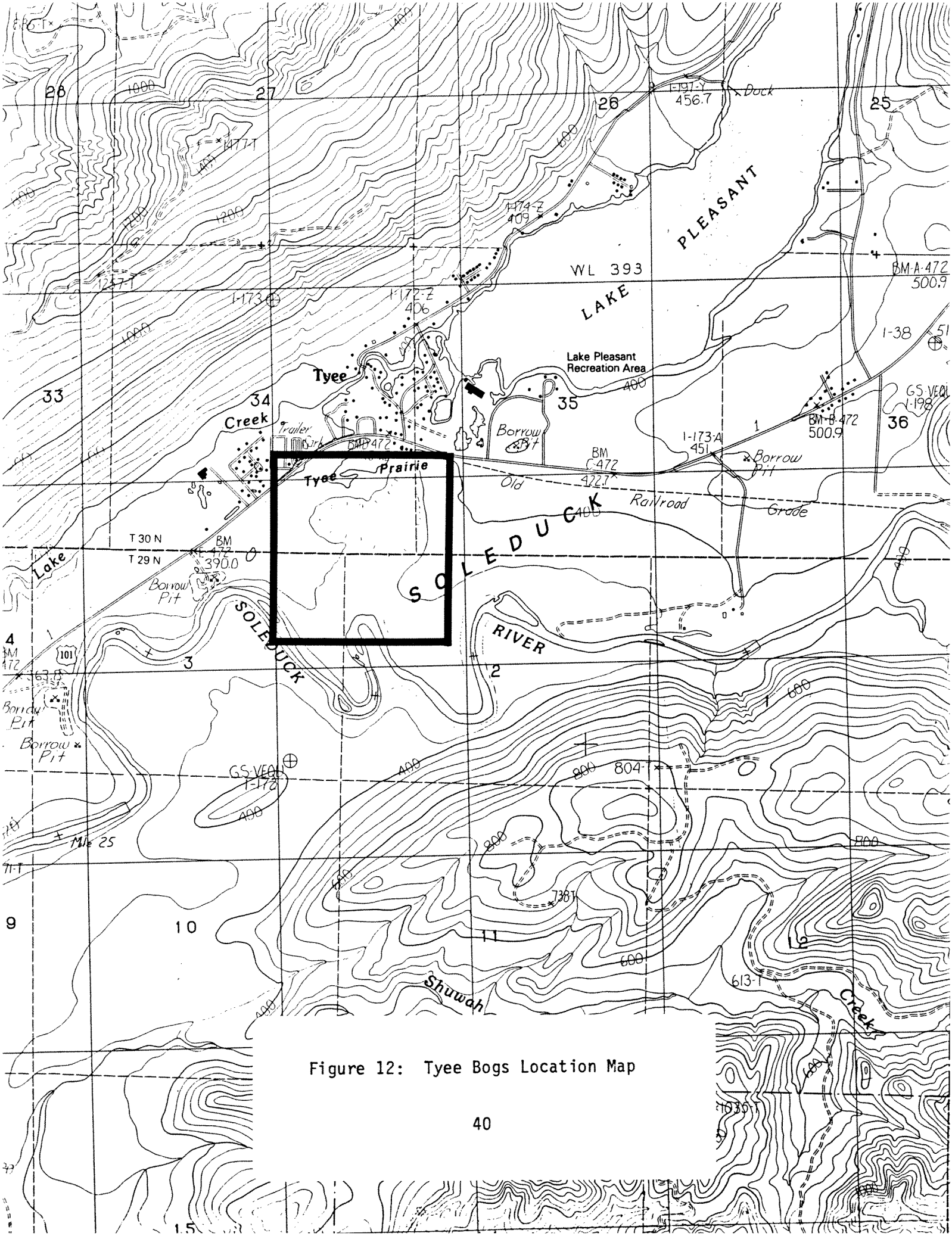


Figure 12: Tyee Bogs Location Map

TYEE BOGS

LOCATION:

Western Clallam County; Sections 2 and 3, Township 29 North, Range 13 West, and Section 34, Township 30 North, Range 13 West, Willamette Meridian.

SIGNIFICANCE:

Tyee Bogs is a first tier site. It consists of three small wetlands, which have examples of 3 sphagnum bog communities and 3 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community.
2. Spiraea douglasii/Sphagnum spp. community.
3. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

Freshwater Wetland:

1. Carex obnupta community.
2. Spiraea douglasii community.
3. Pyrus fusca community.

DESCRIPTION:

Physical: Tyee Bogs is located at about 340 feet elevation on a terrace above the Soleduck River. It is composed of three small wetlands: a 3-acre sphagnum bog, a 4-acre sphagnum bog and a 1-acre freshwater wetland.

The wetlands receive water mostly from precipitation. There are no channeled inflows or outflows, and the wetlands have no surface connection with each other. The 3-acre sphagnum bog is wet year round and may be flooded seasonally. The 4-acre bog is composed of a lagg and sphagnum bog. The lagg is flooded most of the year and then supersaturated. The sphagnum bog is wet year round and may be flooded seasonally. The 1-acre freshwater wetland is in a shallow basin that is flooded seasonally. There may be a moisture gradient with the center of the wetland remaining flooded the longest. The remainder of the year, the site is supersaturated to wet.

The soils in the area are mapped as Klone-Ozette-Tealwhit complex. The sphagnum bog soils are a mixture of sphagnum, fibrous and heath peat with some woody material. The freshwater wetland soils are a mixture of fibrous and heath peat and muck.

Biological: The 3-acre bog is dominated by Ledum groenlandicum, Kalmia occidentalis, Pteridium aquilinum and Sphagnum spp. Gaultheria shallon and stunted Tsuga heterophylla have high percent cover values.

The main body of the 4-acre bog is dominated by Ledum groenlandicum, Kalmia occidentalis and Sphagnum spp. Gaultheria shallon, Vaccinium

oxycoccos and stunted Tsuga heterophylla have high percent cover values. The lagg is dominated by Carex obnupta, Sphagnum spp. and Ledum groenlandicum. Spiraea douglasii, Carex sitchensis, Kalmia occidentalis and Gentiana sceptrum have high percent cover values.

The freshwater wetland has distinct zones. The center is dominated by Carex obnupta and has high percent cover of Carex vesicaria. The next zone is dominated by Spiraea douglasii. The landward margin of the wetland is a thicket of Pyrus fusca.

CONDITION:

Tyee Bogs appears to be in excellent condition. There are no signs of human disturbance in the sphagnum bogs, and the uplands within the basin are mature second growth. The freshwater wetland has old cut logs within the Spiraea douglasii zone, but the vegetation appears in good condition.

The site is threatened with clearcutting and development. The forests are flagged for cutting, and the site is close to a small but developing community.

Tier Two Sites

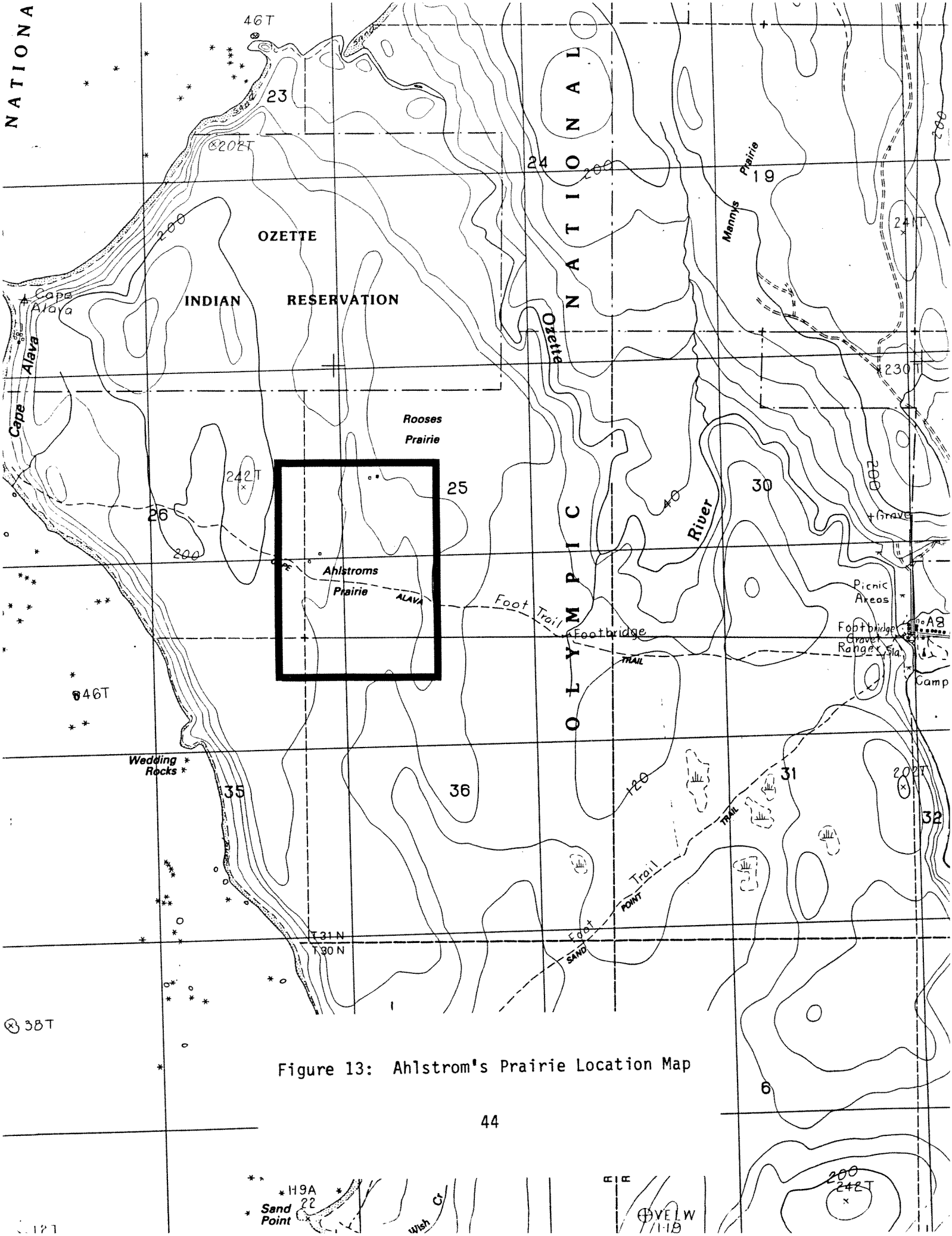


Figure 13: Ahlstrom's Prairie Location Map

AHLSTROM'S PRAIRIE

LOCATION:

Western Clallam County; Sections 25, 26 and 36, Township 31 North, Range 16 West, Willamette Meridian. Ahlstrom's Prairie is part of the Olympic National Park.

SIGNIFICANCE:

Ahlstrom's Prairie is a second tier site. It contains recovering examples of 4 sphagnum bog communities and populations of 2 state-listed plant species.

FEATURES:

Sphagnum Bog:

1. Carex obnupta/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community.
3. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Carex obnupta/Sphagnum spp. community.
4. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Ahlstrom's Prairie is located on a moraine at an elevation of about 160 feet. The site occupies 81 acres of ridges and troughs.

Ahlstrom's Prairie is mostly fed by precipitation. The troughs receive water from sheet flow as well. Depressions within the ridges and the troughs are flooded seasonally, and the rest of the year their soils are wet. One trough is supersaturated year round and seasonally flooded. The ridges are seasonally dry. There are signs of past fire throughout the site.

The site is composed of ridges and troughs generally oriented north-south. The ridges are uneven and have small depressions and hummocks. The soils on the ridges are thin exposing underlying glacial till or outwash. The soils are sphagnum, fibrous and heath peat with woody material. The main trough's soils are mostly composed of sphagnum and fibrous peat.

Biological: The ridges are recovering from fire and past grazing. The upper story is characterized by young, somewhat stunted Tsuga heterophylla, Thuja plicata and Picea sitchensis. The shrub layer is dominated by Ledum groenlandicum, Gaultheria shallon and usually Pteridium aquilinum. Kalmia occidentalis and Calamagrostis nutkaensis are abundant but not always codominant. Sphagnum spp. have 0-40% cover.

The troughs are dominated throughout by Sphagnum spp. Some areas are also dominated by Ledum groenlandicum, Kalmia occidentalis, Vaccinium oxycoccos and Carex obnupta. Other areas are dominated by low growing Sanguisorba officinalis and/or Carex livida, Carex obnupta, or Carex rostrata.

CONDITION:

Ahlstrom's Prairie is the site of a historic homestead. The area was used to graze sheep and there are cut stumps throughout. The whole area burned in the past and may have been purposely burned to create pasture.

Given this history, Ahlstrom's Prairie is in good condition. The vegetation is dominated by native plant species and exotic and weedy species are limited in numbers and abundance. However, the pre-settlement character of the site is not documented and it's not clear if the current and future dynamics of the system mimic those of the native system. It is possible, that in the absence of fire, the ridges, and perhaps the troughs, will shift to a wet Thuja plicata-Tsuga heterophylla/Vaccinium ovatum-Gaultheria shallon community.

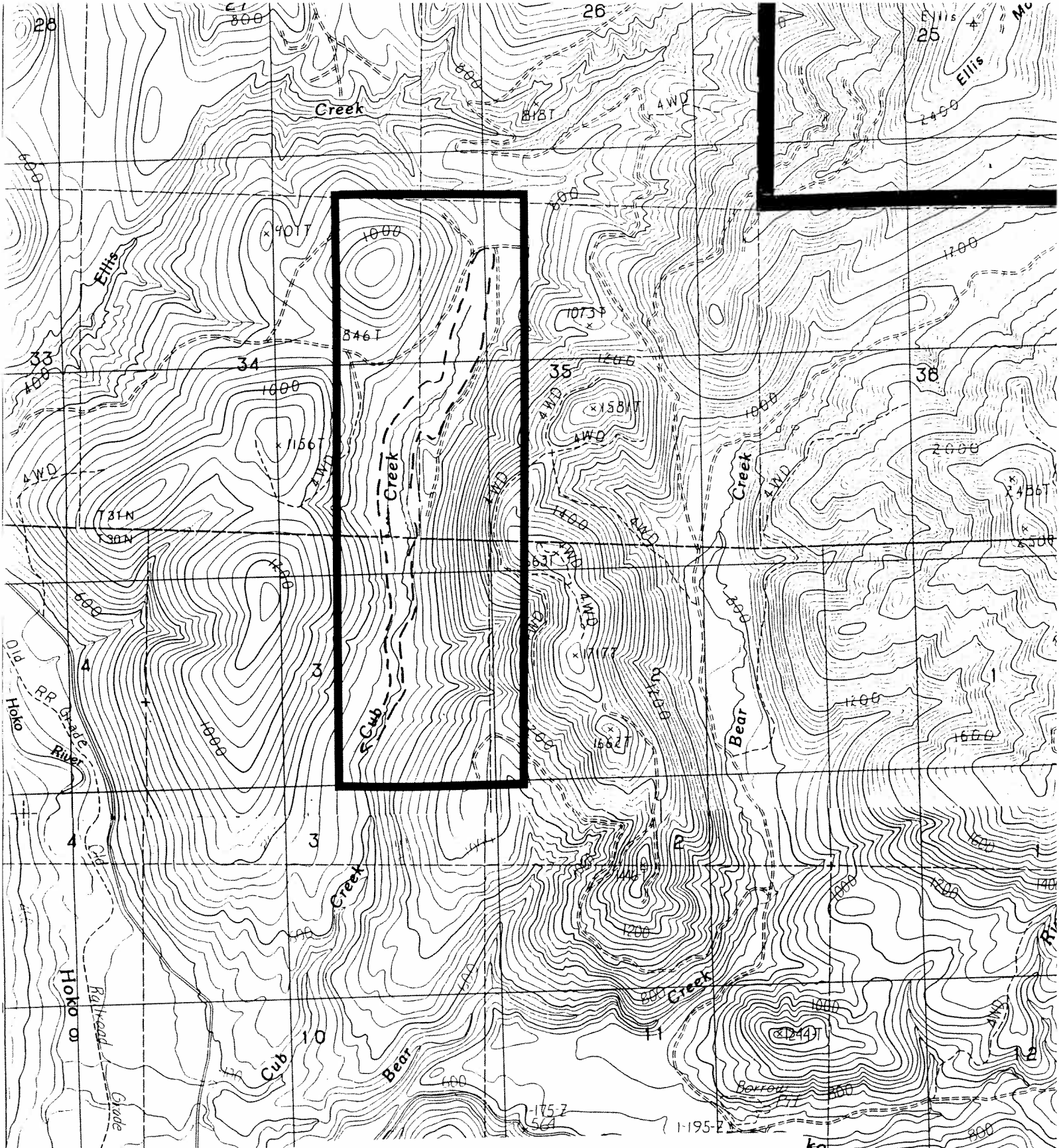


Figure 14: Cub Creek Location Map

CUB CREEK MARSH

LOCATION:

Western Clallam County; Section 3, Township 30 North, Range 13 West, and Sections 34 and 35, Township 31 North, Range 13 West, Willamette Meridian.

SIGNIFICANCE:

Cub Creek Marsh is a second tier site. It is a riparian wetland recovering from past logging activities and contains examples of 3 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Carex sitchensis community.
2. Spiraea douglasii community.
3. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Cub Creek Marsh occurs at an elevation of about 680 feet along the uppermost reach of Cub Creek. It lies within a narrow valley that has moderately steep slopes. The wetland is about 30 acres.

The wetland soils are saturated to supersaturated year round and flooded seasonally. The stream channel is well defined and has steep banks overhung with sedges and shrubs. At the time of the survey, water in the channel was moving slowly.

The soils in the wetland are mapped as Klone-Ozette-Tealwhit complex and the surrounding uplands are mapped as Ozette silt loam. The soils contain areas of fibrous peat, heath peat, muck and large organic material.

Biological: The wetland vegetation generally shifts landward from a community dominated by Carex sitchensis and Oenanthe sarmentosa near the stream channel to a mosaic of that community and Spiraea douglasii. Near the headwaters, the vegetation appears to be dominated by Spiraea douglasii thickets.

Landward of the previously described vegetation are areas of wet forest that were at least selectively cut in the past. These appear to be recovering towards an example of a Picea sitchensis-Alnus rubra/ Lysichitum americanum community but are currently dominated by Alnus rubra, Spiraea douglasii, Carex obnupta and Lysichitum americanum.

CONDITION:

The wetland appears to be recovering well from past disturbance. The forested wetland was at least selectively logged in the past. Alnus rubra, Picea sitchensis, Tsuga heterophylla and Thuja plicata are all reproducing and, except for Juncus effusus, there are no exotic plant species.

A logging road crosses the upper end of the drainage and marks the upper end of the wetland. The logging road runs parallel to the wetland on the east, and in places, fill and road maintenance activities have intruded into the wetland.

The second growth forest to the east side of the wetland was being prepared for logging at the time of the survey.

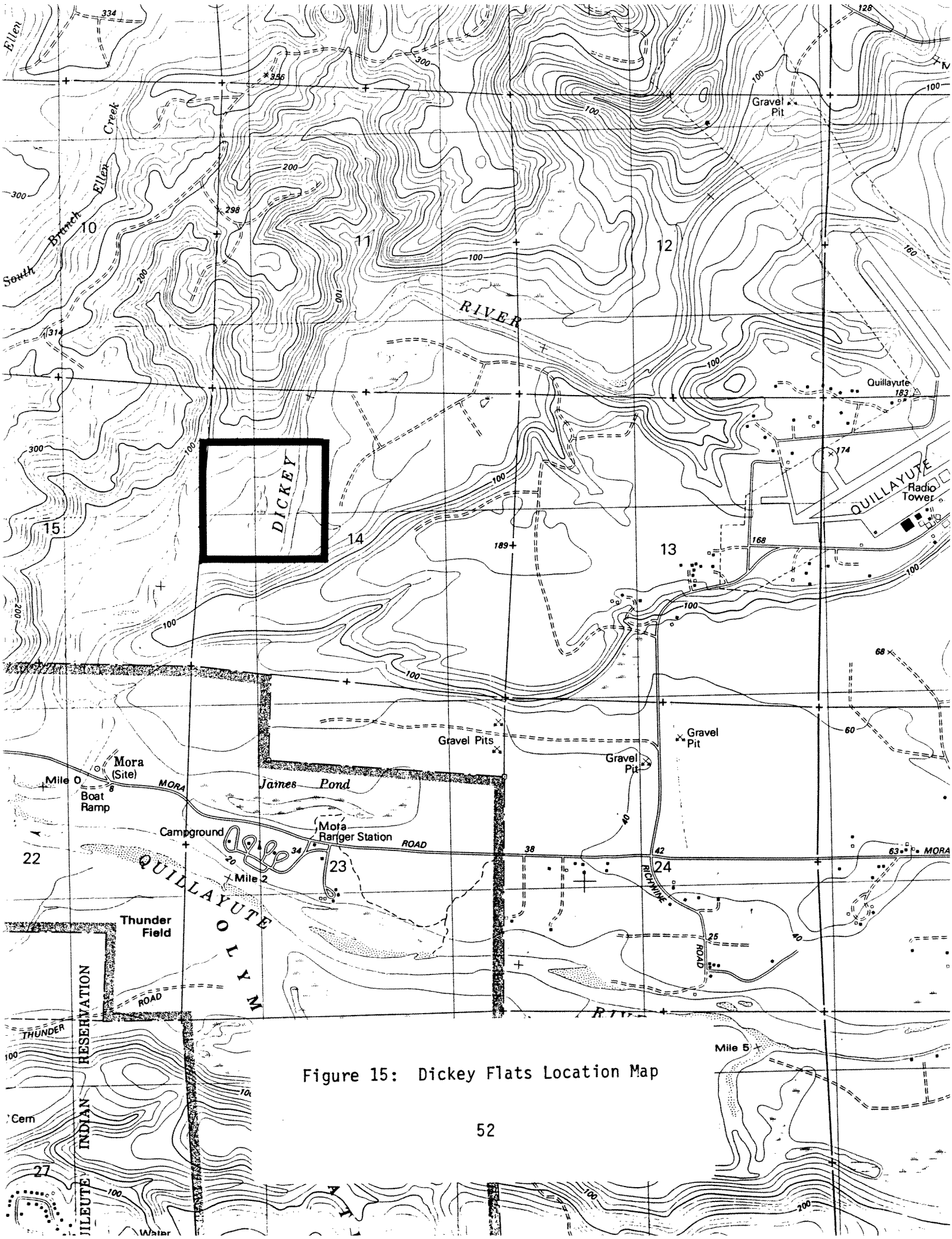


Figure 15: Dickey Flats Location Map

DICKEY FLATS

LOCATION:

Western Clallam County; Section 14, Township 28 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Dickey Flats is a second tier site. It was recently disturbed and is threatened with further degradation but still contains good examples of 3 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community.
2. Carex obnupta community.
3. Carex sitchensis community.

DESCRIPTION:

Physical: Dickey Flats is a 4-acre wetland on a terrace above the Dickey River. It occurs at 20 feet elevation near the confluence of the Dickey and Quillayute Rivers. The wetland consists of a small impoundment, stream channel and herb dominated wetlands.

The wetland area is permanently flooded. It receives water from precipitation, sheet flow and groundwater discharge. The wetland drains to the southwest into the Dickey River, but the outflow is dammed by beaver.

Soils are muck and fibrous peat. Most of the wetland vegetation grows on the pedestaled bases of sedges.

Biological: The center of the wetland, along the impounded stream channel, is dominated by Nuphar polysepalum. Inland the vegetation is dominated by Carex sitchensis perched on their pedestaled bases. Landward yet, the vegetation is dominated by Carex obnupta, also extending above water on pedestaled bases.

CONDITION:

The wetland still appears to be in good condition but may not be for much longer. The uplands and some of the wetland system north and upslope of the wetland were recently clearcut. No buffer was left adjacent to the wetland and the wetland edge was disturbed. Exotic plant species are newly established in the wet ground within the clearcut that feeds into the site, and will probably spread into the site.

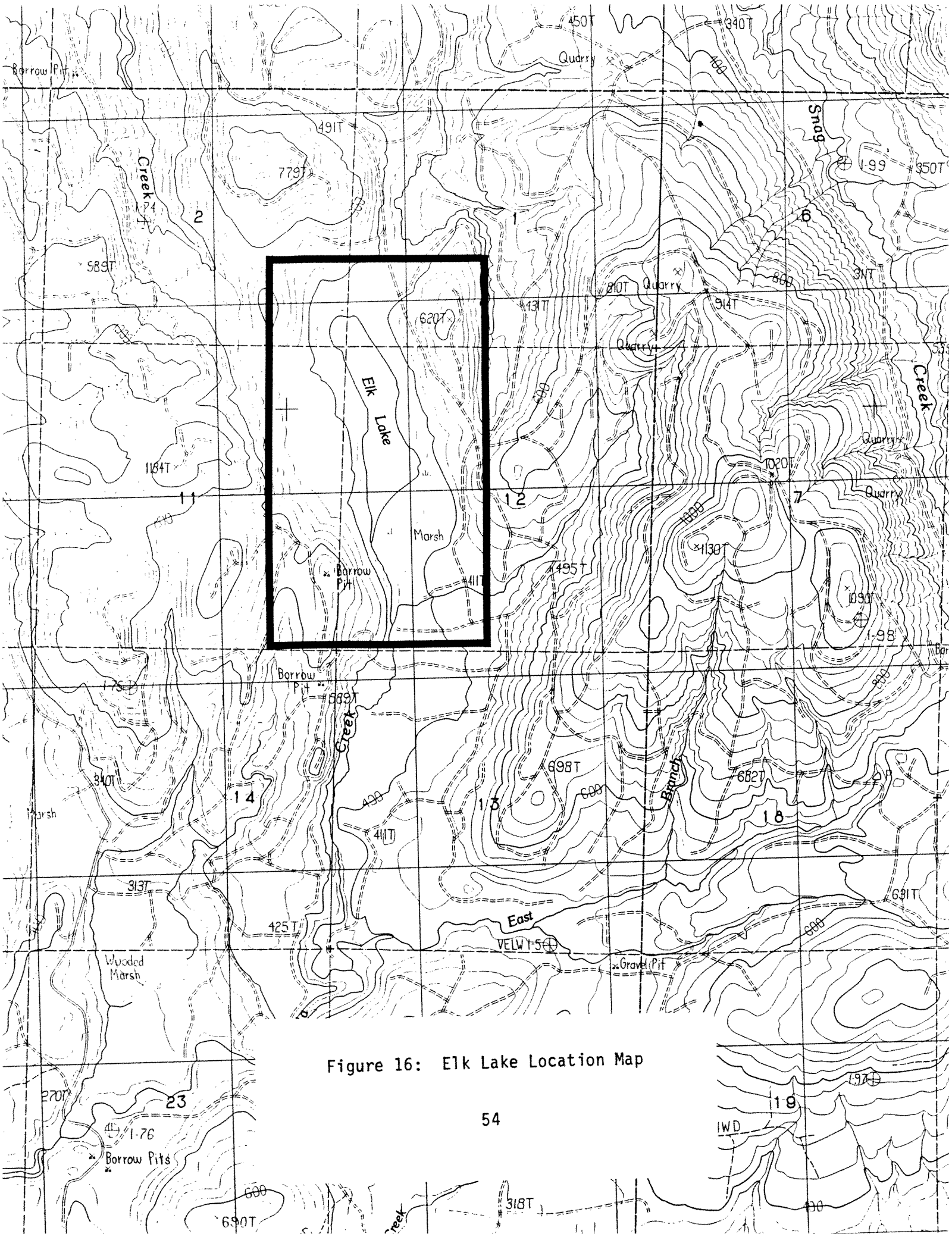


Figure 16: Elk Lake Location Map

ELK LAKE

LOCATION:

Western Clallam County; Sections 1, 2, 11 and 12, Township 31 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Elk Lake is a second tier site. It is hoped that the lake and wetland system will recover from recent clearcutting of the entire upstream drainage and the outflow stream and riparian system. The area still contains remnants of 1 sphagnum bog and 2 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Eriophorum chamissonis/Sphagnum spp. community.

Freshwater Wetland:

1. Carex sitchensis community.
2. Thuja plicata/Lysitchitum americanum community.

DESCRIPTION:

Physical: Elk Lake is the headwaters of Umbrella Creek and is located at about 420 feet elevation. It is a north-south oriented system which consists of a 45-acre lake, about 11 acres of sphagnum bog, and 62 acres of freshwater wetlands.

The system receives water from precipitation, seeps, sheet flow and several small seasonal streams. It has a large channeled outflow which is partially blocked, either by beaver, or as a result of logging activities. The current water level is high. Most of the forested wetland areas around the lake have been flooded, killing the trees. The entire wetland system is flooded year round.

The wetland soils are mapped as Kydaka silty clay loam. The wetland soils are a mixture of fibrous peat, muck and large woody material. The sphagnum bog area has a thin floating mat composed of sphagnum, fibrous and heath peat. Downed trees provide a substrate elevated above the water level.

Biological: The sphagnum bog areas are located along the waterward edge of the wetland, mostly at the southeast end of the lake. These areas appear to be dominated by Eriophorum chammisonis, and have some scraggly Kalmia occidentalis, Ledum groenlandicum and Vaccinium oxycoccos.

The freshwater wetland appears to be divided into three zones: The waterward zone is mostly composed of dense, tall Carex sitchensis growing on their pedestaled bases. Landward of this are areas of Thuja plicata snag forests. These areas are species rich, but the understory is still dominated by Carex sitchensis. There are areas, that were inaccessible, which appear to be living Thuja plicata wet forests.

CONDITION:

It is hoped that this wetland system will recover to something resembling its presettlement condition. The entire drainage basin for this lake has recently been clearcut. The outflow channel and its associated wetlands were also logged. No buffer was maintained, and logs and woody debris occur throughout the stream and wetland system. The water level in the system is elevated, flooding most of what were forested wetlands, and inundating the sphagnum bog communities. There was no way to get into the area to determine why the water level of the lake was so high. Exotic plant species were not abundant.

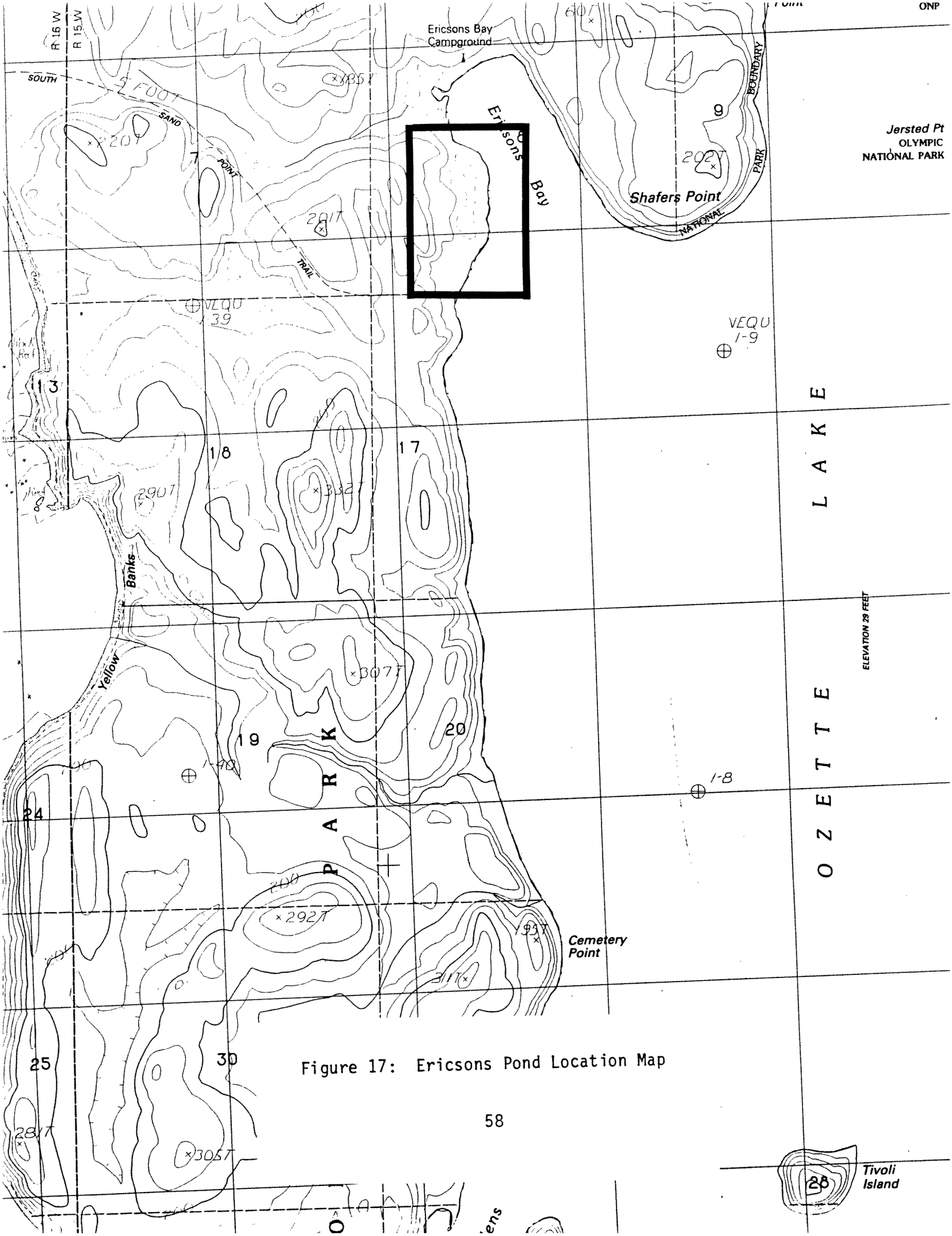


Figure 17: Ericsons Pond Location Map

ERICSONS POND

LOCATION:

Western Clallam County; Section 8, Township 30 North, Range 15 West, Willamette Meridian. Ericsons Pond is part of the Olympic National Park

SIGNIFICANCE:

Ericsons Pond is a second tier site. The site is recovering from past disturbance. It contains populations of 1 state-listed plant and 1 state-listed animal species as well as examples of 1 sphagnum bog and 2 freshwater wetland community.

FEATURES:

Sphagnum Bog:

1. Myrica gale/Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community.

Freshwater Wetland:

1. Nuphar polysepalum community.
2. Carex sitchensis community.

DESCRIPTION:

Physical: Ericsons Pond is located at an elevation of about 40 feet on the west side of Lake Ozette. The site is composed of an 8-acre shallow pond surrounded by 4.5 acres of wetlands, and a 2-acre sphagnum bog to the south.

The wetland system as a whole has no channeled inflow, and probably receives water from precipitation and surface sheet flow. The pond system is separated from Lake Ozette by a berm. The water level in the pond is elevated above the lake and water seeps through the berm to the lake. It looks as if there was in the past at least a seasonal outflow from the pond to Lake Ozette. There is a channeled inflow from the bog to the pond.

The pond is very shallow and most of it is permanently flooded. The surrounding wetland is seasonally flooded, and the substrate is wet year round. The bog to the south is wet year round, and portions may be seasonally flooded.

The soils in the area are primarily sphagnum and sedge peat, with heath peat and some woody material. The pond bottom is a mixture of peat and muck overlaying sand.

Biological: Most of the pond and wetland vegetation appears to be in transition. The pond is dominated by Nuphar polysepalum, but there are hummocks of peat with emergent vegetation and remnants of trees and drier site vegetation. The wetlands surrounding the pond are dominated by Carex sitchensis on soft peat soils mostly with living Sphagnum spp. but in areas without. Small areas are dominated by Kalmia occidentalis.

The bog to the south is codominated by Myrica gale and Carex sitchensis. The vegetation is low growing and there are openings which are dominated by Carex livida, Carex interior complex, Vaccinium oxycoccos and Dodecatheon jeffreyi. There is very little living sphagnum.

CONDITION:

Ericsons Pond is almost exclusively composed of native plant species and appears to be in good condition. However, the area was the site of a homestead and may be recovering from past use. Remnants of a pier are still visible in the north end of the shallow pond. Peat development, remnants of wetland vegetation and tree stumps in the pond indicate that the water level has changed. The wetland vegetation around the pond appears to be in flux, apparently in response to elevated water level.

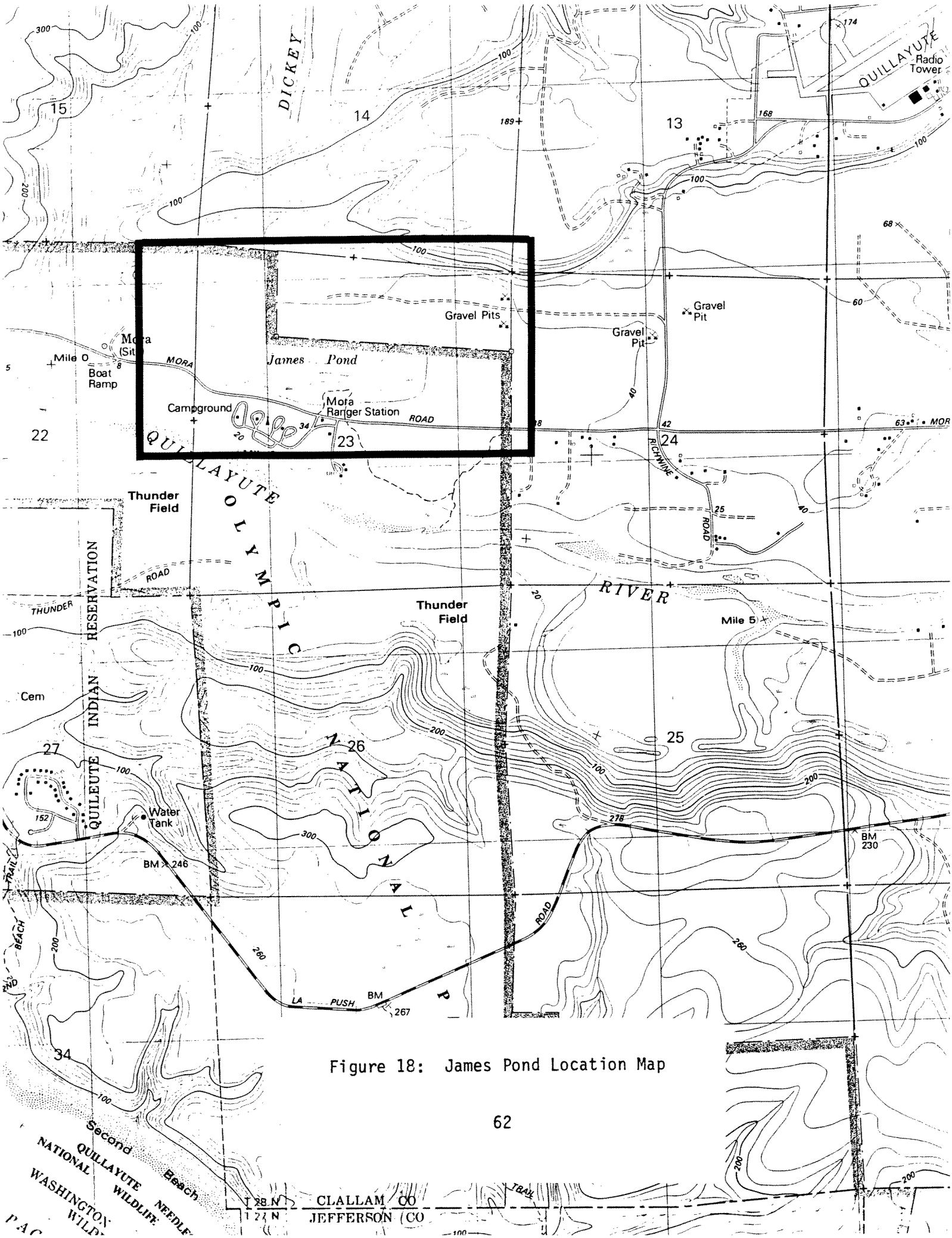


Figure 18: James Pond Location Map

JAMES POND

LOCATION:

Western Clallam County; Section 23, Township 28 North, Range 15 West, Willamette Meridian. Part of James Pond is within the Olympic National Park.

SIGNIFICANCE:

James Pond is a second tier site. A portion of it is in good condition and contains examples of 1 sphagnum bog and 3 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Spiraea douglasii/Sphagnum spp. community.

Freshwater Wetland:

1. Nuphar polysepalum community.
2. Carex obnupta community.
3. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: James Pond is an oxbow of the Quillayute River. It is located on the north side of the current river channel at an elevation of about 20 feet, near the river's mouth. The site is composed of 13 acres of herb and shrub dominated wetlands and ponds, 5 acres of forested wetland, and 14 acres of logged wetlands.

The wetland receives water mostly from precipitation and sheet flow. The pond and some of the herb dominated areas are flooded year round, although the water is shallow. Some of the fringing herb dominated wetlands are flooded most of the year and then supersaturated. The shrub and uncut forested wetlands are seasonally flooded and then saturated to supersaturated. The logged wetlands are wet to supersaturated year round and may be flooded seasonally.

The soils are variable. In the ponded area, the substrate is firm muck and peat probably over sand. There are pockets of deep, soft muck along the pond margins. The seasonally flooded herb and shrub zones are sphagnum, fibrous and/or heath peat. The forested wetlands grade from very soft fibrous peat and muck, to shallow muck and litter. Large woody material provides an elevated substrate throughout the portion of the site that is within the National Park.

The portion of the site outside of the park is highly disturbed and hard to characterize. But there is significant amounts of living Sphagnum spp. and some sphagnum peat.

Biological: The ponded area grades shoreward from rooted aquatic vegetation dominated by Nuphar polysepalum to a zone codominated by Nuphar polysepalum, Potamogeton natans and an aquatic Sparganium emersum

and Hippuris vulgaris are abundant. Landward, Carex vesicaria and the aquatic bryophyte are dominant, and Nuphar polysepalum is abundant. The next landward zone is dominated by Carex obnupta, the aquatic bryophyte, and Carex vesicaria. The landwardmost community in this progression is codominated by Spiraea douglasii, Carex obnupta and Sphagnum spp.

The permanently flooded/supersaturated forested wetland area is dominated by Pyrus fusca, Carex obnupta and Lysichitum americanum, Spiraea douglasii and Gaultheria shallon on logs. Tsuga heterophylla and Picea sitchensis trees and snags are abundant. A drier wet forest area is dominated by Picea sitchensis, Pyrus fusca, Rhamnus purshiana, Gaultheria shallon and Lysichitum americanum.

CONDITION:

The portion of the oxbow which lies within the National Park is in excellent condition. The portion outside of the Park was recently clearcut, both wetland and upland. A logging spur was built across the wetland in three places and a gravel pit was excavated adjacent to it. Hopefully exotic plant species will not establish in the logged portion of the oxbow and spread into the high quality portion. Application of biocides and fertilizers in the logged area is a threat to the high quality portion.

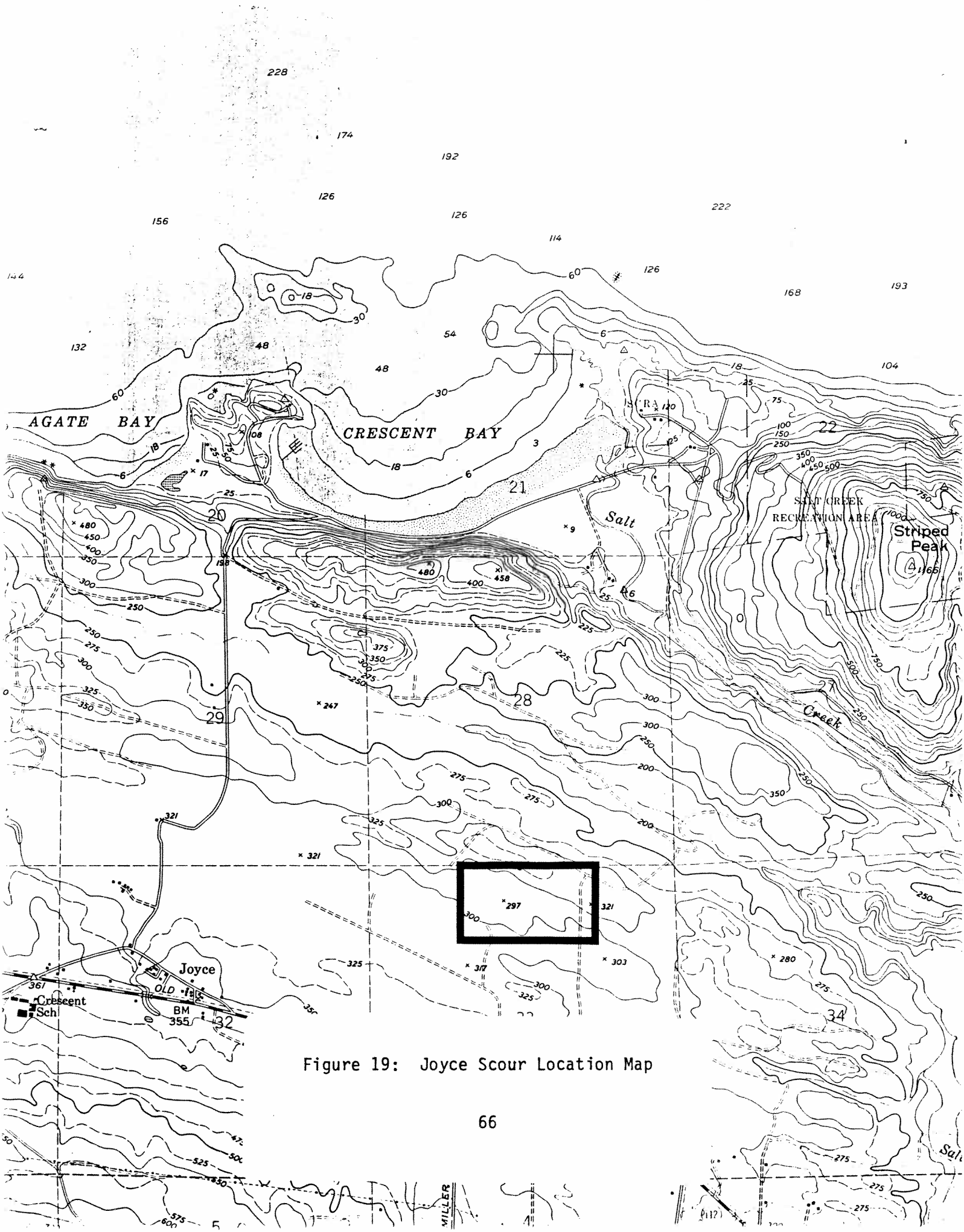


Figure 19: Joyce Scour Location Map

JOYCE SCOUR

LOCATION:

Western Clallam County; Section 33, Township 31 North, Range 8 West, Willamette Meridian.

SIGNIFICANCE:

Joyce Scour is a second tier site. It has been disturbed in the past and is threatened with further degradation, but is one of the higher quality wetlands in the area. It contains examples of 3 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Carex obnupta community.
2. Carex rostrata community.
3. Spiraea douglasii community.

DESCRIPTION:

Physical: Joyce Scour is located in a northwest-southeast oriented glacial trough or scour adjacent to the Strait of Juan de Fuca. It is about 8 acres and occurs at about 300 feet elevation.

The site appears to have neither an inflow nor outflow. It receives water from surface sheet flow and precipitation. Some areas appear to be flooded year round while others are seasonally flooded and then wet to supersaturated.

The soils are mapped as Mukilteo muck. They are a mixture of muck, fibrous peat and heath peat, and there is some woody material.

Biological: The wetland is a mosaic of Spiraea douglasii thickets, openings dominated by Carex obnupta and Oenanthe sarmentosa and seasonal ponds dominated by Carex rostrata, Carex vesicaria, Oenanthe sarmentosa and Nuphar polysepalum.

CONDITION:

Joyce Scour is of questionable quality for inclusion in this report. The wetland is still dominated by native plant species. However, Phalaris arundinacea is scattered throughout the site and may spread uncontrollably, degrading the wetland to an unacceptable level. The site is included mostly because there are very few relatively high quality native wetlands remaining in the lowlands along the Strait of Juan de Fuca.

The wetland has been disturbed in the past. There are signs of past vehicle use through the wetland and Phalaris arundinacea is scattered throughout. Dead Pyrus fusca and Salix sp. plants indicate water level fluctuation of unknown cause. The uplands are about to be logged for the second time.

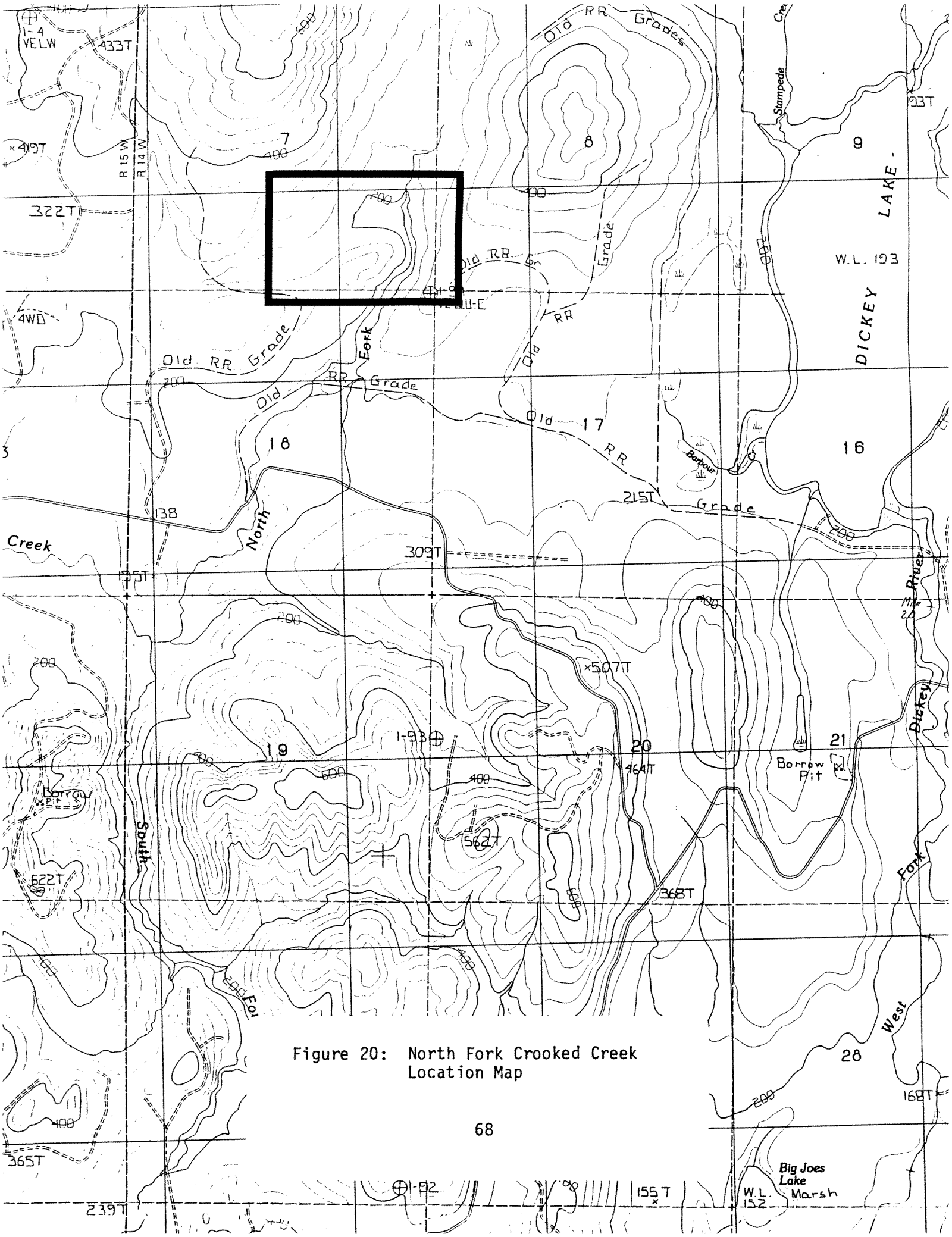


Figure 20: North Fork Crooked Creek Location Map

NORTH FORK CROOKED CREEK

LOCATION:

Western Clallam County; Section 7, Township 30 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

North Fork Crooked Creek is a second tier site. The wetland was disturbed in the past but appears to have recovered well and contains examples of 2 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Carex rostrata-Carex sitchensis community.
2. Tsuga heterophylla/Lysichitum americanum community.

DESCRIPTION:

Physical: North Fork Crooked Creek is the headwaters of a tributary of North Fork Crooked Creek. It occurs at an elevation of 200 feet and is composed of a 2-acre sedge dominated wetland and 5-acre forested wetland.

The wetland receives water from precipitation, sheet flow, channeled surface flow and probably groundwater seepage. The tributary channel is braided through the the forested wetland and is a deep, well defined channel through the sedge wetland. The wetland is seasonally flooded and supersaturated year round. There are signs of past beaver activity including decrepit dams at the outflow end of the wetland.

Soils in the sedge portion of the wetland are a mixture of fibrous and sphagnum peat. Those in the forested wetland are very soft muck. Large woody debris provides an elevated surface on which typically upland plants grow. The surrounding upland soils are mapped as Kydaka-Zeeka complex and Ozette silt loam.

Biological: The sedge dominated portion of North Fork Crooked Creek appears to be in transition. It is dominated by a mixture of Carex rostrata, Carex sitchensis and Scirpus microcarpus, species which are typical of high nutrient wetlands. But it also has areas with high percent cover of Sphagnum spp. and some other plant species typical of low nutrient sphagnum bogs.

The forested wetland is dominated by Tsuga heterophylla and Lysichitum americanum. There is high percent cover of Thuja plicata, Picea sitchensis, Rubus spectabilis, Vaccinium sp., Oenanthe sarmentosa and Gaultheria shallon.

CONDITION:

North Fork Crooked Creek appears to be recovering from past disturbance. Past disturbance is suggested by an abundance of Juncus effusus, the presence of other exotic plant species and an odd mix of sphagnum bog and freshwater wetland plant species. It is possible that the main stream

channel once flowed into the sedge portion of the wetland. A delta in the wetland and the soil survey map suggest this scenario.

The forested wetland was selectively logged in the past. It is composed of native plant species and appears to be recovering well. The forested uplands to the south of this site have been surveyed and flagged, suggesting that they will soon be logged for the second time.

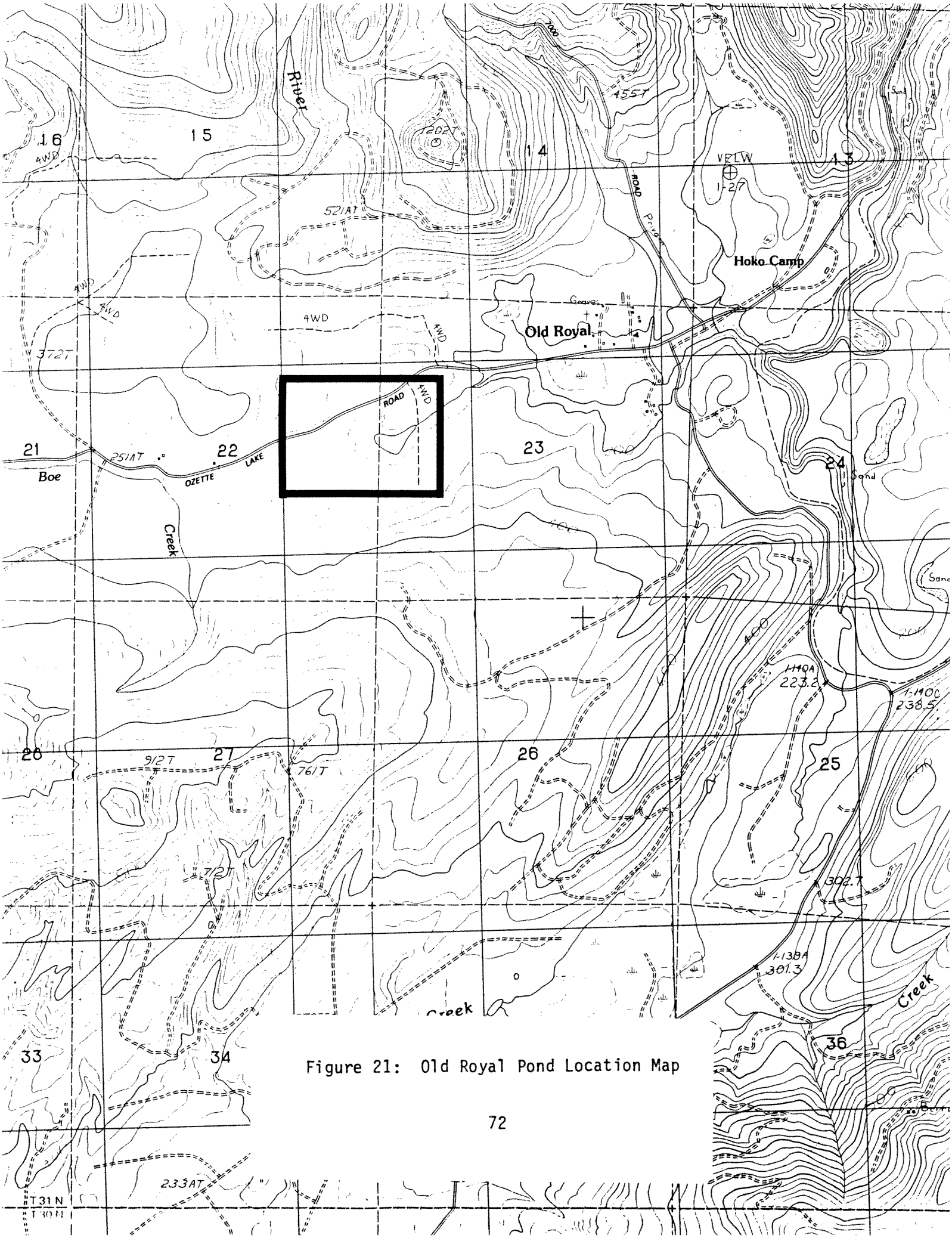


Figure 21: Old Royal Pond Location Map

OLD ROYAL POND

LOCATION:

Western Clallam County; Sections 22 and 23, Township 31 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

Old Royal Pond is a second tier site. It is a diverse wetland system containing examples of 3 freshwater wetland communities and a population of 1 state-listed species. The wetland appears to be recovering well from past logging activity.

FEATURES:

Freshwater Wetland:

1. Carex sitchensis community.
2. Spiraea douglasii community.
3. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Old Royal Pond is a 14-acre wetland system located just west of the town site of Old Royal. It occurs at an elevation of 240 feet and is the headwaters of a tributary of the Hoko River.

The wetland system is composed of a shallow, permanent pond, permanently flooded shrub and herb dominated wetland communities, and a forested wetland that is a mosaic of permanently flooded and permanently supersaturated areas. The outflow is dammed by beaver, and the pond level is about 3 feet above the outflow stream channel.

Soils are mapped as Ozette silt loam. They are a mixture of fibrous peat, heath peat and muck. Large woody material provides a substrate elevated above the soil surface.

Biological: The wetland vegetation generally shifts from a community dominated by Carex sitchensis near the pond margin, to a Spiraea douglasii thicket, to a forested wetland dominated by Alnus rubra, Rubus spectabilis, Lysichitum americanum and Oenanthe sarmentosa. The wet forest was logged in the past and Tsuga heterophylla, Picea sitchensis and Thuja plicata are reproducing.

There is a large area near the pond that is dominated by Scirpus cyperinus. Waterward of the wet forest is an area codominated by Carex rostrata, Carex obnupta and Scirpus microcarpus. There are traces of sphagnum bog vegetation along the wetland-upland interface on the south side of the pond.

CONDITION:

Old Royal Pond is recovering from past logging activities. There are cut stumps and logs throughout the wetland, including in the pond. The stumps have spring board notches indicating that logging took place many years ago. A logging road was built across the outlet and was either

removed or washed away. This is the current site of a beaver dam. The water level is high, due to the beaver dam.

Given its disturbance history, the wetland appears to be recovering well. It is dominated by native plant species, and appears to be developing definable wetland plant communities. Juncus effusus is the only observed exotic plant species.

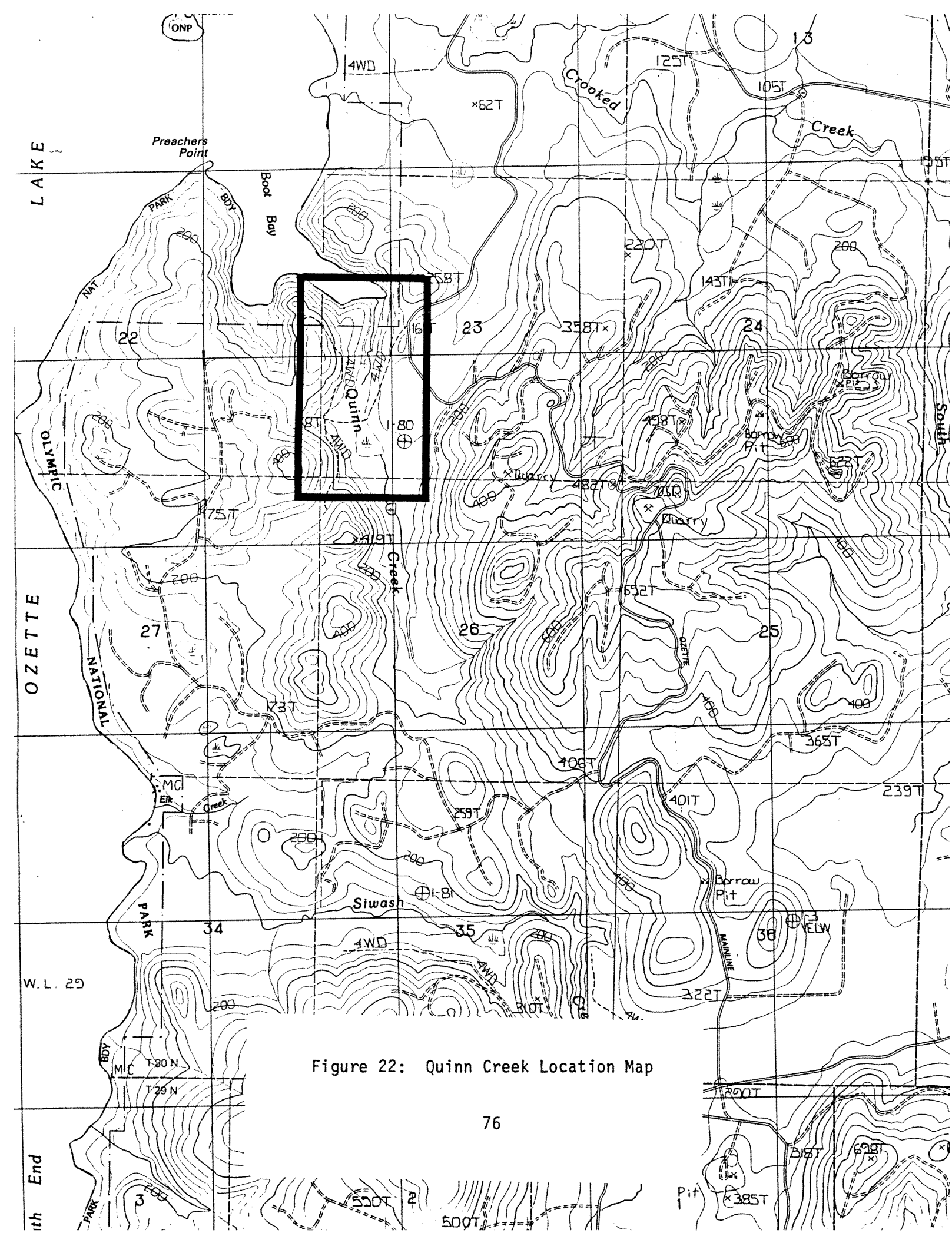


Figure 22: Quinn Creek Location Map

QUINN CREEK

LOCATION:

Western Clallam County; Section 23, Township 30 North, Range 15 West, Willamette Meridian. A portion of Quinn Creek is located within the Olympic National Park.

SIGNIFICANCE:

Quinn Creek is a second tier site. Although disturbed in the past, the wetland appears to be recovering, and contains native freshwater wetland vegetation.

FEATURES:

Freshwater Wetland:

1. Carex obnupta community.

DESCRIPTION:

Physical: Quinn Creek is located at an elevation of about 40 feet on the east side of Lake Ozette. It occurs along the lower reach of Quinn Creek, at the southeast end of Boot Bay. The wetland is about 15 acres.

The wetland occurs along either side of the creek channel. The water in the channel flows very slowly and may be partially blocked by beaver dams. The creek overflows its channel during the winter and spring and floods the wetland. Wetland soils remain supersaturated the rest of the year.

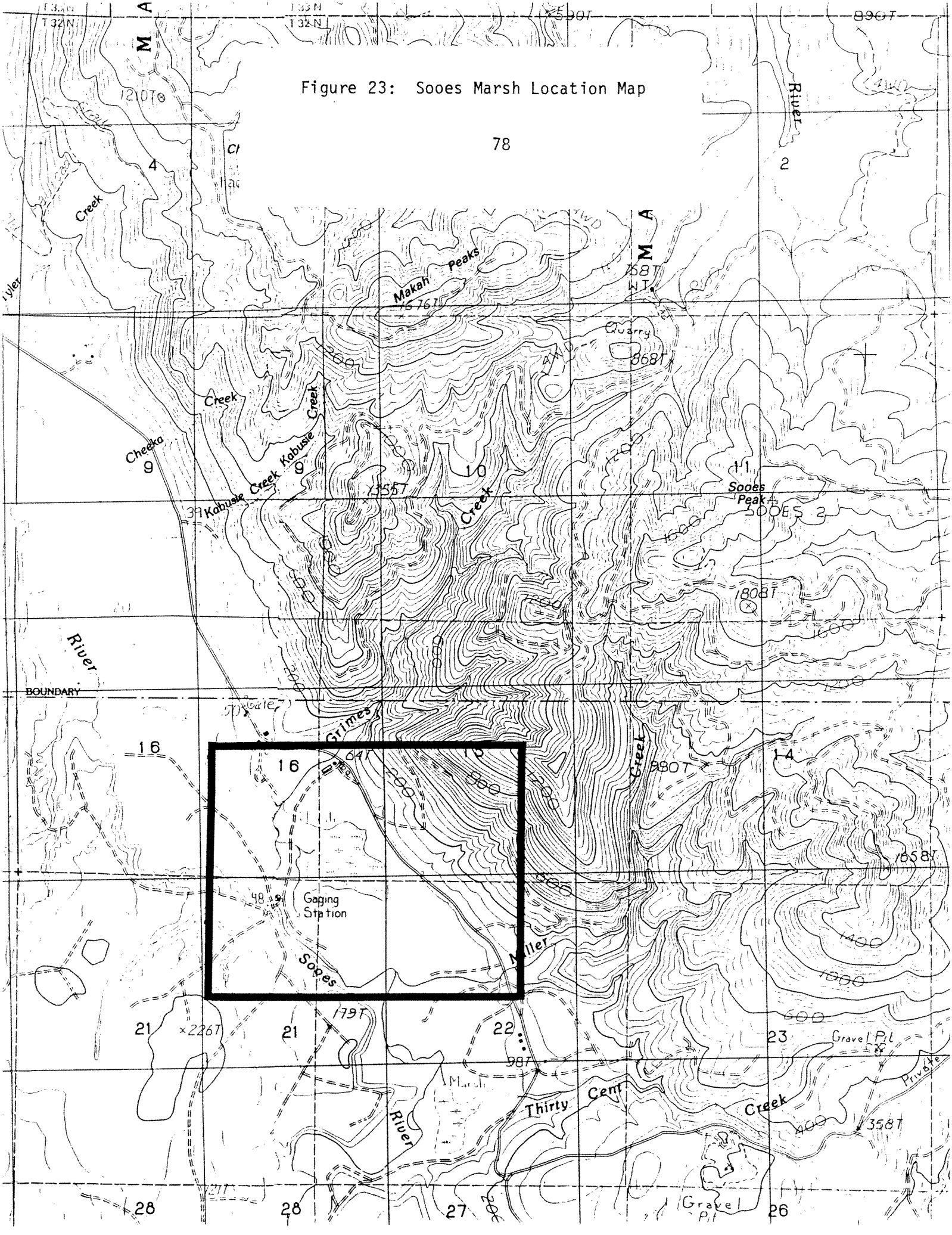
Soils along Quinn Creek are mapped as Tealwhit silt loam. The wetland soils contain fibrous peat, muck and large woody debris.

Biological: The wetland vegetation along Quinn Creek is currently dominated by Carex obnupta, and has high percent cover of Scirpus microcarpus, Athyrium filix-femina, Lysichitum americanum and Physocarpus capitatus.

CONDITION:

Quinn Creek wetland was once a forested wetland system dominated by Picea sitchensis. The wetland was logged and is now composed of species typical of the understory of forested wetlands. Picea sitchensis, Thuja plicata and Tsuga heterophylla are reproducing within the wetland, suggesting that the system may recover. There are no exotic plant species.

Figure 23: Sooes Marsh Location Map



SOOES MARSH

LOCATION:

Western Clallam County; Sections 15, 16, 21 and 22, Township 32 North, Range 15 West, Willamette Meridian.

SIGNIFICANCE:

Sooes Marsh is a second tier site. It contains 4 freshwater wetland communities and, in particular, contains a large example of a forested wetland community.

FEATURES:

Freshwater Wetland:

1. Carex obnupta community.
2. Carex sitchensis community.
3. Spiraea douglasii community.
4. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Sooes Marsh is located at an elevation of about 40 feet on a terrace along the Sooes River. It lies between the Sooes River to the southwest, Grimes Creek to the northwest, Miller Creek to the southeast and a ridge to the northeast. The wetland is about 80 acres: 59 acres of forested wetlands, 17 acres of shrub and herb dominated wetlands and 4 acres of disturbed wetlands.

Most of the wetland is supersaturated year round and flooded seasonally. The disturbed wetland is flooded year round. The wetland receives water from precipitation, small unnamed streams, surface sheet flow and possibly groundwater discharge. The system drains to the northwest into Grimes Creek.

The soils are mapped as Tealwhit silt loam. The wetland soils are a mixture of fibrous and heath peat in the shrub and herb dominated area and some sphagnum peat. The forested wetland has very soft muck soils as well as areas of peat. It has large woody debris which provides a substrate elevated above the soil surface. Soils in the disturbed area were not checked.

Biological: The herb dominated area is species rich. Low growing Carex obnupta, Carex rostrata, Potentilla palustris, Lysichitum americanum and Hypericum anagalloides codominate the southeast end of the herb dominated area. Juncus balticus and Juncus effusus are abundant in parts of this area. Tall, lush Carex sitchensis dominates the majority of the herbaceous wetland area. Potentilla palustris and Lysichitum americanum are codominant and Hypericum anagalloides is abundant in places.

The shrub wetland is dominated by Spiraea douglasii and Lysichitum americanum. The shrub layer is relatively open. Carex sitchensis, Potentilla palustris, Carex rostrata, Athyrium filix-femina, Ledum groenlandicum, Salix spp. and small Alnus rubra are abundant in places.

The forested wetland along the margin of the shrub and herb dominated areas is generally dominated by Alnus rubra, Carex obnupta and Carex sitchensis, and has high percent cover of Calamagrostis nutkaensis and Lysichitum americanum. This grades into the primary wet forest community which is dominated by Picea sitchensis, Carex obnupta and Lysichitum americanum. Alnus rubra and Pyrus fusca are codominant to abundant. Thuja plicata, Tsuga heterophylla, Oenanthe sarmentosa, Gaultheria shallon and Glyceria sp. are abundant in places. Forested wetlands to the northeast are similar in composition, but are scrubby, more open, and are codominated by Thuja plicata, Alnus rubra, Picea sitchensis, Lysichitum americanum and Glyceria sp. Spiraea douglasii, Gaultheria shallon, Oenanthe sarmentosa, Scirpus microcarpus, Carex obnupta, Athyrium filix-femina and Carex rostrata are abundant and in places some are codominant. This may be a groundwater discharge area.

CONDITION:

Sooes Marsh has been disturbed in the past, but currently appears to be in good condition. The forested wetland appears in particularly good condition. The herb and shrub dominated wetland communities appear to be in transition. There are remnants of sphagnum bog vegetation, and an unusual mixture of species which suggest that water and/or nutrient levels have shifted.

A mainline logging road crosses all of the streams which flow into the wetland. A road crosses the main outflow, and the outflow appears to have been diverted and partially impounded by the road. All of the adjacent uplands and portions of the wetlands have been logged in the past. A large cedar shake mill was located directly north of the wetland. Feral cattle roam this area, and although it would be difficult for them to access the wetland, it is possible.

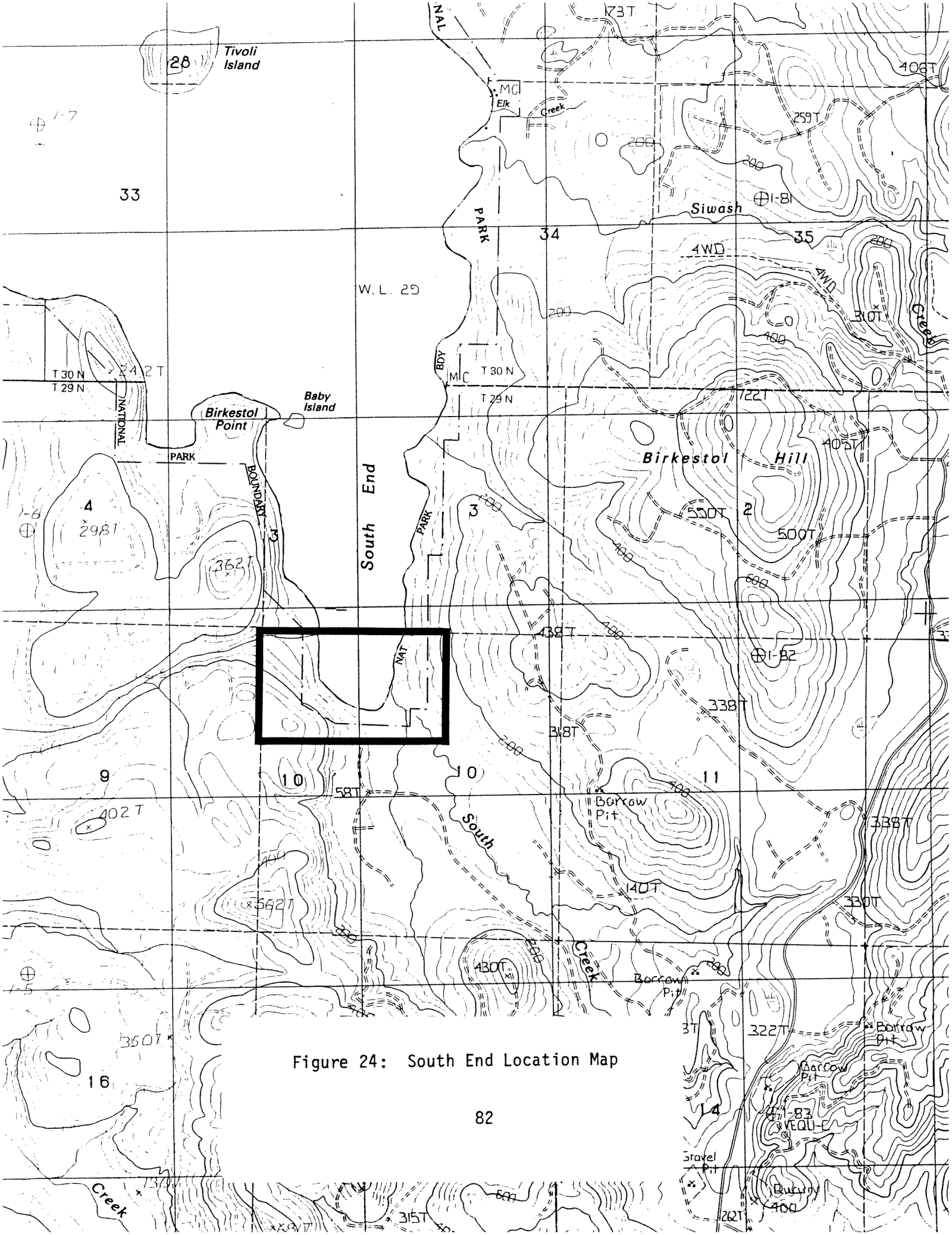


Figure 24: South End Location Map

SOUTH END

LOCATION:

Western Clallam County; Section 10, Township 29 North, Range 15 West, Willamette Meridian. South End is part of Olympic National Park.

SIGNIFICANCE:

South End is a second tier site. It contains a population of 1 state-listed plant species and 5 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Carex obnupta-Juncus nevadensis-Ranunculus flammula community.
2. Equisetum fluviatile community.
3. Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community.
4. Myrica gale-Spiraea douglasii/Carex obnupta community.
5. Pyrus fusca community.

DESCRIPTION:

Physical: South End is located along the southeastern shore of Lake Ozette. About 4 acres of wetlands line the shore at an elevation of about 30 feet. The wetland profile inclines shoreward from shallowly flooded areas (< 3 feet deep) to a bank which, for the most part, marks the upland-wetland boundary. In one area the bank is relatively low and is topped by irregularly flooded wetlands.

The wetland receives water from Lake Ozette, precipitation and South Creek. Wetland hydrology ranges from the shallowly but permanently flooded zone (< 3 feet deep during the summer) to an ecotonal area that is seasonally flooded but swept by most waves the rest of the year. Farther inland the wetland continues to be seasonally flooded, but is swept by waves less frequently the rest of the year.

The substrates are predominantly silty sand with areas of very soft silts and organic matter. There are narrow layers of peat soils visible in the area ecotonal between the permanently and sesonally flooded wetlands. Some heath and fibrous material has built up in the seasonally flooded zone. Surrounding uplands are mostly mapped as Klone-Ozette-Tealwhit complex and Kydaka-Zeeka complex with an area of Ilwaco silt loam.

Biological: The vegetation in the permanently flooded zone is characterized by the presence of Equisetum fluviatile, Lobelia dortmana, Sparganium eurycarpum and Polygonum sp.

The seasonally flooded wetlands generally shift from a narrow band characterized by Carex obnupta, Ranunculus flammula, Carex sitchensis and Carex lenticularis, to fairly open, low growing, species rich Myrica gale and Carex sitchensis dominated communities. Thickets of Myrica gale with Salix spp. and Pyrus fusca are located adjacent to the uplands.

Pyrus fusca, Carex obnupta and Boykinia major dominate an area that at least receives water from waves and storms during the winter.

CONDITION:

The wetland communities in this area are in good condition. Phalaris arundinacea is begining to spread from an area to the east that appears to have been disturbed in the past. The uplands that lie outside of the Park boundary and adjacent to the wetlands have recently been clearcut, including the entire drainage of South Creek which flows into the wetland. Little or no buffer was left along the creek. A trail is maintained between the wetland and the end of a logging spur. Spent gun shells suggest that the area is used for hunting.

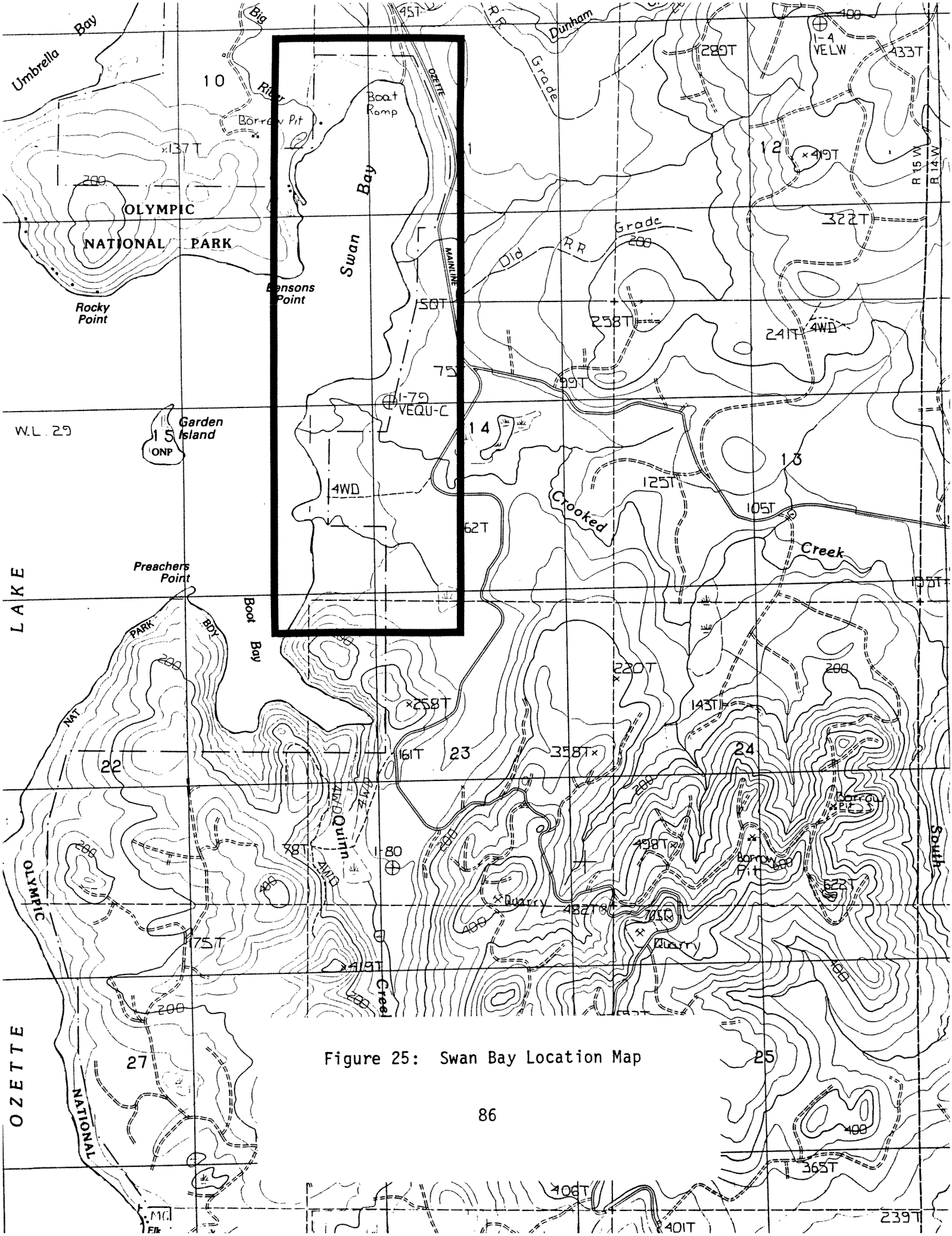


Figure 25: Swan Bay Location Map

SWAN BAY

LOCATION:

Western Clallam County; Sections 10, 11, 14 and 15, Township 30 North, Range 15 West, Willamette Meridian. Swan Bay is part of Olympic National Park.

SIGNIFICANCE:

Swan Bay is a second tier site. It contains populations of 5 state-listed plant species and 9 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Equisetum fluviatile community.
2. Scirpus acutus community.
3. Sparganium eurycarpum community.
4. Carex obnupta-Juncus nevadensis-Ranunculus flammula community.
5. Carex sitchensis-Potentilla palustris community.
6. Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community.
7. Myrica gale-Spiraea douglasii/Carex obnupta community.
8. Picea sitchensis-Alnus rubra/Ly.sichitum americanum community.
9. Pyrus fusca community.

DESCRIPTION:

Physical: The Swan Bay-Boot Bay area is located along the northeastern shore of Lake Ozette. The wetlands occur at an elevation of about 30 feet. The wetland profile progresses shoreward from the shallowly flooded lake shore to an abrupt bench edge 1 to 2 feet high which marks the waterward edge of the seasonally flooded zone. The elevation of the bench gradual increases shoreward either to above the extreme high water mark or to a second bench. Both benches are eroding.

The wetlands receive water mostly from the lake, but also from precipitation and surface flow. Wetland hydrology ranges from the shallowly but permanently flooded zone (< 3 feet deep during the summer) to the waterward edge of the first bench that is seasonally flooded and then swept by waves the rest of the year. Farther inland the wetland continues to be seasonally flooded, but is swept by waves less frequently the rest of the year. Above the second bench, at probably the landward edge of the Pyrus fusca zone, the area is flooded by waves and storm events during the winter. The forested wetlands receive wave and storm water well into their lakeward margin, but most of the water is from a perched water table, groundwater and surface water.

The substrates are predominantly sand with some organic matter in the permanently flooded and seasonally flooded wetlands. There are areas with a little peat development, including sphagnum peat. Forested wetlands and surrounding uplands are mostly mapped as Klone-Ozette-Tealwhit complex and Ozette silt loam with areas of Kydaka-Zeeka complex and Tealwhit silt loam.

Biological: The vegetation in the permanently flooded zone is characterized by the presence of Equisetum fluviatile and Lobelia dortmana. Patches of Scirpus acutus in this zone have many of the same species as found in the Equisetum fluviatile community but include species typical of more protected areas. Protected areas, landward of the Scirpus acutus community, and margins of backwater areas are dominated by Carex sitchensis. Areas dominated by Sparganium eurycarpum seem to occur in slightly protected portions of the bay and tend to have siltier soils than the previous two communities. This community was not surveyed well because of water depth and the softness of the substrate.

The seasonally flooded wetlands generally shift from a narrow band characterized by low growing herb dominated vegetation with Juncus nevadensis, Carex obnupta, Ranunculus flammula and Carex lenticularis, to thickets of Myrica gale. Landward of the thickets are more open, species rich areas dominated by Myrica gale with Aster sp. and Boykinia major. Within this are small areas with only scattered, low growing shrubs, some sphagnum and a species rich floral assemblage.

The landward edge of the seasonally flooded area generally coincides with the beginning of the Pyrus fusca/Carex obnupta community. This is a closed canopy community with sparse understory vegetation which is characterized by Carex obnupta and includes a mixture of typically upland and wetland species.

CONDITION:

The wetland communities in this area have been affected by past logging and homestead activities, but are still in reasonable condition in most places. The forested wetlands have all been at least selectively cut in the past but seem to be recovering.

The primary threat to the herb and shrub dominated seasonally flooded wetlands and the backwater areas is the spread of Phalaris arundinacea. Phalaris arundinacea is the dominant species in large areas of Swan Bay and is scattered throughout the area. There are also concerns about the effects of siltation of the permanently flooded wetlands around the lake due to logging activities within the drainage basin.

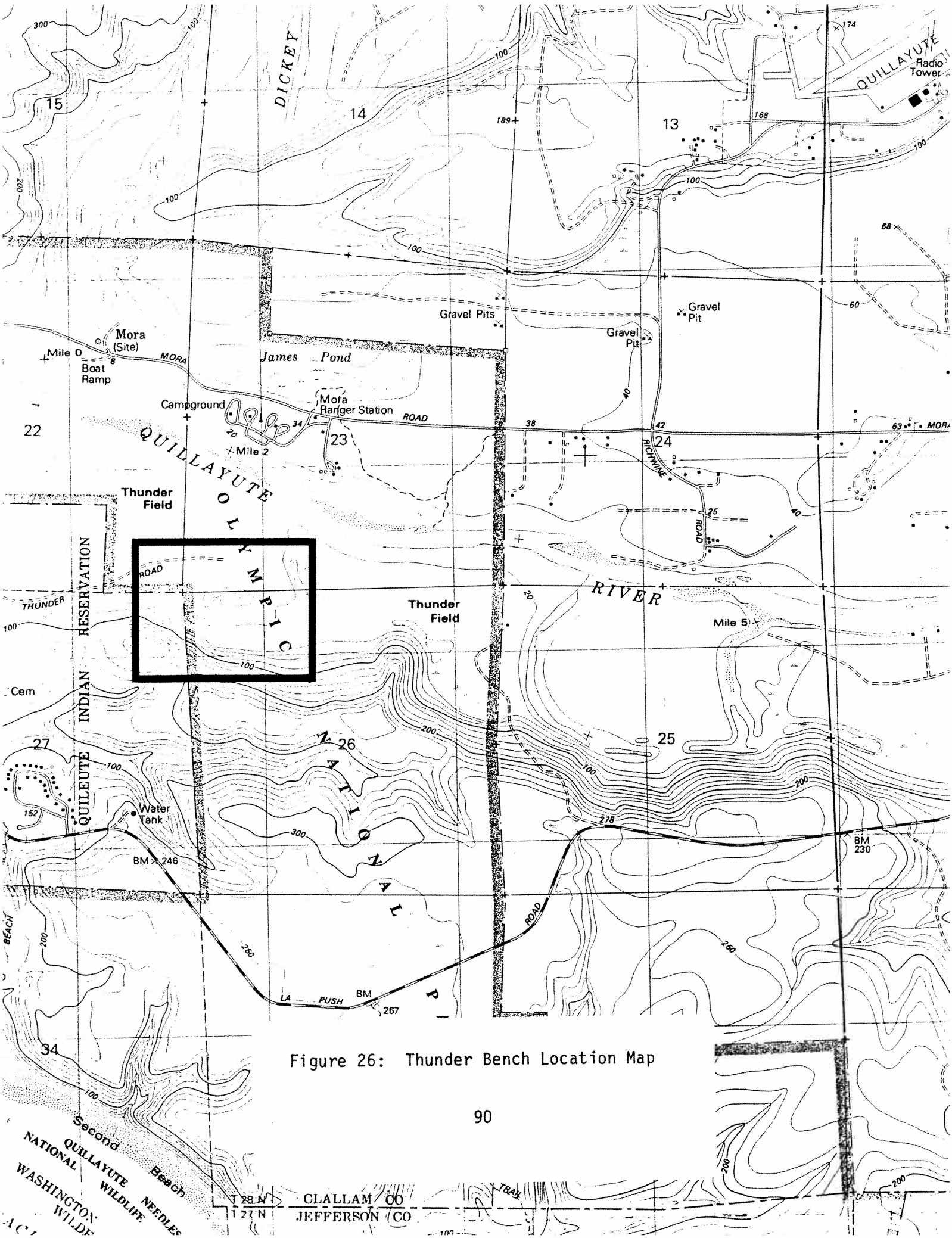


Figure 26: Thunder Bench Location Map

THUNDER BENCH

LOCATION:

Western Clallam County; Section 26, Township 28 North, Range 15 West, Willamette Meridian. Most, if not all, of Thunder Bench is in the Olympic National Park.

SIGNIFICANCE:

Thunder Bench is a second tier site. It is recovering from past disturbance and contains examples of 3 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Nuphar polysepalum community.
2. Carex obnupta community.
3. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Thunder Bench is located in the old flood plain of the Quillayute River, near the river's mouth. It is located at an elevation of about 20 feet at the base of a steep, north facing slope. The site consists of 8 acres of ponds and herb dominated wetlands, and 10 acres of forested wetlands.

The site receives water from sheet flow and possibly groundwater discharge. The herb dominated areas grade from areas which are permanently flooded and have open water, to areas that are seasonally flooded and then supersaturated. The water level appears to be controlled by beavers. The forested wetlands are supersaturated year round and may be flooded seasonally.

The soils are muck and fibrous peat. Large woody debris provide substrates elevated above the soil and water surfaces.

Biological: The ponded areas are characterized by the presence of Nuphar polysepalum and Potamogeton natans. The shallower permanently to seasonally flooded areas are dominated by Carex obnupta and Lysichitum americanum. Small Alnus rubra, Picea sitchensis and Tsuga heterophylla are abundant. Gaultheria shallon is abundant on fallen logs. There are lots of snags and a few half-dead trees.

The forested wetland is dominated by Picea sitchensis, Tsuga heterophylla and Lysichitum americanum.

CONDITION:

The herb dominated wetlands and ponds appear to be in excellent condition. Exotic plant species are scarce and there are no obvious signs of human disturbance. The forested wetlands were selectively logged in the past but are recovering well.

The greatest threat to this area is spread of Phalaris arundinacea into this wetland from nearby wetlands. The forested wetlands may not be threatened, but the herb dominated wetlands and pond margins are prime habitat.

Most of this site lies within the Olympic National Park, but the western tip lies within the Quileute Indian Reservation.

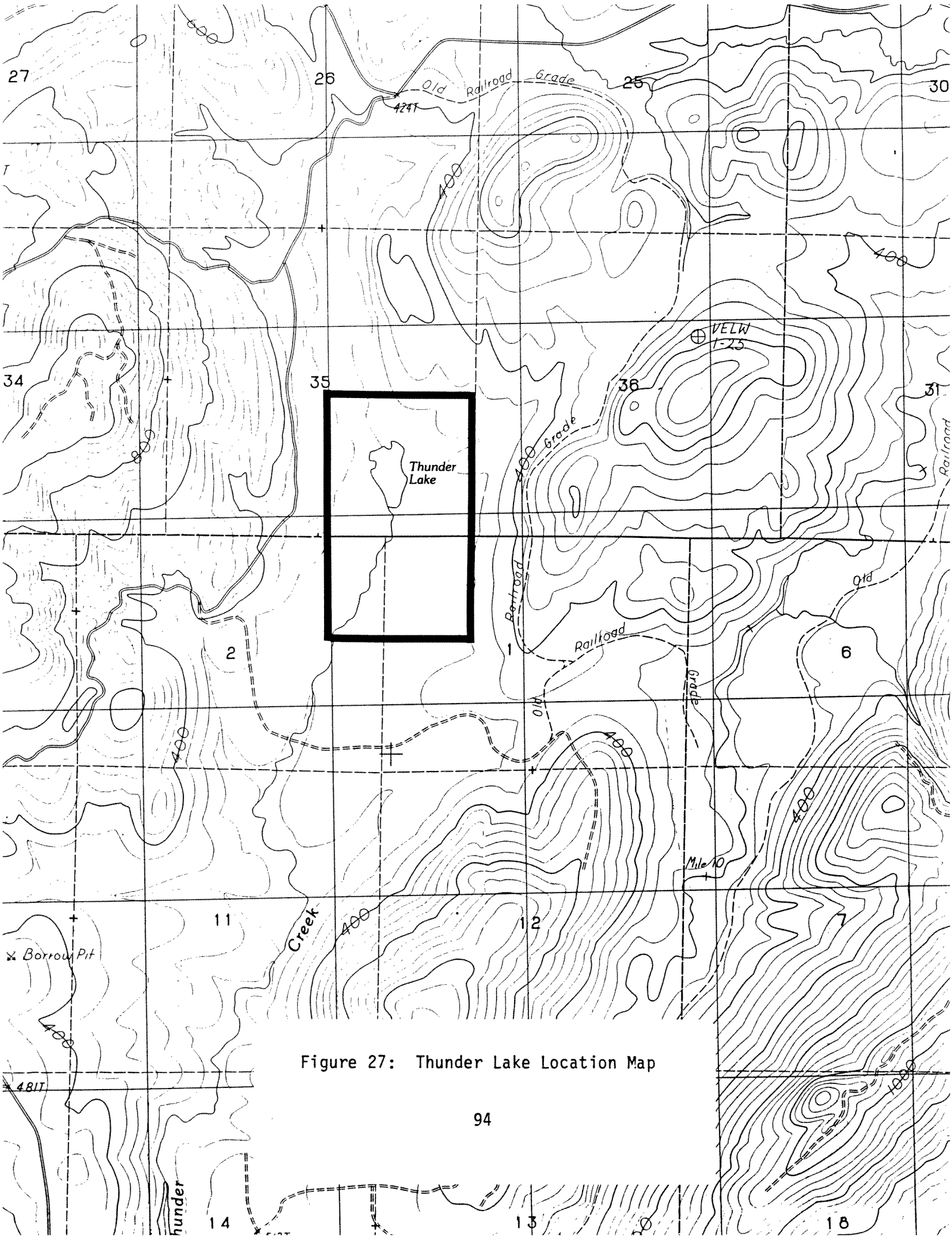


Figure 27: Thunder Lake Location Map

THUNDER LAKE

LOCATION:

Western Clallam County; Sections 1 and 2, Township 29 North, Range 14 West, and Section 30, Township 30 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

Thunder Lake is a second tier site. The shrub and herb dominated wetlands adjacent to the lake are in good condition, but the forested wetlands have been selectively logged and clearcut. The site contains examples of 3 freshwater wetland communities.

FEATURES:

Freshwater Wetland:

1. Carex rostrata-Carex sitchensis community.
2. Spiraea douglasii community.
3. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Thunder Lake is located at 280 feet elevation near the headwaters of Thunder Creek. It is located in a narrow valley within hilly terrain. The site consists of a 9-acre lake, 4 acres of herb and shrub dominated vegetation encircling the lake, 3 acres of wetland vegetation along the outflow stream, and several acres of disturbed forested wetland.

There is both an inflow and outflow from the lake. Both have broad channels, 10 feet or more wide, which carry very slow moving brown colored water. There is another channel which may be artificial and that has been dammed by beaver. There are signs of beaver activity particularly along the outflow channel. The wetland areas are permanently to seasonally flooded. Seasonally flooded areas appear to remain supersaturated year round.

The soil in the area is mapped as Klone-Ozette-Tealwhit complex. The wetland soils are very soft organic material. There is some fibrous and heath peat. Within the forested wetland zone, substrates are a mosaic of very soft, anoxic, muck, firmer mesic soils and large woody material.

Biological: Along the outflow channel is a broad riparian zone dominated by Rubus spectabilis, Carex obnupta and Lysichitum americanum. The vegetation is low growing, apparently kept cropped by wildlife.

Vegetation around the lake shifts from a permanently flooded zone dominated by Carex rostrata and Carex sitchensis to a seasonally to permanently flooded zone dominated by Spiraea douglasii, Carex rostrata, Carex sitchensis and Lysichitum americanum. In places, this zone is composed of nearly pure stands of Spiraea douglasii.

The forested wetland appears to be an example of the Picea sitchensis-

Alnus rubra/Lysichitum americanum community. It is codominated by Picea sitchensis, Tsuga heterophylla, Alnus rubra, Rubus spectabilis, and Lysichitum americanum. Carex obnupta and Oenanthe sarmentosa are codominant in places.

CONDITION:

The herb and shrub dominated portions of the wetland appear to be in good condition. Most of the forested wetland has been clearcut. One area of forested wetland on the northwest side of the lake was selectively logged in the past. A narrow line of trees was left between the shrub dominated wetland and recent clearcuts. Exotic plant species established in wet areas in the clearcuts may spread into the undisturbed wetlands.

An odd channel flanked by berms is located on the northwest side of the lake. A delta-like area extends out into the lake from near the channel's mouth. The area has an unusual diversity and high percent cover of exotic plant species. This area appears to receive human use in the form of hunting and fishing, and may be a human-made feature.

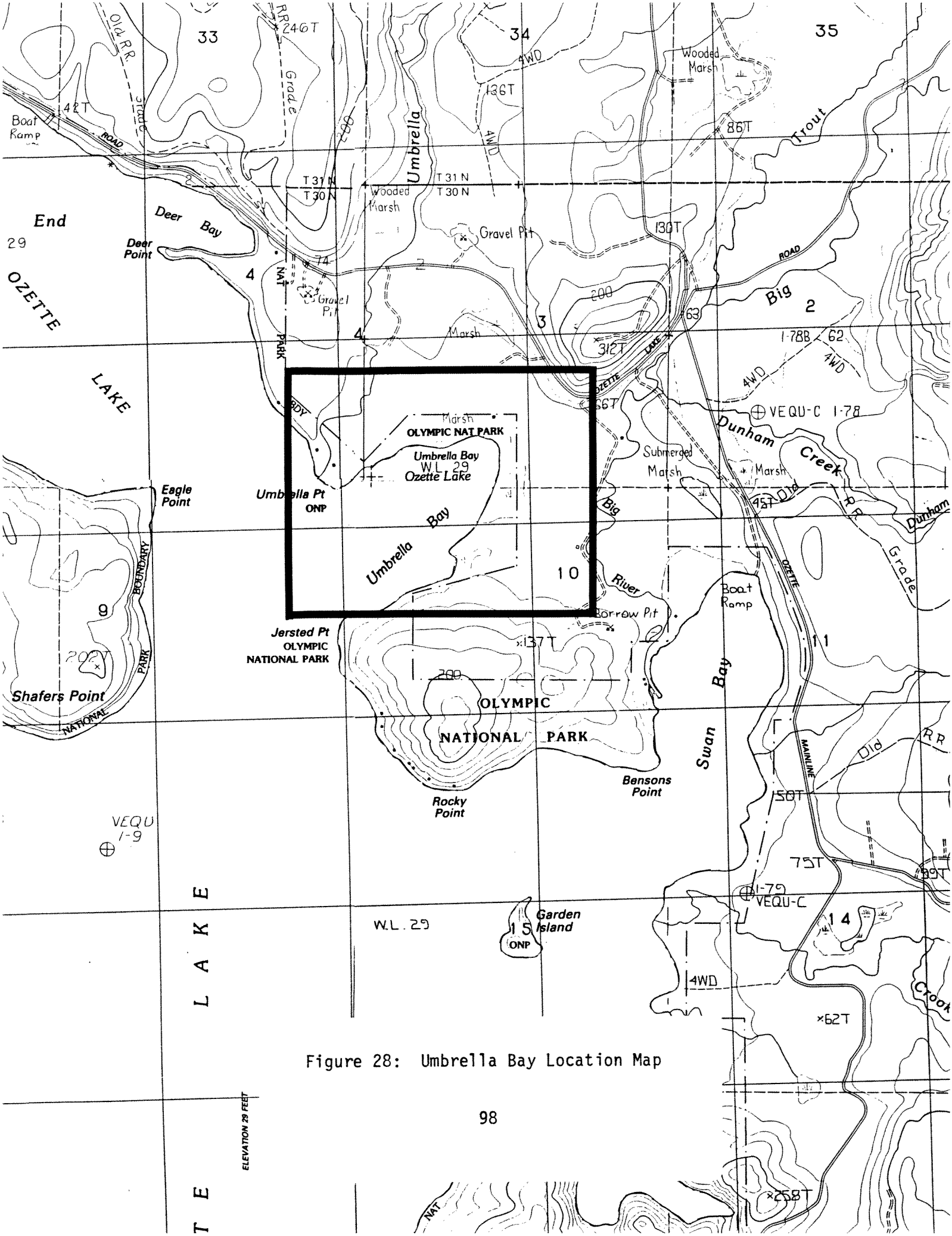


Figure 28: Umbrella Bay Location Map

UMBRELLA BAY

LOCATION:

Western Clallam County; Sections 3, 4 and 10, Township 30 North, Range 15 West, Willamette Meridian. Most of Umbrella Bay is within the Olympic National Park.

SIGNIFICANCE:

Umbrella Bay is a second tier site. The area contains examples of 8 freshwater wetland communities, and a population of 1 state-listed plant species.

FEATURES:

Freshwater Wetland:

1. Equisetum fluviatile community.
2. Nuphar polysepalum community.
3. Sparganium eurycarpum community.
4. Carex obnupta-Juncus nevadensis-Ranunculus flammula community.
5. Carex sitchensis-Potentilla palustris community.
6. Myrica gale-Spiraea douglasii/Carex obnupta community.
7. Spiraea douglasii community.
8. Pyrus fusca community.

DESCRIPTION:

Physical: Umbrella Bay is located at the northeast end of Lake Ozette, at an elevation of about 30 feet. It is a very shallow bay oriented northeast-southwest. There are about 8 acres of permanently flooded emergent wetlands and 44 acres of seasonally flooded wetlands around the bay.

Water in the permanently flooded wetland area varies from a few inches to 3 or 4 feet deep during the summer. The herb and shrub dominated areas are seasonally flooded. The herb dominated areas receive water from waves year round. The shrub dominated areas stay moist, but generally do not receive water from waves during the summer. The tree dominated areas are flooded at least occasionally during the winter, and the soils stay wet year round.

The bay bottom appears to be sandy near the bay's mouth, and grades to soft silts and organic matter at the northeast end. The seasonally flooded wetlands appear to be underlain by sand, and have fibrous and heath peat layers.

Biological: The permanently flooded area is dominated by Sparganium eurycarpum. It occurs in the northeast half of the bay on silty soils. Intermixed with it are patches of Nuphar polysepalum. Towards the bay mouth are small areas of the Equisetum fluviatile community.

The lakeward margin of the seasonally flooded wetlands is dominated by Carex sitchensis. In areas, this community occurs as hummocks in the ecotone between seasonally and permanently flooded zones. Near the bay's

mouth, this zone is occupied by the Carex obnupta-Juncus nevadensis-Ranunculus flammula community.

The shrub dominated wetlands that ring the bay are a mixture of Myrica gale and Spiraea douglasii dominated communities. These typically are dense, tall thickets. Intermixed with, and landward of the shrub zone, the vegetation is composed of dense thickets of Pyrus fusca. The most extensive thicket is at the east end of the bay.

The landwardmost wetland community is dominated by Picea sitchensis and Alnus rubra, and has Carex obnupta in the understory. Most of this community has been logged recently and it is not known if it will recover.

CONDITION:

Umbrella Bay is in questionable condition. It was the site of early settlement activity and at least the forested wetlands have been effected by logging activities. Phalaris arundinacea is established within the seasonally flooded wetland communities, and exotics are abundant in the recently logged wet forest areas. A private boat launch area is a conduit for exotic plant species.

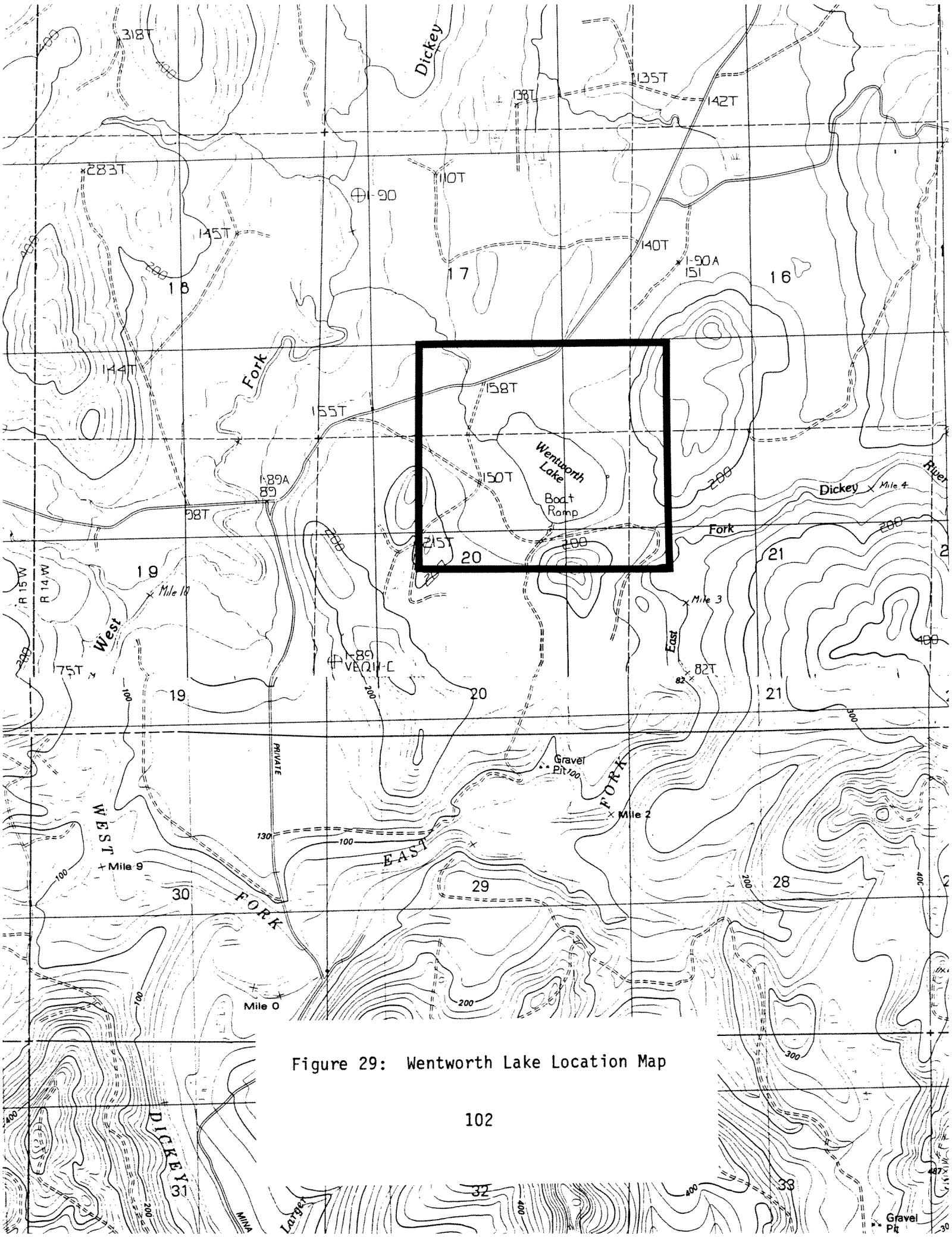


Figure 29: Wentworth Lake Location Map

WENTWORTH LAKE

LOCATION:

Western Clallam County; Sections 17 and 20, Township 29 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

Wentworth Lake is a second tier site. Most of the forested wetlands have been logged and the outflow wetland has been disturbed, but the herb and shrub dominated wetlands are in relatively good condition. The wetland contains examples of 2 sphagnum bog and 5 freshwater wetland communities.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum-Myrica gale/Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community.

Freshwater Wetland:

1. Brasenia shreberi community.
2. Nuphar polysepalum community.
3. Scirpus acutus community.
4. Myrica gale/Calamagrostis canadensis community.
5. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

DESCRIPTION:

Physical: Wentworth Lake is located at an elevation of about 150 feet and is the headwaters of a tributary of the West Fork Dickey River. The site consists of a 41-acre lake (29 acres of open water and 12 acres of rooted aquatic vegetation), surrounded by 3.5 acres of shrub dominated vegetation which in turn is surrounded by 27.5 acres of disturbed forested wetlands.

The lake and wetland receive water from precipitation, sheet flow and probably ground water. The area is mapped as overlaying compacted glacial till and having a perched water table. There is no channeled inflow. The outflow channel is located at the northwest end of the lake. The outflow is dammed by beavers in several locations and the water moves very slowly.

The rooted aquatic zone appears to coincide with a submerged peat bench which surrounds the open water area but is broadest near the northwest end of the lake. Adjacent to the submerged bench is a zone elevated above the lake surface composed of perennially wet sphagnum, fibrous and heath peat. Some portions of this zone are seasonally flooded. The forested wetland shifts from perennially supersaturated to seasonally flooded. The forested wetland soils are probably Kydaka-Zeeka complex. The soils in the surrounding uplands are mapped as Kydaka-Zeeka complex.

Biological: Vegetation over the submerged bench shifts landward from Brasenia shreberi to Nuphar polysepalum to Potentilla palustris. Carex lasiocarpa extends out from the bog margin in places and patches of Scirpus acutus and some sedge tussocks are scattered in this zone.

Myrica gale is dominant over the shrub zone surrounding the submerged bench. Ledum groenlandicum, Spiraea douglasii and Vaccinium oxycoccos along with Myrica gale are indicative of areas that have Sphagnum spp. Calamagrostis canadensis, Carex sitchensis and Potentilla palustris are indicative of areas which do not have Sphagnum spp.

The wet forest has been disturbed in the past, most of it was clearcut and other portions selectively logged. One small area may have been left untouched. Thuja plicata and Tsuga heterophylla are the dominant tree species although there is some Picea sitchensis and Alnus rubra. The understory of the wettest areas of forest are dominated by Lysichitum americanum and Carex obnupta. Drier areas are dominated by Gaultheria shallon and Lysichitum americanum and contain more typically upland plant species.

CONDITION:

The lake, submerged bench and shrub dominated wetlands are in good condition. There is a population of Nymphaea odoratum that was probably introduced into the lake by humans. A dilapidated hunter's cabin is located in the shrub zone on the southeast side of the lake, and a boat launch is located on the south side of the lake.

The forested wetlands and wetlands along the outflow stream have been badly damaged by logging and road building activities. The forested wetland areas appear to be dominated by native plant species and may recover. Exotic plant species, primarily Phalaris arundinacea, have become established in the wetlands along the outflow stream, mostly where a logging road crosses the stream.

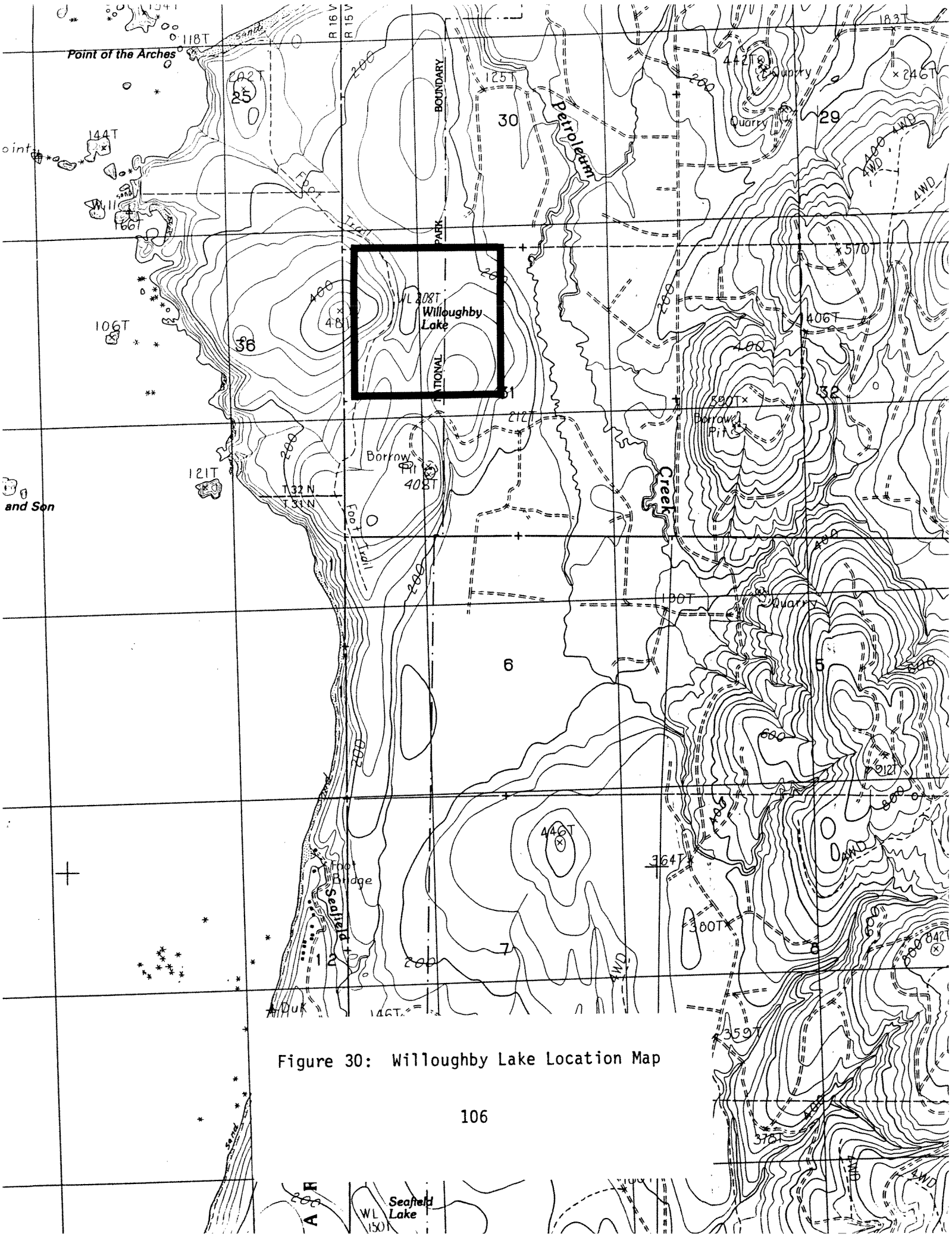


Figure 30: Willoughby Lake Location Map

WILLOUGHBY LAKE

LOCATION:

Western Clallam County; Section 31, Township 32 North, Range 15 West, Willamette Meridian. Willoughby Lake is part of the Olympic National Park.

SIGNIFICANCE:

Willoughby Lake is a second tier site. The site is composed of a small lake and bog which has examples of 2 sphagnum bog communities. The site is recovering from past disturbance.

FEATURES:

Sphagnum Bog:

1. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community.
2. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

DESCRIPTION:

Physical: Willoughby Lake is located in a saddle between two hills at an elevation of 210 feet. It is composed of a 5-acre oval lake and about a 1/2-acre shrub dominated and almost 2-acre stunted tree dominated sphagnum bog located at the north end of the lake.

The wetland receives water from precipitation and may be influenced by lake water. There doesn't appear to be a channeled inflow to the system, but the lake drains to the northeast. The wetland soils are wet to supersaturated year round.

The bog soils are composed of sphagnum, fibrous, heath and woody peat. Fallen trees, elevated above the peat, provide an additional substrate.

Biological: Kalmia occidentalis, Ledum groenlandicum and Sphagnum spp. dominate the shrub zone. Vaccinium oxycoccos, Gentiana sceptrum, low growing Gaultheria shallon and highly stunted Thuja plicata are abundant.

Somewhat stunted Tsuga heterophylla and Thuja plicata dominate the overstory in the forested wetland. Ledum groenlandicum, Gaultheria shallon, Pteridium aquilinum and Sphagnum spp. dominate the understory. Kalmia occidentalis and Cornus canadensis are abundant.

CONDITION:

Willoughby Lake appears to be in good condition. There are cut stumps of pole size conifers over much of the wetland. The site receives low levels of recreational use, a path leads from a logging spur to the east and follows the lake margin. The disturbance to the site is expected to go down as the clearcut to the east and the logging spur become over grown.

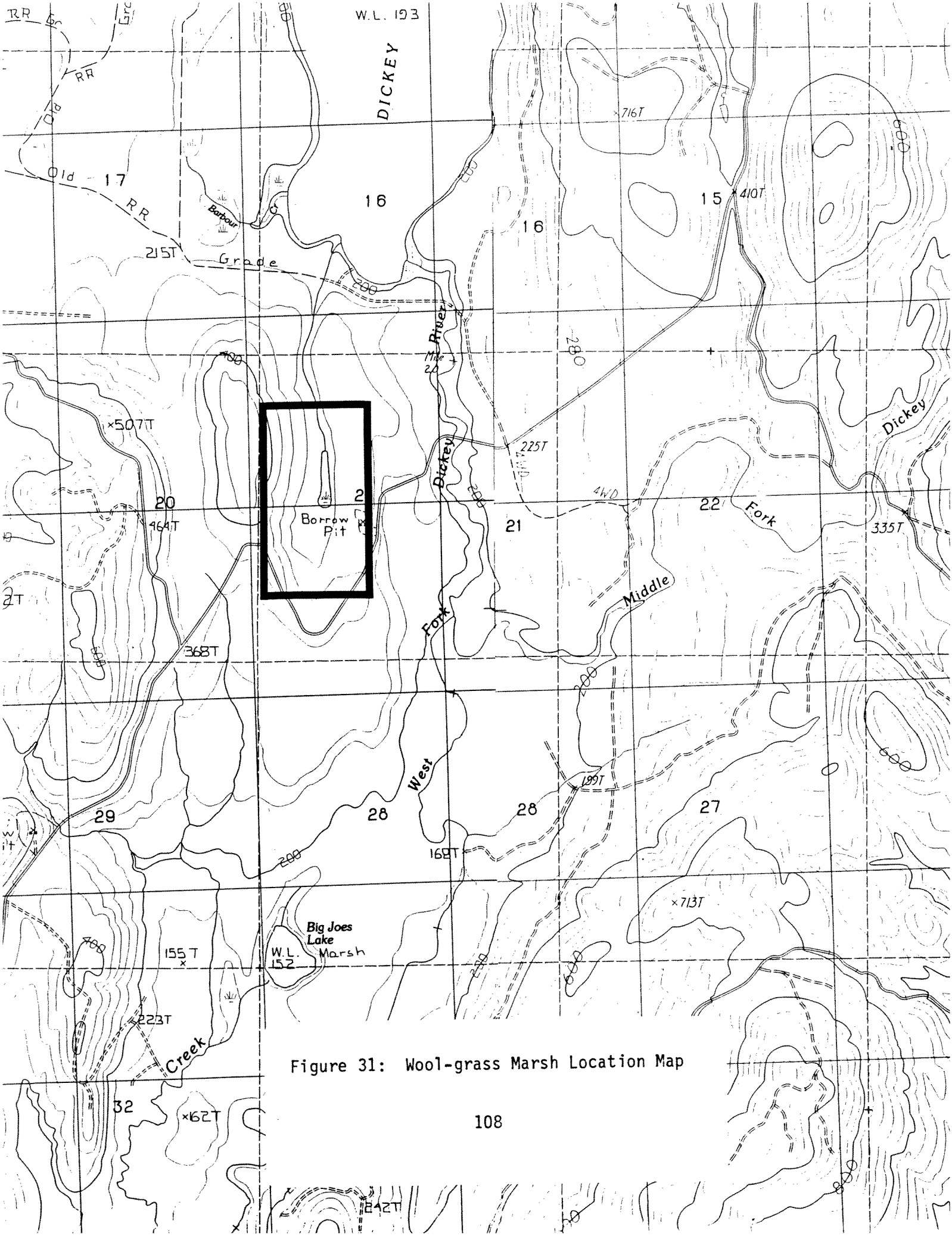


Figure 31: Wool-grass Marsh Location Map

WOOL-GRASS MARSH

LOCATION:

Western Clallam County; Section 21, Township 30 North, Range 14 West, Willamette Meridian.

SIGNIFICANCE:

Wool-grass Marsh is a second tier site. The wetland appears to be recovering from past disturbance, and contains remnants of 3 sphagnum bog communities.

FEATURES:

Sphagnum Bog:

1. Carex rostrata/Sphagnum spp. community.
2. Spiraea douglasii/Sphagnum spp. community.
3. Thuja plicata-Tsuga heterophylla/Gaultheria shallon/ Lysichitum americanum/Sphagnum spp. community.

DESCRIPTION:

Physical: Wool-grass Marsh is located at an elevation of about 280 feet in a narrow, steep-sided, north-south oriented trough. It is approximately 17 acres and is the headwaters of a small stream which flows into Dickey Lake.

The wetland receives water from precipitation, surface flow and seasonal streams. The outflow stream is blocked, either by a beaver dam or a log jam. The wetland has a moisture gradient from a shallow, vegetated pond to supersaturated herb and shrub dominated wetlands to mesic forested wetlands.

The wetland soils are a mixture of fibrous peat and anoxic muck near the outflow. To the south soils are sphagnum, fibrous and heath peat and muck. To the south, the soils are firmer and there is more woody material. Logs are scattered throughout the site providing habitat for typically upland species.

Biological: The wettest areas are dominated by Scirpus cyperinus. The next wettest areas are codominated by Carex rostrata and Potentilla palustris and have high percent cover of Sphagnum spp. A large portion of the wetland is a mosaic of Carex rostrata and Spiraea douglasii and is codominated by Sphagnum spp. The southern portion of the wetland is a recovering forested wetland. It has high percent cover of Thuja plicata, Tsuga heterophylla, Picea sitchensis, Alnus rubra, Spiraea douglasii, Lysichitum americanum, Gaultheria shallon, Carex obnupta and Sphagnum spp.

CONDITION:

Although logged in the past, Wool-grass Marsh is dominated by native plant species. Juncus effusus is the only problem species found, and occurs infrequently. The site has a mixture of high and low nutrient wetland species suggesting that it may be in transition.

Logging has had an impact on the system. Trees cut within the wetland have springboard notches. The uplands were clearcut as much as 40 years ago, leaving no buffer around the wetland. Logs and debris from the uplands are located within the wetland. Logs are scattered throughout the wetland and many are massed at the north end near the outflow. A road parallels the wetland, cutting across seasonal stream channels that flow into the wetland.

GLOSSARY

Dominant - a plant species which covers at least 20 percent of an area.

Exotic - a non-native species.

Fibrous Peat - peat composed of the remains of herbaceous plants, mostly sedges. It contains little if any Sphagnum spp.

Freshwater - water with less than 0.5 parts per thousand marine derived salt.

Heath Peat - peat composed of the remains of shrubby plants.

Hummock - a small mound. Hummocky microtopography consists of small mounds, usually composed of sphagnum moss.

Impounded - backed-up or accumulated behind an obstruction. An impounded wetland is one in which water has backed-up or accumulated behind an obstruction such as a beaver dam.

Lagg - the mineral-rich drainage area surrounding a sphagnum bog.

Minerotrophic Water - water that has been in contact with mineral soil.

Muck - peat decomposed to such a degree that plant parts can not be distinguished.

Native - indigenous to, or originating naturally in, Washington; remaining or growing in an unaltered natural condition.

Peat - the remains of plants which have accumulated in water or in wet places.

Pristine - having never been disturbed or altered from the native condition.

Sphagnum Bog - a wetland with a well developed Sphagnum moss or peat layer and resultant distinctive flora.

Sphagnum Peat - peat composed primarily of Sphagnum spp.

Woody Peat - peat composed of particles of partially decomposed wood.

BIBLIOGRAPHY

Alt, D.D. and D.W. Hyndman. 1984. Roadside Geology of Washington. Mt. Press Pub. Co., Missoula, Montana. 282p.

Damman, A.W.H. 1986. Hydrology, development, and biogeochemistry of ombrogenous peat bogs with special reference to nutrient relocation in a western Newfoundland bog. Can. J. Bot. 64:384-394.

Hill, M.O. 1979. Twinspan - A FORTRAN program for arranging multivariate data in an ordered two-way table of classification of individuals and attributes. Cornell Univ. N.Y. 14850. 90p.

Hitchcock, C.L. and A. Cronquist. 1978. Flora of the Pacific Northwest: an illustrated manual. University of Wash. Press. 730p.

McKee, B. 1972. Cascadia. Stuart Press, Seattle, Wash. 394p.

Rigg, G.B. 1958 Peat Resources of Washington. Wash. Division of Mines and Geology, Bull. No. 44. 272p.

Tabor, R.W. and W.M. Cady. 1978. Geologic map of the Olympic Peninsula, Washington. U.S.G.S. Misc. Invest. Series, Map I-994

United States Department of Agriculture. 1987. Soil Survey of Clallam County Area, Washington. U.S.D.A. Soil Conservation Service. 213p.

Washington Natural Heritage Program. 1990. Endangered, Threatened and Sensitive Vascular Plants of Washington. Wash. Dept. Nat. Resources, Div. of Land and Water Conservation, Olympia Wash. 51p.

APPENDIX A

PRELIMINARY CLASSIFICATION OF OLYMPIC PENINSULA FRESHWATER WETLANDS

This is an initial classification of native freshwater wetland vegetation found on the western coast of the Olympic Peninsula, Washington, between Grays Harbor and the Strait of Juan de Fuca. The study area extends east to Joyce along the north side of the peninsula. The classification includes sphagnum and non-sphagnum impounded wetlands occurring below 1,500 feet elevation.

The classification is intended to assist in the characterization and comparison of native wetlands on the coastal lowlands of the Olympic Peninsula. It was developed following a review of the literature and three years of reconnaissance level field surveys of relatively undisturbed wetlands. Species cover data were analyzed using Twinspan (Hill, 1979). The resulting classification should be treated as preliminary, ready for quantitative field testing.

During field surveys, each site was characterized by describing its apparent physical characteristics and plant communities. The communities were identified by: 1) dominant species, 2) presence or absence of key indicator species, and 3) observable differences in environmental conditions, such as soil characteristics or hydrology. A range of percent cover was recorded for all observed species in relatively undisturbed and accessible wetlands.

Wetland plant communities are difficult to define. Discrete communities are not typical. Instead, continua and mosaics of species appear to be the norm. Some of the recognized communities recur throughout the inventory area. Others do not recur or are not consistent in their associated species or environmental characteristics.

The classification below has been divided into two parts. The first includes recurring communities, that is, those for which at least three examples were found. The second includes communities observed to occur two or fewer times, or which occurred more frequently but were highly variable in their associated species composition.

The classification is similar to that used for the May, 1986 Northwest Wetlands Technical Conference convened by the Washington Department of Ecology in Port Townsend, Washington. The classification differs from that used at the conference in that it does not include information on soils. It also provides one finer level of resolution than did the conference classification; the plant community level. The classification is compatible with Cowardin et al., 1979.

CLASSIFICATION OF RECURRING COMMUNITIES:

I. Low Elevation Sphagnum Bog

A. Non-macrophyte
1. bog pond.

B. Herb Dominated
1. Carex livida-Sanguisorba officinalis/Sphagnum spp. community.
2. Carex rostrata/Sphagnum spp. community.
3. Carex rostrata-Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community.
5. Juncus supiniformis/Sphagnum spp. community.
6. Rhynchospora alba/Sphagnum spp. community.

C. Shrub Dominated
1. Kalmia occidentalis-Ledum groenlandicum/Xerophyllum tenax/ Sphagnum spp. community.
2. Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/ Pteridium aquilinum/Sphagnum spp. community.
3. Kalmia occidentalis-Ledum groenlandicum-Myrica gale/Sphagnum spp. community.
4. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/ Sphagnum spp. community.
5. Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/ Carex obnupta/Sphagnum spp. community.
6. Myrica gale/Carex rostrata-Nephrophyllidium crista-galli-Sanguisorba officinalis/Sphagnum spp. community.
7. Myrica gale/Carex sitchensis-Sanguisorba officinalis/ Sphagnum spp. community.
8. Spiraea douglasii/Sphagnum spp. community.

D. Tree Dominated
1. Pinus contorta/Ledum groenlandicum/Sphagnum spp. community.
2. Pinus contorta-Thuja plicata/Myrica gale/Sphagnum spp. community.
3. Thuja plicata-Tsuga heterophylla/Gaultheria shallon/ Lysichitum americanum/Sphagnum spp. community.
4. Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community.

II. Low Elevation Freshwater Wetland
A. Permanently Flooded
1. Non-macrophyte
a. pond.

2. Macrophyte
a. Equisetum fluviatile community.
b. Nuphar polysepalum community.
c. Scirpus acutus community.
d. Sparganium eurycarpum community.

B. Saturated Soils or Seasonally Flooded
    1. Herb Dominated
        a. Carex obnupta community.
        b. Carex obnupta-Juncus nevadensis-Ranunculus flammula community.
        c. Carex sitchensis-Potentilla palustris community.

    2. Shrub Dominated
        a. Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community.
        b. Myrica gale/Lysichitum americanum community.
        c. Myrica gale-Spiraea douglasii/Carex obnupta community.
        d. Spiraea douglasii community.

    3. Tree Dominated
        a. Picea sitchensis-Alnus rubra/Lysichitum americanum community.

CLASSIFICATION OF NON-RECURRING COMMUNITIES:

I. Low Elevation Sphagnum Bog

A. Non-macrophyte
none

B. Herb Dominated
1. Carex obnupta/Sphagnum spp. community.
2. Eriophorum chamissonis/Sphagnum spp. community.

C. Shrub Dominated
1. Myrica gale/Calamagrostis canadensis/Sphagnum spp. community.

D. Tree Dominated
1. none

II. Low Elevation Freshwater Wetland

A. Permanently Flooded
1. Non-macrophyte
a. none

2. Macrophyte
a. Brasenia schreberi community.
b. Scirpus subterminalis community.

B. Saturated Soils or Seasonally Flooded
1. Herb Dominated
a. Carex rostrata community.
b. Carex rostrata-Carex sitchensis community.
c. Carex sitchensis community.

2. Shrub Dominated
a. Spiraea douglasii-Salix spp./Carex obnupta community.

3. Tree Dominated
a. Pyrus fusca community.
b. Pyrus fusca/Calamagrostis canadensis community.
c. Thuja plicata/Lysichitum americanum community.

APPENDIX B

OLYMPIC PENINSULA FRESHWATER WETLAND COMMUNITY DESCRIPTIONS

The following wetland community descriptions provide information on physical and floristic characteristics of each community listed in the preceding classification. Included are species lists which distinguish between the dominant or characteristic species ("Indicator Species"), and those which are minor or uncharacteristic ("Other Species").

The community descriptions are presented in two major groups, the first includes those communities which were observed to recur in the landscape, while the second includes those which were not observed to recur. Within each of these major categories are two subheadings: sphagnum bog and freshwater (non-sphagnum) wetland communities. The descriptions are listed in the same order as in the classification (Appendix A).

RECURRING COMMUNITIES

LOW ELEVATION SPHAGNUM BOG COMMUNITIES

A sphagnum bog is characterized by the presence of sphagnum moss species (Sphagnum spp.) and sphagnum peat. Bogs have low pH and low nutrient availability. They typically are fed by precipitation, which is low nutrient water. This set of conditions gives rise to an unusual flora, many species of which are unique to sphagnum bogs.

Throughout most of the western Washington lowlands, sphagnum bogs occur in depressions or basins. Their surfaces are flat to convex and they receive water only from precipitation. However, on the west side of the Olympic Mountains bogs occur on slopes as well as in basins. The ability to develop sloping bogs is due to the high precipitation/evaporation ratio found on the west side of the Olympic Peninsula. These sloping bogs are probably in contact with some minerotrophic water (water that has been in contact with mineral soil) and have higher nutrient levels than bogs fed exclusively by rain water (Damman, 1986).

Bog Pond: Typically these are small ponds or lakes located in small basins and bounded on at least one side by sphagnum peat. The pH of the water is 5.5 or less. The water is usually brown to red brown in color. Often these ponds are surrounded by mats of sphagnum which slowly extend out over the water's surface and finally fill the basin. These ponds frequently overlay fibrous, heath, woody, and sphagnum peat.

Small seasonal to permanent ponds also occur within sloping bogs on the west side of the Olympic Peninsula. These ponds typically lie perpendicular to the slope and catch water flowing over the bog surface and seeping downhill through the peat. They are typically oblong and only a few square feet in area. The seasonal ponds often support populations of Juncus supiniformis.

Carex livida-Sanguisorba officinalis/Sphagnum spp. community: This community occurs mostly in western Jefferson and Clallam Counties. It occurs on supersaturated peat along seeps and seasonal drainages. Soils are a mixture of sphagnum, fibrous and heath peat, and often contain some woody material.

This is a difficult community to characterize. Cover of vascular plants is often sparse, and woody species are highly stunted. Sphagnum spp. are the only consistently dominant species in the community. Kalmia occidentalis, Ledum groenlandicum, Vaccinium oxycoccos, Sanguisorba officinalis, Carex livida and Carex interior complex all occur in most stands but with wide ranging cover values. Carex obnupta, Rhynchospora alba and highly stunted Thuja plicata are frequent associated species. Platanthera dilatata, Tofieldia glutinosa and Gentiana douglasiana have high fidelity to this community but have low percent cover values and are not always present.

This community is similar to the Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community, but is wetter, has lower percent cover of woody species, and higher frequency and percent cover of herbaceous species typical of slightly wetter environments, specifically Sanguisorba officinalis, Rhynchospora alba, Carex livida, Carex interior complex and Carex obnupta.

Indicator Species:

- Carex interior complex
- Carex livida
- Kalmia occidentalis
- Ledum groenlandicum
- Sanguisorba officinalis
- Sphagnum spp.
- Vaccinium oxycoccos

Other Species:

- Agrostis sp.
- Agrostis aequivalvis
- Agrostis oregonensis
- Agrostis scabra
- Anemone oregana var. felix
- Blechnum spicant
- Boykinia spp.
- Calamagrostis nutkaensis
- Camassia sp.
- Carex obnupta
- Carex pluriflora
- Carex rostrata
- Cladina rangiferina
- Cornus canadensis
- Deschampsia caespitosa
- Drosera rotundifolia
- Empetrum nigrum
- Eriophorum chamissonis
- Gaultheria shallon
- Gentiana douglasiana
- Gentiana sceptrum
- Linnaea borealis
- Lysichitum americanum
- Menyanthes trifoliata
- Nephrophyllidium crista-galli
- Panicum occidentalis
- Picea sitchensis
- Pinus monticola
- Platanthera dilatatum
- Pteridium aquilinum
- Pyrus fusca
- Rhamnus purshiana
- Rhynchospora alba
- Spiraea douglasii
- Spiranthes romanzoffiana
- Thuja plicata
- Tofieldia glutinosa
- Trientalis arctica
- Trisetum canescens
- Tsuga heterophylla
- Vaccinium cf uliginosum
- Veratrum sp.

Hypericum anagalloides
Juncus ensifolius
Juncus supiniformis
Viola palustris
Xerophyllum tenax

Carex rostrata/Sphagnum spp. community: This community occurs in western Jefferson and Clallam Counties. It occurs on mixed sphagnum and fibrous peat soils which are permanently flooded with a few inches of water, or are supersaturated. Typically it occurs in a shaded portion of a site.

This is a low growing, species rich community The Thuja plicata are highly stunted, usually reaching only a few feet tall.

This community intergrades with the Carex livida-Sanguisorba officinalis/Sphagnum spp. community. It is easily distinguished from the latter by the predominance of Carex rostrata.

Indicator Species:
Carex rostrata
Sphagnum spp.

Other Species:
Agrostis sp.
Agrostis scabra
Anemone oregana var. felix
Blechnum spicant
Boykinia cf elata
Camassia sp.
Carex interior complex
Carex livida
Deschampsia caespitosa
Drosera rotundifolia
Gentiana sceptrum
Hypericum anagalloides
Kalmia occidentalis
Ledum groenlandicum
Linnaea borealis
Nephrophyllidium crista-galli
Pinus contorta
Pinus monticola
Pteridium aquilinum
Rhamnus purshiana
Rhynchospora alba
Sanguisorba officinalis
Thuja plicata
Trientalis arctica
Vaccinium oxycoccos
Viola sp.

Carex rostrata-Carex sitchensis-Sanguisorba officinalis/Sphagnum spp. community: Surveyed examples of this community are located in Grays Harbor County in Myrica gale bogs. The community is often associated with slow, seasonally flowing water, and may be affected by minerotrophic water. It is wet year round and seasonally flooded. Soils are a mixture of sphagnum and fibrous peat.

The vegetation is lush and forms tall dense stands dominated by sedges. Carex rostrata is always a dominant species. Carex sitchensis is usually codominant, but occasionally can have very low percent cover. Gentiana sceptrum, Sanguisorba officinalis and Sphagnum spp. are usually present and can be codominant. A subset of stands have an abundance of Carex obnupta.

This community is similar to the Myrica gale/Carex sitchensis-Sanguisorba officinalis/Sphagnum spp. community. It differs in not having Myrica gale and in being less species rich.

Indicator Species:

Carex rostrata
Carex sitchensis
Gentiana sceptrum
Sanguisorba officinalis
Sphagnum spp.

Other Species:

Carex obnupta
Deschampsia caespitosa
Drosera rotundifolia
Eriophorum chamissonis
Juncus balticus
Myrica gale
Trientalis arctica
Vaccinium oxycoccos

Juncus supiniformis/Sphagnum spp. **community:** This community occurs in western Jefferson County and one site in western Clallam County. It is found in small seasonally flooded depressions or ponds. The surface layer of peat dries during the summer in most cases, but the underlying peat is saturated. The substrate is a mixture of decomposed fibrous and sphagnum peat.

The community is clearly identified by the abundance of Juncus supiniformis and lack of other vegetation. Carex livida and Rhynchospora alba typically occur around the margins of this community within the study area. Although the depressions/ponds occur within sphagnum peat, there is seldom any living Sphagnum spp. These areas may be elk wallows.

Indicator Species:

Juncus supiniformis

Other Species:

Carex livida
Carex rostrata
Hypericum anagalloides
Rhynchospora alba

Rhynchospora alba/Sphagnum spp. **community:** This community occurs throughout the study area. It is typically found in a band along the quaking margin of a sphagnum mat adjacent to open water, in wet depressions or along seeps. Soils are supersaturated sphagnum peat, and may be seasonally flooded. The substrate is soft and often sinks when stepped on.

Rhynchospora alba is dominant in this community. Kalmia occidentalis and Vaccinium oxycoccos frequently occur. Shrub species, when found, have a short growth form, usually not exceeding 2 feet. Frequently there are no living Sphagnum spp. Along seeps, this community is usually in a mosaic with other communities.

This community is most similar to the Carex livida-Sanguisorba officinalis/ Sphagnum spp. community, but is easily distinguished by its dominance by Rhynchospora alba.

Indicator Species:

Rhynchospora alba

Other Species:

Agrostis sp.
Agrostis scabra
Boykinia cf major
Carex interior complex
Carex livida
Carex rostrata
Drosera rotundifolia
Empetrum nigrum
Eriophorum chamissonis
Gentiana sceptrum
Juncus acuminatus
Kalmia occidentalis
Ledum groenlandicum
Lysichitum americanum
Nephrophyllidium crista-galli
Nuphar polysepalum
Sanguisorba officinalis
Sphagnum spp.
Thuja plicata
Tofieldia glutinosa
Vaccinium oxycoccos

Kalmia occidentalis-Ledum groenlandicum/Xerophyllum tenax/Sphagnum spp. **community:** This is a dry bog community which occurs in western Jefferson and Clallam Counties. It is seasonally dry and seasonally saturated. It can be seasonally flooded. Substrates are a mixture of heath, fibrous and sphagnum peat, and there is large woody material in some sites. Mineral soil is sometimes visible at the soil surface and there are often signs of past fire.

The vegetation in this community is not lush. The shrubs are generally scraggly and form an open canopy 2-4 feet tall. The community is depauperate. Kalmia occidentalis, Ledum groenlandicum and Xerophyllum tenax are codominant. Pteridium aquilinum is always present and sometimes codominant. Gaultheria shallon is usually present but low growing and not codominant.

This community is most similar to the Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community. It differs from that community in the presence of Xerophyllum tenax and paucity of its flora.

Indicator Species:

Gaultheria shallon
Kalmia occidentalis
Ledum groenlandicum
Pteridium aquilinum
Xerophyllum tenax

Other Species:

Cladina rangiferina
Cornus canadensis
Gentiana sceptrum
Maianthemum dilatatum
Picea sitchensis
Pinus contorta
Pyrus fusca
Sphagnum spp.
Trientalis arctica
Tsuga heterophylla
Vaccinium oxycoccos

Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community: This community is found in western Clallam County, mostly in "prairies". It occurs in areas that are relatively dry seasonally, The soils remain moist year round and are seasonally supersaturated. Typically it occurs on slopes or ridges. The soils tend to be very thin, overlaying mineral soil. It is possible that it is associated with past burning.

The vegetation typically is stunted but the shrub layer can be tall and dense. There are scattered somewhat stunted Thuja plicata and Tsuga heterophylla and sometimes Picea sitchensis. Ledum groenlandicum is always a dominant species. Kalmia occidentalis, Gaultheria shallon, Pteridium aquilinum, Blechnum spicant and Sphagnum spp. are usually codominant.

This community is most similar to the Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community. It differs physically from the latter community by occurring on slopes, being seasonally drier and having a thinner layer of peat. Vegetationally, this community has far less stunted trees, but the shrub and herbaceous vegetation is more stunted. This community may be a seral stage of the Thuja plicata-Tsuga heterophylla/Vaccinium ovatum-Gaultheria shallon wet forest community, the other does not appear to be.

Indicator Species:

- Blechnum spicant
- Calamagrostis nutkaensis
- Gaultheria shallon
- Kalmia occidentalis
- Ledum groenlandicum
- Pteridium aquilinum
- Sphagnum spp.

Other Species:

- Agrostis spp.
- Carex interior complex
- Carex livida
- Carex obnupta
- Cladina rangiferina
- Cornus canadensis
- Danthonia spicata
- Drosera rotundifolia
- Empetrum nigrum
- Gentiana douglasiana
- Gentiana sceptrum
- Hypericum anagalloides
- Linnaea borealis
- Lycopodium clavatum
- Maianthemum dilatata
- Panicum occidentalis
- Picea sitchensis
- Pyrus fusca
- Sanguisorba officinalis
- Spiraea douglasii
- Thuja plicata
- Tofieldia glutinosa
- Trientalis arctica
- Tsuga heterophylla
- Vaccinium ovatum
- Vaccinium oxycoccos

Kalmia occidentalis-Ledum groenlandicum-Myrica gale/Sphagnum spp. community: This community occurs throughout the study area. It occurs in areas that are wet year round and seasonally flooded. The community may be influenced seasonally by minerotrophic water. Soils are a mixture of sphagnum, fibrous and heath peat.

The vegetation is lush. Myrica gale is always a dominant species. In most cases, either or both Kalmia occidentalis and Ledum groenlandicum are also dominant. Sphagnum spp. are usually dominant too. Stunted Thuja plicata and/or Pinus contorta are common but not dominant.

This community is similar to the Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community. They differ in that Myrica gale is present in this community. Vaccinium oxycoccos is more consistently present and has higher percent cover values in the latter community.

Indicator Species:

Kalmia occidentalis
Ledum groenlandicum
Myrica gale
Sphagnum spp.

Other Species:

Agrostis sp.
Agrostis aequivalvis
Agrostis oregana
Agrostis scabra
Blechnum spicata
Boykinia sp.
Calamagrostis nutkaensis
Carex canescens
Carex interior complex
Carex lasiocarpa
Carex leptalea
Carex livida
Carex obnupta
Carex rostrata
Carex sitchensis
Cornus canadensis
Deschampsia caespitosa
Dodecatheon jeffreyi
Drosera rotundifolia
Dulichium arundinaceum
Gaultheria shallon
Gentiana douglasiana
Gentiana sceptrum
Hypericum anagalloides
Juncus ensifolius
Juncus supiniformis
Linnaea borealis
Lycopus uniflorus
Lysichitum americanum
Maianthemum dilatatum
Menyanthes trifoliata
Nephrophyllidium crista-galli
Nuphar polysepalum
Picea sitchensis
Pinus contorta
Pinus monticola
Plantago macrocarpa
Platanthera dilatata
Potentilla palustris
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Rubus pedatus
Sanguisorba officinalis
Senecio triangularis
Thuja plicata
Tsuga heterophylla
Trientalis arctica
Vaccinium ovatum
Vaccinium oxycoccos
Viola palustris

Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community: This community occurs throughout the study area. The community is wet year round and often seasonally flooded. Substrates are a mixture of heath, fibrous and sphagnum peat.

The community is species rich. Shrubs are moderately low-growing, reaching about 4-feet tall, and form an open canopy. Kalmia occidentalis, Ledum

groenlandicum and Sphagnum spp. are codominant. Vaccinium oxycoccos is present in all stands and has an average range of cover values between 5% and 15%.

This community is similar to the Carex livida-Sanguisorba officinalis/Sphagnum spp. community. The latter tends to be wetter and have higher frequency and cover of Sanguisorba officinalis, Rhynchospora alba, Carex livida, Carex interior complex and Carex obnupta. It also has higher frequency and cover of Thuja plicata. Platanthera dilatata and Gentiana douglasiana often occur in the latter community and do not occur in this community. The shrub layer in the latter community tends to be lower growing and have a more open canopy than does this community.

Indicator Species:

Kalmia occidentalis
Ledum groenlandicum
Sphagnum spp.
Vaccinium oxycoccos

Other Species:

Agrostis sp.
Agrostis scabra
Anemone oregana var. felix
Blechnum spicant
Boykinia spp.
Calamagrostis canadensis
Calamagrostis nutkaensis
Camassia sp.
Carex canescens
Carex cusickii
Carex interior complex
Carex livida
Carex obnupta
Carex pluriflora
Carex rostrata
Carex sitchensis
Cladina rangiferina
Cornus canadensis
Deschampsia caespitosa
Drosera rotundifolia
Empetrum nigrum
Eriophorum chamissonis
Gaultheria shallon
Gentiana sceptrum
Hypericum anagalloides
Juncus acuminatus
Juncus ensifolius
Linnaea borealis
Lycopus uniflorus
Lysichitum americanum
Maianthemum dilatatum
Nephrophyllidium crista-galli
Nuphar polysepalum
Picea sitchensis
Pinus contorta
Pinus monticola
Potentilla palustris
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Sanguisorba officinalis
Spiraea douglasii
Spiranthes romanzoffiana
Thuja plicata
Tofieldia glutinosa
Trientalis arctica
Tsuga heterophylla
Vaccinium uliginosum
Veratrum sp.
Veronica scutellata
Xerophyllum tenax

Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Carex obnupta/Sphagnum spp. community: Examples of this community are located in western Clallam County. It occurs in sphagnum bogs and "prairies" in which the soils remain wet to saturated year round and may be flooded seasonally. The soils

are a mixture of heath, fibrous and sphagnum peat, and often have some woody debris. Peat hummocks often are well developed within this community.

The shrubs are usually 2 to 4 feet tall and form an open canopy. Kalmia occidentalis, Ledum groenlandicum and Sphagnum spp. are codominant. Vaccinium oxycoccos and Carex obnupta are usually present and often codominant. Carex pluriflora and Empetrum nigrum have high fidelity to this community.

This community is most similar to the Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community, Rhynchospora alba/Sphagnum spp. community and Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/ Pteridium aquilinum/Sphagnum spp. community. It is distinguished from the Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/ Pteridium aquilinum/Sphagnum spp. community by being wetter and generally not having Pteridium aquilinum, Gaultheria shallon or Calamagrostis nutkaensis. It is distinguished from the Rhynchospora alba/Sphagnum spp. community by having no or low percent cover of Rhynchospora alba and Lysichitum americanum, in having Carex obnupta and generally having Linnaea borealis, Blechnum spicant and higher percent cover of Thuja plicata. It is distinguished from the Kalmia occidentalis-Ledum groenlandicum-Vaccinium oxycoccos/Sphagnum spp. community by the paucity of species in the latter and particularly the lack of Carex obnupta.

Indicator Species:

Carex obnupta
Kalmia occidentalis
Ledum groenlandicum
Sphagnum spp.
Vaccinium oxycoccos

Other Species:

Agrostis spp.
Agrostis aequivalvis
Blechnum spicant
Boykinia cf major
Calamagrostis nutkaensis
Carex interior complex
Carex livida
Carex pluriflora
Carex sitchensis
Cladina rangiferina
Cornus canadensis
Drosera rotundifolia
Empetrum nigrum
Eriophorum chamissonis
Gaultheria shallon
Gentiana douglasiana
Gentiana sceptrum
Hypericum anagalloides
Linnaea borealis
Lysichitum americanum
Nuphar polysepalum
Picea sitchensis
Pinus monticola
Platanthera dilatata
Pteridium aquilinum
Rhynchospora alba
Sanguisorba officinalis
Spiraea douglasii
Thuja plicata
Tofieldia glutinosa
Tsuga heterophylla
Trientalis arctica

Myrica gale/Carex rostrata-Nephrophyllidium crista-galli-Sanguisorba officinalis/Sphagnum spp. community: This community is known from northwestern Grays Harbor County. The community is seasonally flooded, and

the soils remain wet year round. The community is seasonally flooded with minerotrophic water. Soils are a mixture of fibrous, heath and sphagnum peat.

This community has two subgroups easily distinguished by the height of Myrica gale. The low growth form of the community occurs in openings within dense Myrica gale dominated vegetation. Myrica gale is dominant within this community, and is typically less than 4 feet tall. Sphagnum spp. are also dominant. Carex rostrata is always present and usually codominant. Nephrophyllidium crista-galli and Sanguisorba officinalis are always present and can be codominant but usually have lower cover values. Nephrophyllidium crista-galli has very high fidelity to this community.

In the tall growth form of this community, Myrica gale is typically 5-7 feet tall. Carex rostrata occurs in most sites and is often codominant. Sphagnum spp. occur in most sites but have low percent cover (<5%).

This community is most similar to the Myrica gale/Carex sitchensis-Sanguisorba officinalis/Sphagnum spp. community. It differs in its species composition, particularly in having Carex rostrata and not having Carex sitchensis.

Indicator Species (low growth form):

- Carex rostrata
- Myrica gale
- Nephrophyllidium crista-galli
- Sanguisorba officinalis
- Sphagnum spp.

Other Species (low growth form):

- Agrostis sp.
- Agrostis scabra
- Carex interior complex
- Carex livida
- Deschampsia caespitosa
- Eriophorum chamissonis
- Gaultheria shallon
- Gentiana sceptrum
- Hypericum anagalloides
- Juncus ensifolius
- Kalmia occidentalis
- Ledum groenlandicum
- Picea sitchensis
- Pinus contorta
- Pinus monticola
- Platanthera dilatata
- Pteridium aquilinum
- Pyrus fusca
- Rhynchospora alba
- Rubus pedatus
- Thuja plicata
- Tsuga heterophylla

Indicator Species (tall growth form):

- Carex rostrata
- Myrica gale

Other Species (tall growth form):

- Calamagrostis canadensis
- Deschampsia caespitosa
- Gentiana sceptrum
- Hypericum anagalloides
- Juncus ensifolius
- Kalmia occidentalis
- Ledum groenlandicum
- Pyrus fusca
- Rhamnus purshiana
- Rhynchospora alba
- Rubus pedatus
- Sanguisorba officinalis
- Spiraea douglasii
- Sphagnum spp.

Picea sitchensis
Pinus contorta
Viola palustris

Myrica gale/Carex sitchensis-Sanguisorba officinalis/Sphagnum spp. community: This community is known to occur in northwestern Grays Harbor and western Clallam Counties. It is wet year round and seasonally flooded with minerotrophic water. Soils are a mixture of fibrous, heath and sphagnum peat.

This community has two subgroups easily distinguishable by height of Myrica gale. One has low growing Myrica gale, typically less than 1 foot tall. The other is dominated by Myrica gale at least 4 feet tall. Myrica gale is a dominant species in both cases. Both subgroups have high frequency of Sanguisorba officinalis and Carex sitchensis. The subgroup with the low growth form is more species rich than the tall growth form subgroup. The low growth form subgroup has a greater tendency to have present Deschampsia caespitosa, Trientalis arctica, Dodecatheon jeffreyi, Carex livida, Gentiana douglasiana and Gentiana sceptrum than does the tall growth form subgroup.

This community is most similar to the Myrica gale/Carex rostrata-Nephrophyllidium crista-galli-Sanguisorba officinalis/Sphagnum spp. community. It is distinguishable by the lack of Nephrophyllidium crista-galli, and by the presence of Carex sitchensis.

Indicator Species:

Carex sitchensis
Myrica gale
Sanguisorba officinalis
Sphagnum spp.

Other Species:

Agrostis sp.
Agrostis aequivalvis
Agrostis oregonensis
Agrostis scabra
Anemone oregana var. filix
Blechnum spicant
Boykinia spp.
Carex interior complex
Carex livida
Carex obnupta
Carex rostrata
Calamagrostis canadensis
Deschampsia caespitosa
Dodecatheon jeffreyi
Drosera rotundifolia
Dulichium arundinaceum
Eriophorum chamissonis
Galium sp.
Gentiana douglasiana
Gentiana sceptrum
Glyceria elata
Juncus supiniformis
Kalmia occidentalis
Ledum groenlandicum
Lycopus uniflorus
Lysichitum americanum
Menyanthes trifoliata
Nuphar polysepalum
Picea sitchensis
Pinus contorta
Plantago macrocarpa
Platanthera dilatata
Potentilla palustris
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Senecio triangularis
Spiraea douglasii
Thuja plicata
Trientalis arctica
Trisetum canescens

Hypericum anagalloides
Juncus acuminatus
Juncus ensifolius
Juncus nevadensis
Tsuga heterophylla
Vaccinium oxycoccos
Viola palustris

Spiraea douglasii/Sphagnum spp. community: This community occurs infrequently in western Clallam County, but is common in other areas of western Washington. It occurs in areas that are at least seasonally flooded and supersaturated the rest of the year. Soils are a mixture of sphagnum, fibrous and sphagnum peat.

Spiraea douglasii and Sphagnum spp. are codominant. Typically the shrub layer is relatively low growing (2-4 feet tall) and forms an open canopy. Sedge species, particularly Carex obnupta, are common and can be codominant.

Indicator Species:
Carex obnupta
Gentiana sceptrum
Sphagnum spp.
Spiraea douglasii

Other Species:
Blechnum spicant
Carex canescens
Carex rostrata
Carex sitchensis
Dulichium arundinacea
Kalmia occidentalis
Ledum groenlandicum
Lycopus uniflorus
Maianthemum dilatata
Menyanthes trifoliata
Nuphar polysepalum
Pyrus fusca
Salix spp.
Trientalis arctica

Pinus contorta/Ledum groenlandicum/Sphagnum spp. community: This community occurs in northwestern Grays Harbor and western Jefferson Counties within the study area. It typically occurs in seasonally dry areas, and in some cases there are signs of past fire.

The community varies from open shrublands with low-growing Kalmia occidentalis and Ledum groenlandicum, and scattered stunted Pinus contorta, to stands of pole sized Pinus contorta with Ledum groenlandicum and Gaultheria shallon. Where there are signs of fire, there is little or no living Sphagnum spp. and there is high cover of Pteridium aquilinum. Substrates are a mixture of sphagnum and heath peat, with woody debris.

This community is most similar to the Pinus contorta-Thuja plicata/Myrica gale/Sphagnum spp. community. It differs in being drier, having greater abundance of Kalmia occidentalis, Ledum groenlandicum and Pteridium aquilinum, and less Blechnum spicant, Carex interior, Lysichitum americanum, Myrica gale, Vaccinium species, Picea sitchensis and Pyrus fusca.

Indicator species:

Gaultheria shallon
Kalmia occidentalis
Ledum groenlandicum
Pinus contorta
Pteridium aquilinum
Sphagnum spp.
Thuja plicata
Tsuga heterophylla

Other species:

Agrostis scabra
Anemone oregana var. felix
Blechnum spicant
Boykinia spp.
Carex interior complex
Carex rostrata
Cladina rangiferina
Cornus canadensis
Empetrum nigrum
Eriophorum chamissonis
Gentiana sceptrum
Hypericum anagalloides
Linnaea borealis
Lysichitum americanum
Maianthemum dilatatum
Myrica gale
Nephrophyllidium crista-galli
Picea sitchensis
Pinus monticola
Rhamnus purshiana
Rubus pedatus
Sanguisorba officinalis
Trientalis arctica
Vaccinium sp.
Vaccinium ovatum
Vaccinium oxycoccos
Xerophyllum tenax

Pinus contorta-Thuja plicata/Myrica gale/Sphagnum spp. community: This community occurs in Grays Harbor County and western Clallam County. The water table is from slightly below to slightly above the soil surface year round, and probably is seasonally flooded. Some areas have ground water discharge. Soils are organic, a mixture of fibrous, heath, woody and sphagnum peat. There is some woody debris which provides an elevated substrate for typically upland species.

The community has an open canopy and is species rich. Trees generally obtain pole size diameters. Thuja plicata, Pinus contorta, Myrica gale and Sphagnum spp. are codominant in most cases. Ledum groenlandicum, Gaultheria shallon, Lysichitum americanum and Tsuga heterophylla occur in all or most stands and are sometimes codominant.

This community may be ecotonal between Myrica gale communities and the Thuja plicata-Tsuga heterophylla/Gaultheria shallon/ Lysichitum americanum/Sphagnum spp. community. It differs from the Myrica gale communities in having an abundance of trees. It differs from the Thuja plicata-Tsuga heterophylla/ Gaultheria shallon/Lysichitum americanum/Sphagnum spp. community by being wetter and in having Myrica gale and Carex interior complex.

Indicator Species:

Blechnum spicant
Carex interior complex
Gaultheria shallon

Ledum occidentalis
Lysichitum americanum
Myrica gale
Pinus contorta
Sphagnum spp.
Thuja plicata
Tsuga heterophylla

Other Species:

Agrostis aequivalvis
Agrostis exarata
Athyrium filix-femina
Boykinia spp.
Calamagrostis nutkaensis
Carex leptalea
Carex livida
Carex obnupta
Carex rostrata
Carex sitchensis
Cornus canadensis
Deschampsia caespitosa
Dodecatheon jeffreyi
Drosera rotundifolia
Gentiana douglasiana
Gentiana sceptrum
Juncus ensifolius
Kalmia occidentalis
Linnaea borealis
Maianthemum dilatatum
Oenanthe sarmentosa
Picea sitchensis
Platanthera dilatata
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Rubus pedatus
Rubus ursinus
Sanguisorba officinalis
Senecio triangularis
Spiraea douglasii
Trientalis arctica
Vaccinium ovalifolium
Vaccinium ovatum
Vaccinium oxycoccos
Vaccinium parvifolium

Thuja plicata-Tsuga heterophylla/Gaultheria shallon/Lysichitum americanum/Sphagnum spp. community: This community occurs throughout the study area. The ground ranges from being covered with shallow standing water to being saturated. The ground is a combination of sphagnum, fibrous and heath peat, and woody material. Large woody debris and fallen trees are typical, and provide an above ground substrate that supports upland species.

This community has an open canopy and at least some living Sphagnum spp. Conifers reach large diameters, but often have broken tops. The mid- and understories are a mosaic of wetland and upland species, and of herb and shrub dominated assemblages. The community is codominated by Thuja plicata, Tsuga heterophylla and Gaultheria shallon. Rhamnus purshiana, Lysichitum americanum, Blechnum spicant, Pyrus fusca, Picea sitchensis, Menziesia ferruginea and Vaccinium spp. frequently occur within the community.

This community is most similar to the Pinus contorta-Thuja plicata-Tsuga heterophylla/Myrica gale/Sphagnum spp. community. It differs in not having Pinus contorta, Myrica gale or Carex interior complex and having significantly less Ledum groenlandicum, Kalmia occidentalis, Sphagnum spp. and Calamagrostis nutkaensis. It has significantly more Rhamnus purshiana, Pyrus fusca and Vaccinium spp. than the other community. Menziesia ferruginea occurs in this community and not in the other.

Indicator Species:

Blechnum spicant
Gaultheria shallon
Lysichitum americanum
Menziesia ferruginea
Rhamnus purshiana
Sphagnum spp.
Thuja plicata
Tsuga heterophylla
Vaccinium spp.

Other Species:

Abies amabilis
Agrostis sp.
Agrostis oregonensis
Anemone oregana var. felix
Boykinia elata
Calamagrostis canadensis
Camassia sp.
Carex interior complex
Carex livida
Carex obnupta
Cornus canadensis
Deschampsia caespitosa
Drosera rotundifolia
Gentiana sceptrum
Hypericum anagalloides
Juncus ensifolius
Juncus supiniformis
Kalmia occidentalis
Ledum groenlandicum
Linnaea borealis
Luzula sp.
Maianthemum dilatatum
Menziesia ferruginea
Oenanthe sarmentosa
Picea sitchensis
Polystichum munitum
Pseudotsuga menziesii
Pteridium aquilinum
Pyrus fusca
Rhamnus purshiana
Rhynchospora alba
Rubus pedatus
Rubus spectabilis
Rubus ursinus
Sanguisorba officinalis
Spiraea douglasii
Spiranthes romanzoffiana
Trientalis arctica
Trisetum canescens
Vaccinium ovatum
Vaccinium oxycoccos
Vaccinium parvifolium
Veratrum sp.
Viola palustris

Tsuga heterophylla/Ledum groenlandicum/Sphagnum spp. community: This community occurs in western Clallam County within the study area but is more common elsewhere in western Washington. Substrates are wet year round, but may never be flooded. The substrate is composed of sphagnum, other mosses, heath and woody peat.

The trees are highly stunted. The canopy is open. The shrub layer is moderately dense and usually between 2 and 4 feet tall. Ledum groenlandicum, Sphagnum spp. and highly stunted Tsuga heterophylla are consistently dominant in this community. Kalmia occidentalis, Pteridium aquilinum, Gaultheria shallon and Blechnum spicant usually occur and are often dominant species.

This community is most similar to the Kalmia occidentalis-Ledum groenlandicum-Gaultheria shallon/Pteridium aquilinum/Sphagnum spp. community. It differs in occurring in basins rather than slopes, having greater peat development, being wetter and having more highly stunted trees. It appears to be a seral stage

community which follows most Kalmia occidentalis-Ledum groenlandicum/Sphagnum spp. communities, probably in the absence of fire.

Indicator Species:

- Gaultheria shallon
- Ledum groenlandicum
- Sphagnum spp.
- Tsuga heterophylla
- Thuja plicata

Other Species:

- Blechnum spicant
- Carex interior complex
- Carex obnupta
- Carex rostrata
- Cladina rangiferina
- Cornus canadensis
- Drosera rotundifolia
- Gentiana sceptrum
- Kalmia occidentalis
- Linnaea borealis
- Lysichitum americanum
- Maianthemum dilatata
- Menziesia ferruginea
- Picea sitchensis
- Pteridium aquilinum
- Pyrus fusca
- Rhamnus purshiana
- Spiraea douglasii
- Trientalis arctica
- Vaccinium sp.
- Vaccinium ovatum
- Vaccinium oxycoccos
- Vaccinium parvifolium

LOW ELEVATION FRESHWATER WETLAND COMMUNITIES

Freshwater wetlands are those which have no marine derived salts, and very little sphagnum, either living or in the soil. The pH is greater than 5.5, either circumneutral or basic. They may be high or low nutrient systems.

Equisetum fluviatile community: This community occurs around the margin of Lake Ozette, Clallam County. It occurs in areas that are permanently flooded, in water that isn't more than 3 feet deep during the summer months. Substrates are mostly sandy. In areas there are some silt or cobble-gravel substrates as well.

The community is sparsely populated. Equisetum fluviatile is the indicator and most consistently occurring species. This is the primary habitat for Lobelia dortmanna and in places Lobelia dortmanna is codominant with Equisetum fluviatile.

This community intergrades with the Scirpus acutus and Sparganium eurycarpum communities. The three communities are easily distinguished by their dominant species.

Indicator Species:

- Equisetum fluviatile

Other Species:

- Isoetes bolanderi
- Lobelia dortmanna
- Ranunculus aquatilis
- Ranunculus flammula

Polygonum sp.
Potamogeton epihydrus
Sparganium eurycarpum

Nuphar polysepalum community: This community occurs throughout the study area. It occurs in shallow, permanently flooded areas in the rooted aquatic zone but extends into the emergent zone. Soils tend to be anoxic muck or peat. It is found in both sphagnum and non-sphagnum wetlands.

The community is monospecific or composed of several aquatic plant species. In all cases, Nuphar polysepalum is a dominant species.

Indicator species:
Nuphar polysepalum

Other species:
Brasenia schreberi
Carex sitchensis
Elodea sp.
Juncus supiniformis
Menyanthes trifoliata
Potamogeton natans
Potentilla palustris
Sparganium emersum

Scirpus acutus community: This community occurs around Lake Ozette, Clallam County. It occurs in the permanently flooded zone in water <3 feet deep during the summer. Soils are mostly firm sand with some organic material and pockets of soft silts. Wave action is reduced within the stand by the Scirpus acutus stems.

The community is clearly identified by the presence of Scirpus acutus, which forms large circular colonies. There appears to be an energy, substrate and species composition gradient which runs through the Scirpus acutus stand from the open water to the shore. Energy and particle size decrease shoreward as species richness increases.

The understory of this community is similar to the Equisetum fluviatile community but has Utricularia intermedia and more Ranunculus flammula. Shoreward, on soft silty soils, this community intergrades with the Carex sitchensis-Potentilla palustris community.

Indicator Species:
Ranunculus flammula
Scirpus acutus

Other Species:
Carex sitchensis
Carex vesicaria
Dulichium arundinaceum
Eleocharis palustris
Equisetum fluviatile
Isoetes bolanderi
Ludwigia palustris
Menyanthes trifoliata
Nuphar polysepalum
Potentilla palustris
Utricularia intermedia

Sparganium eurycarpum community: This community occurs mostly in bays around Lake Ozette, Clallam County. It was not surveyed well because the water was too deep and the substrate too soft. It occurs in water at least 1 foot deep. The substrates are usually soft silt and organic debris or muck. The soft substrates sometimes overlay sand.

The community is easily identified by prominent stands of Sparganium eurycarpum. Associated species were not well surveyed except in the rare cases where the community occurred in shallow water and on firm substrates.

In places, this community forms a mosaic with the Nuphar polysepalum community. On firm substrates, the community has associated species similar to the Equisetum fluviatile community.

Indicator Species:
Sparganium eurycarpum

Other Species:
Equisetum fluviatile
Lobelia dortmanna
Nuphar polysepalum
Ranunculus flammula

Carex obnupta community: This community occurs occasionally in western Clallam County and is common elsewhere in western Washington. It occurs in areas that are flooded year round or nearly year round. Soils are organic muck with some fibrous material.

The community often is solely composed of Carex obnupta. The vegetation is lush. Where it is flooded year round, Carex obnupta forms pedestalled bases.

This community is not very similar to other wetland communities, but intergrades with several, forming mosaics or ecotonal vegetation. Common associates are Carex vesicaria, Carex sitchensis and Spiraea douglasii communities.

Indicator Species:
Carex obnupta

Other Species:
Carex sitchensis
Carex vesicaria
Nuphar polysepalum

Carex obnupta-Juncus nevadensis-Ranunculus flammula community: This community occurs around the margins of Lake Ozette, Clallam County. It is located along the waterward edge of the seasonally flooded zone, usually on a low bench up to 2 feet above the lake bed. Soils remain wet year round. It is seasonally flooded and waves carry water over the community year round. It is abraded by waves and possibly winter ice. Substrates are sandy and have fibrous peat and roots.

The vegetation is low growing, somewhat mat forming, and is immediately recognizable within the landscape. It lies between the permanently flooded lake bed and shrub dominated communities of the seasonally flooded lake shore wetlands. The most prevalent species are Juncus nevadensis, Carex obnupta and Ranunculus flammula. Additional indicator species include Equisetum fluviatile, Mentha arvensis and Carex lenticularis. Species which are sometimes abundant but not indicators are Carex sitchensis, low growing Myrica gale, low growing Salix spp. and Potentilla palustris.

This community is very similar to the Carex sitchensis-Potentilla palustris community and perhaps they should be lumped together. The latter occurs in slightly more protected areas, or slightly inland of the former. The latter is clearly dominated by tall sedges.

Indicator Species:

Carex lenticularis
Carex obnupta
Equisetum fluviatile
Juncus nevadensis
Mentha arvensis
Ranunculus flammula

Other Species:

Aster sp.
Carex sitchensis
Carex vesicaria
Deschampsia caespitosa
Drosera rotundifolia
Eleocharis palustris
Gentiana sceptrum
Juncus balticus
Juncus covillei
Juncus supiniformis
Lobelia dortmanna
Lycopus uniflorus
Myosotis laxa
Potentilla pacifica
Potentilla palustris
Salix spp.
Spiranthes romanzoffiana
Utricularia intermedia
Veronica scutellata
Viola palustris

Carex sitchensis-Potentilla palustris community: This community occurs around Lake Ozette, Clallam County. It is located on the lakeward margin of the seasonally flooded zone in some embayments and in small backwater ponds within the seasonally flooded zone. It is seasonally to permanently flooded and receives water from waves year round. Soils are silty with sedge peat, and in the backwater areas are soft silt and muck. The community sometimes occurs as closely spaced hummocks in the ecotone between permanently and seasonally flooded areas. The sedge hummocks provide a peat substrate elevated above the permanently flooded zone.

The community is dominated by lush Carex sitchensis. Potentilla palustris is consistently present and occasionally is codominant. Equisetum fluviatile is usually present. Carex vesicaria and Dulichium arundinacea are often present.

This community is closely related to the Carex obnupta-Juncus nevadensis-Ranunculus flammula community. It occurs in slightly more protected areas, or

slightly inland of the latter. It is clearly dominated by tall sedges as opposed to the low mat like growth form of the latter.

Indicator Species:

Carex sitchensis
Carex vesicaria
Equisetum fluviatile
Potentilla palustris

Other Species:

Aster sp.
Boykinia cf major
Carex lasiocarpa
carex lenticularis
Carex obnupta
Carex oederi
Deschampsia caespitosa
Dulichium arundinaceum
Eleocharis palustris
Juncus nevadensis
Juncus supiniformis
Ludwigia palustris
Mentha arvensis
Menyanthes trifoliata
Myosotis laxa
Myrica gale
Nuphar polysepalum
Ranunculus flammula
Salix sp.
Utricularia intermedia
Veronica scutellata
Viola palustris

Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community: This community occurs around Lake Ozette, Clallam County. It occurs near the landward end of the seasonally flooded zone around the lake margin. It is seasonally flooded and is abraded by waves and possibly ice during the winter. Substrates are mostly sand with some heath and fibrous peat.

Most species within this community are stunted. The shrub layer is usually less than 1 foot tall but can be as much as 4 feet high and have an open canopy. The herb layer is unusually species rich and is composed of many species which have high fidelity to the community. It contains some species typical of sphagnum bogs.

This community is easily distinguished from the surrounding vegetation by its low growth form. However, it does intergrade with the Myrica gale-Spiraea douglasii/Carex obnupta community which is located waterward of it.

Indicator Species:

Aster sp.
Boykinia cf major
Carex obnupta
Deschampsia caespitosa
Myrica gale
Panicum occidentalis

Other Species:

Agrostis alba
Agrostis oregonensis
Agrostis scabra
Athyrium filix-femina
Lycopus uniflorus
Maianthemum dilatatum
Mentha arvensis
Physocarpus capitatus

Botrychium multifidum
Calamagrostis canadensis
Calamagrostis crassiglumis
Carex buxbaumii
Carex interior complex
Carex lenticularis
Carex livida
Carex oederi
Carex sitchensis
Dodecatheon jeffreyi
Drosera rotundifolia
Dulichium arundinaceum
Equisetum fluviatile
Galium sp.
Gentiana sceptrum
Hypericum anagalloides
Juncus balticus
Juncus covillei
Lonicera involucrata
Lycopodium inundatum
Plantago macrocarpa
Platanthera dilatata
Potentilla pacifica
Prunella vulgaris
Pteridium aquilinum
Pyrus fusca
Ranunculus flammula
Rhynchospora alba
Rosa nutkaensis
Salix spp.
Sanguisorba officinalis
Sisyrinchium sp.
Sphagnum spp.
Spiraea douglasii
Spiranthes romanzoffiana
Tofieldia glutinosa
Trientalis arctica
Vaccinium uliginosum
Viola palustris

Myrica gale/Lysichitum americanum community: This community occurs in northwestern Grays Harbor County. It was found associated with springs, seeps and very slow moving streams. It is seasonally to permanently flooded. Soils are a mixture of fibrous and heath peat.

This is a lush community codominated by Myrica gale and Lysichitum americanum. The Myrica gale is 6-8 feet tall. Spiraea douglasii is codominant in places. Stunted, scraggly Picea sitchensis are often scattered through the community. Pyrus fusca and Gaultheria shallon are common. There are no Sphagnum spp. in this community.

This community differs from other Myrica gale communities in its species composition, particularly its lack of Sphagnum spp. and generally combined abundance of Spiraea douglasii and Lysichitum americanum.

Indicator Species:
Gaultheria shallon
Lysichitum americanum
Myrica gale
Picea sitchensis
Pyrus fusca
Spiraea douglasii

Other Species:
Blechnum spicant
Carex obnupta
Carex sitchensis
Epilobium sp.
Ledum groenlandicum
Lonicera involucrata
Rhamnus purshiana
Rubus ursinus
Salix sp.
Thuja plicata
Tsuga heterophylla
Typha latifolia

Menziesia ferruginea
Oenanthe sarmentosa
Physocarpus capitatus
Vaccinium ovatum
Vaccinium parvifolium

Myrica gale-Spiraea douglasii/Carex obnupta community: This community occurs around Lake Ozette, Clallam County. It is seasonally flooded, but receives water from waves year round. It is abraded by waves and possibly seasonally by ice. The shrub layer is 4 to 6 feet tall and forms a nearly closed canopy. The substrate is mostly sand, but there is some heath and fibrous peat.

This community is the dense, tall Myrica gale zone that dominates the seasonally flooded wetlands around Lake Ozette. There is a gradient from the edge of the permanently flooded lake shore to higher and drier areas shoreward. The former areas are constantly scoured by waves and generally depauperate, often with Myrica gale the dominant species and any others having low abundance. The latter areas are less often affected by wave action, tend to have more soil development, and are more species rich. Spiraea douglasii, Carex sitchensis and Carex obnupta can be codominant in the latter.

Waterward this community can intergrade with the Carex obnupta-Juncus nevadensis-Ranunculus flammula and Carex sitchensis-Potentilla palustris communities. Landward it can intergrade with the Myrica gale/Aster sp.-Boykinia major-Deschampsia caespitosa community. The former two communities form a fairly sharp edge with this community and are easily distinguished by the lack of or low growth form of shrubby species. The later integration is the most difficult to sort out. This community is not as species rich as the other and there are a number of species which do not occur in it that do occur in the other.

Indicator Species:
Carex obnupta
Carex sitchensis
Myrica gale
Spiraea douglasii

Other Species:
Aster sp.
Boykinia cf major
Carex lenticularis
Carex vesicaria
Dodecatheon jeffreyi
Equisetum fluviatile
Juncus nevadensis
Mentha arvensis
Myosotis laxa
Panicum occidentalis
Potentilla pacifica
Potentilla palustris
Ranunculus flammula
Salix spp.
Scirpus acutus

Spiraea douglasii community: This community occurs throughout the study area. It can be either seasonally or permanently flooded. Soils are organic muck, fibrous peat and heath peat.

Spiraea douglasii typically forms dense nearly monospecific stands, 6-10 feet tall. In areas, the community is less dense and can have a variety of herbaceous species (usually sedges) in the understory.

This community is easily distinguished from other communities. It often forms mosaics with other communities, particularly communities dominated by Carex spp. It is easily distinguished from the Spiraea douglasii/Sphagnum spp. community by its tall growth form and lack of Sphagnum spp. It is distinguished from the Spiraea douglasii-Salix spp./Carex obnupta community by its dense canopy dominated by Spiraea douglasii, lack of Salix spp. and more depauperate flora.

Typical species:

Spiraea douglasii

Other species:

Carex obnupta
Carex rostrata
Oenanthe sarmentosa
Picea sitchensis
Pyrus fusca
Rhamnus purshiana
Salix spp.

Picea sitchensis-Alnus rubra/Lysichitum americanum community: This community commonly occurs throughout the study area. Soils are wet year round and in places are permanently flooded. Fallen trees and soil mounds provide drier microsites. Soils are organic, ranging from soft muck to firm fibrous, heath and woody peat.

Microtopographic differences are correlated with differences in hydrology and plant species composition: Depressions are usually permanently flooded and dominated by Carex obnupta and Oenanthe sarmentosa. Seasonally flooded areas usually have high percent cover of Pyrus fusca, Rubus spectabilis, Lonicera involucrata, Salix spp., Lysichitum americanum and Carex obnupta. Dry microsites are dominated by Gaultheria shallon.

Several species have high affinities with this community: Alnus rubra, Rubus spectabilis, Athyrium filix-femina and Oenanthe sarmentosa.

Indicator Species:

Alnus rubra
Athyrium filix-femina
Carex obnupta
Gaultheria shallon
Lysichitum americanum
Oenanthe sarmentosa
Picea sitchensis
Rubus spectabilis
Tsuga heterophylla

Other Species:

Agrostis exarata
Angelica genuflexa
Blechnum spicant
Botrychium multifidum
Calamagrostis nutkaensis
Carex rostrata
Carex sitchensis
Carex vesicaria
Cornus canadensis
Cornus stolonifera
Epilobium sp.
Galium sp.
Glyceria elata
Hypericum anagalloides
Juncus balticus
Ledum groenlandicum
Lonicera involucrata
Maianthemum dilatata
Menziesia ferruginea
Myrica gale
Nuphar polysepalum
Physocarpus capitatus
Polygonum sp.
Puccinellia sp.
Pyrus fusca
Rhamnus purshiana
Rubus ursinus
Salix spp.
Scirpus microcarpus
Sparganium emersum
Sphagnum spp.
Spiraea douglasii
Typha latifolia
Vaccinium sp.
Vaccinium ovatum
Vaccinium parvifolium
Veronica americanum
Viburnum edule
Viola palustris

NON-RECURRING COMMUNITIES

LOW ELEVATION SPHAGNUM BOG COMMUNITIES

Carex obnupta/Sphagnum spp. community: This community is known from one location in western Clallam County. It occurs in a trough that is supersaturated year round and seasonally flooded. The soils are a mixture of sphagnum and fibrous peat.

This community occurs in the same habitat as the Carex livida-Sanguisorba officinalis/Sphagnum spp. community. The occurrence appears to have burned in the past, and was used as pasture for livestock.

Indicator Species:

- Carex obnupta
- Sphagnum spp.

Other Species:

- Agrostis spp.
- Blechnum spicant
- Boykinia major
- Calamagrostis nutkaensis
- Eriophorum chamissonis
- Galium sp.
- Gentiana sceptrum
- Hypericum anagalloides
- Lysichitum americanum
- Sanguisorba officinalis
- Viola palustris

Eriophorum chamissonis/Sphagnum spp. community: This community occurs once in the study area and infrequently throughout western Washington. The community occurs on floating sphagnum peat mats that sink when stepped on. The water level is at the soil surface year round.

The vegetation is characterized by high percent cover of Eriophorum chamissonis. Ledum groenlandicum is common, but is less than a foot tall and is scraggly. In many cases, the water level of the wetland is higher than it was in the past.

This community is related to the Rhynchospora alba/Sphagnum spp. community but occurs in wetter areas.

Indicator Species:

- Eriophorum chamissonis
- Sphagnum spp.

Other Species:

- Carex pluriflora
- Ledum groenlandicum
- Lysichitum americanum
- Vaccinium oxycoccos

Myrica gale/Calamagrostis canadensis/Sphagnum spp. community: There are two known occurrences of this community, both in western Clallam County. In both cases, the soils are seasonally flooded. In one the soils remain supersaturated the rest of the year and in the other they are saturated to wet. The soils are a mixture of heath, fibrous and sphagnum peat.

The vegetation is characterized by the codominance of Myrica gale and Calamagrostis canadensis.

Indicator Species:
- Calamagrostis canadensis
- Myrica gale

Other Species:
- Agrostis oregonensis
- Boykinia cf major
- Carex obnupta
- Carex rostrata
- Carex sitchensis
- Gentiana sceptrum
- Lycopus uniflorus
- Lysichitum americanum
- Platanthera dilatata
- Potentilla palustris
- Pyrus fusca
- Sphagnum spp.
- Spiraea douglasii

LOW ELEVATION FRESHWATER WETLAND COMMUNITIES

Brasenia schreberi community: This community is known from one site in western Clallam County and one in northwestern Grays Harbor County, but is more common elsewhere in western Washington. It is not well studied. It occurs in shallow, permanently flooded portions of lakes, often waterward of peat wetlands.

Within the study area, it is found in proximity to Sphagnum spp. mats and adjacent to Nuphar polysepalum community. The lake water is tea colored and may be acidic.

Indicator Species:
- Brasenia schreberi

Other Species:
- Dulichium arundinaceum
- Nuphar polysepalum
- Scirpus subterminalis

Scirpus subterminalis community: This community is known from one site in Grays Harbor County within the study area, but is more common elsewhere in western Washington. It occurs in shallow ponds which can be permanently flooded or occasionally flooded most of the year and supersaturated seasonally. The soils are a mixture of peat and muck.

The community is often solely composed of Scirpus subterminalis. Nuphar polysepalum is sometimes present.

This community occurs adjacent to Nuphar polysepalum and sometimes Brasenia schreberi communities.

Indicator Species:
Scirpus subterminalis

Other Species:
Nuphar polysepalum

Carex rostrata community: This community occurs mostly in northwestern Grays Harbor County but also occurs in western Clallam County. It is either seasonally or permanently flooded and affected by minerotrophic water seasonally. Substrates are typically fibrous peat, but may contain some sphagnum.

This community is dominated by Carex rostrata. It is usually either in a mosaic with Myrica gale communities, in which case some Sphagnum spp. are usually present, or it is in a mosaic with Carex sitchensis dominated vegetation. It is not a clearly defined community but may be ecotonal between low and high nutrient conditions.

Typical species:
Carex rostrata

Other species:
Angelica genuflexa
Calamagrostis canadensis
Carex cusickii
Carex sitchensis
Cicuta douglasii
Epilobium sp.
Galium spp.
Glyceria elata
Mimulus guttatus
Myosotis laxa
Oenanthe sarmentosa
Potentilla palustris
Puccinellia pauciflora

Carex rostrata-Carex sitchensis community: This community occurs throughout the study area. It occurs in areas that are permanently flooded, associated with ponded water or slow moving streams. Soils are mostly fibrous peat and muck, and can be very soft.

The vegetation is lush but composed of few species. Carex sitchensis and Carex rostrata are codominant. Potentilla palustris is abundant in some stands.

This is a poorly defined community and may be split into more than one community upon further study.

Indicator Species:
Carex rostrata
Carex sitchensis

Other Species:

Agrostis scabra
Alnus rubra
Angelica genuflexa
Athyrium filix-femina
Calamagrostis canadensis
Carex obnupta
Carex canescens
Carex cusickii
Carex obnupta
Epilobium watsonii
Galium spp.
Gentiana sceptrum
Glyceria elata
Hypericum anagalloides
Juncus balticus
Ledum groenlandicum
Lycopus uniflorus
Lysichitum americanum
Myosotis laxa
Myrica gale
Nuphar polysepalum
Nephrophyllidium crista-galli
Oenanthe sarmentosa
Picea sitchensis
Potentilla palustris
Pyrus fusca
Rhamnus purshiana
Sanguisorba officinalis
Scirpus microcarpus
Sphagnum spp.
Spiraea douglasii
Stellaria longipes
Veronica americana
Veronica scutellata
Viola palustris

Carex sitchensis community: This community occurs throughout the study area. It occurs in areas that are permanently flooded, along the margins of ponds or slowly flowing water. Soils are composed of fibrous peat and muck. The pedestalled bases of the sedge and logs provide elevated substrates for typically upland species.

The vegetation is lush. Carex sitchensis is dominant. Oenanthe sarmentosa is codominant along some stream channels. Potentilla palustris is codominant along some pond margins.

Indicator Species:

Carex sitchensis

Other Species:

Agrostis exarata
Alnus rubra
Angelica genuflexa
Athyrium filix-femina
Epilobium sp.
Equisetum fluviatile
Galium spp.
Glyceria elata
Lonicera involucrata
Lysichitum americanum
Oenanthe sarmentosa
Physocarpus capitatus
Picea sitchensis
Potentilla palustris
Spiraea douglasii
Stellaria calycantha
Veronica americana
Veronica scutellata

Spiraea douglasii-Salix spp./Carex obnupta community: This community occurs in northwestern Grays Harbor and western Clallam Counties. It occurs in areas that are seasonally to shallowly and permanently flooded. The soils are very soft muck and organic material, with large organic debris.

These areas may be in transition to forested wetlands, or may be areas of forested wetlands that have raised water levels and are being invaded by more hydrophytic vegetation.

The canopy is more open than in the Spiraea douglasii community, resulting in a species rich understory.

Indicator Species:

Carex obnupta
Salix spp.
Spiraea douglasii

Other Species:

Agrostis scabra
Alnus rubra
Athyrium filix-femina
Blechnum spicant
Carex canescens
Carex cusickii
Carex sitchensis
Carex vesicaria
Cornus stolonifera
Drosera rotundifolia
Equisetum fluviatile
Galium sp.
Gaultheria shallon
Ledum groenlandicum
Lonicera involucrata
Lycopus uniflorus
Lysichitum americanum
Menyanthes trifoliata
Nuphar polysepalum
Oenanthe sarmentosa
Physocarpus capitatus
Picea sitchensis
Polypodium glycyrrhiza
Potentilla palustris
Pyrus fusca
Rhamnus purshiana
Scirpus cyperinus
Scirpus microcarpus
Sparganium sp.
Sphagnum spp.
Thuja plicata
Typha latifolia
Vaccinium sp.
Veronica scutellata
Viola palustris

Pyrus fusca communities: This community occurs throughout the study area. It typically forms the uppermost edge of wetlands. It is seasonally flooded. Some examples have supersaturated soils the rest of the year, while others are seasonally wet. Soils range from black anoxic muck, to peat, to sand with organic matter.

The species composition of this community varies with the composition of the adjacent wetland community but is always dominated by Pyrus fusca. Pyrus fusca forms a closed to nearly closed canopy. Understory vegetation is absent to sparser than the adjacent associated community. Carex obnupta commonly occurs in the understory.

Indicator Species:

Pyrus fusca

Other Species:

Agrostis oregonensis
Alnus rubra
Athyrium filix-femina
Lysichitum americanum
Maianthemum dilatatum
Mentha arvense

Blechnum spicant
Boykinia cf major
Carex obnupta
Carex sitchensis
Cornus canadensis
Galium sp.
Gaultheria shallon
Gentiana sceptrum
Ledum groenlandicum
Lonicera involucrata
Menziesia ferruginea
Rhamnus purshiana
Physocarpus capitatus
Picea sitchensis
Rosa nutkaensis
Salix sp.
Spiraea douglasii
Vaccinium sp.
Vaccinium parvifolium

Pyrus fusca/Calamagrostis canadensis community: This community is known to occur at one site in western Clallam County. It occurs on a low rise and is wet year round. It may be flooded seasonally. Soils are fibrous and woody peat over sand.

Pyrus fusca forms an open canopy over a dense understory of Calamagrostis canadensis.

Indicator Species:
Calamagrostis canadensis
Pyrus fusca

Other Species:
Agrostis oregonensis
Blechnum spicant
Boykinia cf major
Carex obnupta
Carex rostrata
Carex sitchensis
Gentiana sceptrum
Lycopus uniflorus
Myrica gale
Trisetum canescens

Thuja plicata-Tsuga heterophylla/Lysichitum americanum community: This community occurs throughout the study area. The water table is slightly above to slightly below the soil surface. It occurs in areas with perched water tables, groundwater discharge areas, headwater areas and adjacent to nearly still streams. The soils are soft organic muck and peat. Large woody debris and fallen logs provide a substrate elevated above the soil surface.

The community is characterized by relatively large Tsuga heterophylla and candelabra Thuja plicata. Sphagnum spp. may be present but don't exceed 15% cover. Microtopographic differences are correlated with differences in hydrology and plant species composition: Depressions are usually permanently flooded and have high percent cover of Lysichitum americanum. Raised ground, or fallen logs have high percent cover of Gaultheria shallon.

This community intergrades with the Thuja plicata-Tsuga heterophylla/ Gaultheria shallon/Lysichitum americanum/Sphagnum spp. community. This community appears to be influenced by higher nutrient water, and the trees tend to be larger than the latter. The two communities seem to intergrade and may prove to be different forms of the same community.

Indicator Species:

Gaultheria shallon
Lysichitum americanum
Thuja plicata
Tsuga heterophylla

Other Species:

Agrostis aequivalvis
Athyrium filix-femina
Blechnum spicant
Calamagrostis nutkaensis
Carex interior complex
Carex obnupta
Cornus canadensis
Ledum groenlandicum
Maianthemum dilatatum
Menziesia ferruginea
Myrica gale
Oenanthe sarmentosa
Picea sitchensis
Pyrus fusca
Rhamnus purshiana
Rubus spectabilis
Rubus ursinus
Sphagnum spp.
Spiraea douglasii
Vaccinium ovatum
Vaccinium parvifolium

APPENDIX C

PLANT SPECIES SCIENTIFIC AND COMMON NAMES

Scientific Name	Common Name
Abies amabilis	Pacific silver fir
Agrostis sp.	bentgrass
Agrostis aequivalvis	Alaska bentgrass
Agrostis alba	redtop
Agrostis exarata	spike bentgrass
Agrostis oregonensis	Oregon bentgrass
Agrostis scabra	winter bentgrass
Alnus rubra	red alder
Angelica genuflexa	kneeling angelica
Anemone oregana var. felix	Oregon anemone
Aster sp.	aster
Athyrium filix-femina	lady-fern
Blechnum spicant	deer-fern
Botrychium multifidum	leathery grape-fern
Boykinia elata	slender boykinia
Boykinia major	mountain boykinia
Calamagrostis canadensis	bluejoint reedgrass
Calamagrostis crassiglumis	thickglume reedgrass
Calamagrostis nutkaensis	Pacific reedgrass
Callitriche spp.	water-starwort
Camassia sp.	camas
Carex buxbaumii	Buxbaum's sedge
Carex canescens	gray sedge
Carex cusickii	Cusick's sedge
Carex interior complex =	
Carex interior	inland sedge
Carex muricata	muricate sedge
Carex phyllomanica	coastal stellate sedge
Carex lasiocarpa	slender sedge
Carex lenticularis	lenticulate sedge
Carex leptalea	bristle-stalked sedge
Carex livida	pale sedge
Carex obnupta	slough sedge
Carex oederi	green sedge
Carex pluriflora	several-flowered sedge
Carex rostrata	beaked sedge
Carex sitchensis	Sitka sedge
Carex vesicaria	inflated sedge

Cicuta douglasii	Douglas' water-hemlock
Cladina rangiferina	reindeer lichen
Cornus canadensis	bunchberry
Cornus stolonifera	red-osier dogwood
Danthonia spicata	poverty danthonia
Deschampsia caespitosa	tufted hairgrass
Dodecatheon jeffreyi	Jeffrey's shooting star
Drosera rotundifolia	sundew
Dulichium arundinaceum	dulichium
Eleocharis palustris	creeping spike-rush
Elodea sp.	waterweed
Elodea canadensis	Canadian waterweed
Empetrum nigrum	crowberry
Epilobium cf watsonii	willow-herb
Equisetum arvense	field horsetail
Equisetum fluviatile	water horsetail
Eriophorum chamissonis	Chamisso's cotton-grass
Galium spp.	bedstraw
Galium cymosum	Pacific bedstraw
Gaultheria shallon	salal
Gentiana douglasiana	swamp gentian
Gentiana sceptrum	king's gentian
Glyceria elata	tall mannagrass
Holcus lanatus	common velvet-grass
Hypericum anagalloides	bog St. John's-wort
Isoetes bolanderi	Bolander's quillwort
Juncus acuminatus	tapered rush
Juncus balticus	Baltic rush
Juncus covillei	Coville's rush
Juncus effusus	soft rush
Juncus ensifolius	dagger-leaf rush
Juncus nevadensis	sierra rush
Juncus supiniformis	spreading rush
Kalmia occidentalis	western bog laurel
Ledum groenlandicum	Labrador-tea
Linnaea borealis	western twinflower
Lobelia dortmanna	water lobelia
Lonicera involucrata	black twin-berry
Ludwigia palustris	false loosestrife
Luzula sp.	woodrush
Lycopodium clavatum	elk-moss
Lycopodium inundatum	bog clubmoss
Lycopus uniflorus	northern bugleweed

Lysichitum americanum	skunk cabbage
Maianthemum dilatatum	beadruby
Mentha arvensis	corn mint
Menyanthes trifoliata	buckbean
Menziesia ferruginea	fool's huckleberry
Mimulus guttatus	yellow monkey-flower
Myosotis laxa	small-flowered forget-me-not
Myrica gale	sweet gale
Nephrophyllidium crista-galli	deer-cabbage
Nuphar polysepalum	Indian pond lily
Oenanthe sarmentosa	Pacific water-parsley
Panicum occidentale	western witchgrass
Phalaris arundinacea	reed canarygrass
Physocarpus capitatus	Pacific ninebark
Picea sitchensis	Sitka spruce
Pinus contorta	lodgepole pine
Pinus monticola	western white pine
Plantago macrocarpa	Alaska plantain
Platanthera dilatata	white bog-orchid
Polygonum sp.	knotweed
Polypodium glycyrrhiza	licorice-fern
Polystichum munitum	sword-fern
Potamogeton epihydrus	ribbon-leaf pondweed
Potamogeton natans	floating-leaved pondweed
Potentilla pacifica	Pacific silverweed
Potentilla palustris	purple cinquefoil
Prunella vulgaris	self-heal
Pseudotsuga menziesii	Douglas fir
Pteridium aquilinum	bracken
Puccinellia sp.	alkaligrass
Puccinellia pauciflora	weak alkaligrass
Pyrus fusca	western crabapple
Ranunculus aquatilis	white water-buttercup
Ranunculus flammula	lesser spearwort
Rhamnus purshiana	cascara
Rhynchospora alba	white beakrush
Rosa nutkana	Nootka rose
Rubus pedatus	five-leaved bramble
Rubus spectabilis	salmonberry
Rubus ursinus	Pacific blackberry
Salix spp	willow
Sanguisorba officinalis	garden burnet

Scirpus acutus	hardstem bulrush
Scirpus cyperinus	wool-grass
Scirpus fluviatilis	river bulrush
Scirpus microcarpus	small-fruit bulrush
Scirpus subterminalis	water clubrush
Senecio triangularis	arrowleaf groundsel
Sisyrinchium sp.	blue-eyed grass
Solidago canadensis	Canadian goldenrod
Sparganium sp.	bur-reed
Sparganium emersum	simplestem bur-reed
Sparganium eurycarpum	broadfruited bur-reed
Sparganium cf minimum	small bur-reed
Sphagnum spp.	sphagnum
Spiraea douglasii	spirea
Spiranthes romanzoffiana	ladies-tresses
Stellaria calycantha	northern starwort
Stellaria longipes	longstalk starwort
Thuja plicata	western red cedar
Tofieldia glutinosa	sticky tofieldia
Trientalis arctica	northern starflower
Trisetum canescens	tall trisetum
Tsuga heterophylla	western hemlock
Typha latifolia	cat-tail
Utricularia intermedia	mountain bladderwort
Utricularia vulgaris	common bladderwort
Vaccinium alaskaense	Alaskan blueberry
Vaccinium deliciosum	blue-leafed huckleberry
Vaccinium ovalifolium	early blueberry
Vaccinium ovatum	evergreen huckleberry
Vaccinium oxycoccos	wild cranberry
Vaccinium parvifolium	red bilberry
Vaccinium uliginosum	bog blueberry
Veratrum sp.	false hellebore
Veronica americana	American brooklime
Veronica scutellata	marsh speedwell
Viburnum edule	moosewood viburnum
Viola palustris	marsh violet
Xerophyllum tenax	indian basket-grass