DRAFT

NATIONAL WETLANDS INVENTORY

NOTES TO USERS

LOWER COLUMBIA RIVER

HOQUIAM SW

MAP PREPARATION

The U.S. Fish and Wildlife Service, Office of Habitat Resources, is conducting an inventory of the wetlands of the United States. The National Wetlands Inventory (NWI) is establishing a wetland data base in both map and computer forms for the entire country. The NWI information will serve to identify the current status of U.S. wetlands and can be used as a reference point from which future changes in wetlands can be evaluated.

The purpose of Notes to Users is to provide general information regarding the production of NWI maps and wetlands found within a relatively similar geographic area. Notes to Users are not intended to include complete descriptions of all wetlands found in the area nor provide complete plant species information.

Specific wetland map delineations and classification are the product of photo-interpretation of nigh altitude aerial photography, supported by preliminary field reconnaissance and aided by the use of collateral information (County Soil Surveys, USGS quadrangles, etc.). The system for wetlands classification is in accordance with "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin, et. al., 1979).

The photography used for photointerpretation was National High Altitude color infrared at a scale of 1:58,000. Photography was taken on eight different dates. For the study area, 3% of the coverage was flown on July 29, 1980; 21.2% was flown on July 26, 1981; 72.8% was flown on five days in August 1981; and 3% was flown on August 6, 1982.

GEOGRAPHY

The study area is located along the Washington state - Oregon border from just east of Bridal Veil, Oregon and Washougal, Washington to the Pacific Ocean. The study area consisted of all 7.5 minute U.S.G.S. quadrangles which contained any portion of the Columbia River. (One small section where the Cowlitz River enters the Columbia had been previously mapped and was not remapped at this time.) The northwest corner of the Mount Hood National Forest is located in the soutneast corner of the study area.

Bailey's Ecoregion Classification (1980) identifies two distinct zones within the mapping area. The first of these ecoregions is the Humid Temperate Domain, Marine Division, Willamette-Puget Forest Province. This area is the north-south depression between the Coast Range and Cascade Mountains. Elevations range from sea level to about 1800 feet within the mapping area. The Willamette Valley portion is a nearly level to gently sloping flood plain which is mostly Portland, Oregon metropolitan area and agricultural lands with dissected high terraces and hills on the west side of the Willamette River. The portion of the Puget Sound Valley located with the study area is made up of Vancouver,

Washington urban area and gently rolling agricultural lands along the northeast side of tne Columbia River.

The characteristic vegetation of this ecoregion is a dense coniferous forest of Douglas-fir (Pseudotsuga menzeisii), western redcedar (Thuja plicata) and western hemlock (Tsuga heterophylla). Where these forests have been logged, deciduous trees such as red alder (Alnus rubra), big leaf maple (Acer macrophyllum), Oregon ash (Fraxinus latifolia)and black cottonwood (Populus balsamifera) become established. Poorly drained sites with swamp or bog communities are common. Many areas of the Columbia River floodplain have been cleared (and many also drained) for use as agricutural land.

The second ecoregion is the Humid Temperate Domain, Marine Division, Pacific Forest Province. This ecoregion has five forest setions; three of which, the Sitka Spruce-Cedar-Hemlock Forest Section, tne Cedar-Hemlock-Douglas-fir Forest Section and the Silver fir-Douglas-fir Forest Section, are found within the mapping area. This area covers the western side and foothills of the Cascade Mountains in the southeast portion of the mapping area and tne Coast Range mountains west of the Willamette River. Elevations in these two portions of the mapping area range from sea level to approximately 3000 feet in the Coast Range portion and from approximately 1000 to 4000 feet in the Cascade Mountain portion. These areas are made up of rugged, steep mountains fronted by a narrow coastal plain along the Pacific Ocean.

The common forest tree species are Douglas-fir, western redcedar, western hemlock, black cottonwood, grand fir (Abies grandis), Sitka spruce (Picea sitchensis), red alder and silver fir (Abies amabilis). Many species of shrubs grow exceptionally well in and around tne forests, making them practically impenetrable in many places.

CLIMATE

The Willamette-Puget Sound Valley areas are characterized by a mild climate. Temperatures average 48°F to 55°F. Rainfall is also moderate, averaging from 15 to 60 inches The majority of the rainfall comes in winter with summers being drier and sometimes having moisture deficits.

The Cascade Mountain and Coast Ranges also have a mild climate. Temperatures in these portions of the study area average 35°F to 50°F. Rainfall is heavy with averages ranging from 30 to 150 inches. Maximum precipitation occurs during the winter in these portions of the study area also.

SOILS

Soil is a major factor in any plant community. Its properties become a major determining fctor in hydric conditions and soils

are therefore one of the criteria used to determine and define wetlands.

Hydric soils of the study area are Mollisols, Inceptisols, Alfisols, Histosols, Entisols and Spodosols. Soils of flood plains, terraces, bottomlands, dunes and fans are represented by five associations. Ocosta soils are very deep, poorly drained, nearly level and are found on flood plains and deltas protected from tidal overflow. The Grehalem-Rennie association is composed of very deep, well drained and poorly drained, nearly level soils on flood plains. The Yaquina-Netarts-Dune land association is made up of very deep, somewhat poorly drained and well drained, nearly level to moderately steep soils in dune areas. The Wauna-Lacoda association is deep, nearly level poorly drained and very poorly drained silt loams which formed in recent alluvial deposits. The Sauvie-Rafton association is deep, nearly level, poorly and very poorly drained silt loams and silty clay loams which also formed in recent alluvial deposits. The Sauvie-Rafton-Pilchuck association is excessively to very poorly drained silt loams, silty clay loams and sands. The Sauvie-Puyallup association is deep, nearly level to gently sloping, somewhat poorly drained to somewhat excessively drained, moderately fine to moderately coarse textured soils of flood plains. The Hillsboro-Gee-Odne association is made up of deep, dominantly nearly level to sloping, well drained to poorly drained, medium textured soils of terraces. Another terrace association, the Hillsboro-Dollar-Cove, is made up of deep, dominantly nearly level to sloping, well drained to very poorly drained, medium textured soils.

Soils of broad, rolling terraces and low hills, some with claypans or hardpans are represented by three associations. The Quatama-Quafeno-Wollent association is moderately well and poorly drained loams and silt loams. The Powell association is made up of somewhat poorly drained silt loams and the Cornelius-Cascade association is made up of deep, gently sloping to moderately steep, moderately well to somewhat poorly drained silt loams which formed in silty materials.

The last of the soil associations with some hydric characteristics occurs on glacial uplands.* This is the Halbert-Willaby association which is made up of shallow and very deep, poorly and moderately well drained, nearly level to moderately steep soils.

Wetlands can and do occur on other soil associations within the study area, as these are broad associations and not a list of all hydric soils of the area. Other associations not listed here have hydric soils as small inclusions within otherwise well drained groups of soils.

*As defined by U.S.D.A. Soil Conservation Service.

USER CAUTION

The map document was prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and geography in accordance with "Classification of Wetlands and Deep Water Habitats of the United States", Cowardin, et al, 1979. The aerial photographs typically reflected conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of aerial photographs. Thus, a detailed on-the-ground and historical analysis of a single site may result in revision of the wetland boundaries established through photographic interpretation. In addition, some small wetlands and those obscured by dense forest cover may not be included on the map document.

Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either design or products of this inventory, to define limits of proprietary jurisdiction of any Federal, State, or local government or to establish the geographical scope of regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State, or local agencies concerning specific agency regulatory programs and proprietary jurisdictions that may affect such activities.

Additional information regarding this map or other National Wetland Inventory activities may be obtained by contacting:

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Aerial photo interpretation was completed by Martel Laboratories, Inc., St. Petersburg, Florida. Maps were prepared by NWI National Team in St. Petersburg, Florida

WETLAND COMMUNITIES AND DEEP WATER HABITATS

All five wetland systems and deep water habitats; Marine, Estuarine, Lacustrine, Riverine and Palustrine, occur within the study area.

MARINE SYSTEM

The Marine system is respresnted by the Pacific Ocean and its associated beaches. There are two zones along the beaches. These are classified as Marine, intertidal, unconsolidated shore, regularly and irregularly flooded (M2USN and M2USP, respectively). There are also limited areas of rocky shore. These habitats are delineated as linears and classified as Marine, intertidal, rocky shore, irregularly flooded (M2RSP).

ESTUARINE SYSTEM

Estuarine influence occurs within Willapa Bay and upstream in the Columbia River from the Pacific Ocean to the downstream end of Puget Island. The permanently flooded portions of this section of the Columbia River are classified as Estuarine, subtidal, unconsolidated bottom, subtidal (E1UBL). Flats or shoals which are exposed are classified as Estuarine, intertidal, unconsolidated shore regularly flooded or irregularly flooded (E2USN or E2USP). Beach zones along the shore are also classified this way. Areas where aquatic beds were visible on the photography were classified with a mixed class label; Estuarine, intertidal, aquatic bed/unconsolidated shore, irregularly exposed (E2AB/USM). Eelgrass (Zostera marina) is the dominant plant in these beds. Japanese eelgrass (Zostera japonica) has reportedly become established as well.

Inasmuch as stage of tide and water clarity greatly affect signatures of tidal flats and grass beds, thse delineations on the maps are conservative and collateral data was used to corroborate these somewhat unreliable or indistinct photo signatures during photointerpretation.

Emergent wetlands of both regularly and irregularly flooded zones occur. The most common is in the regularly flooded zone. These are classified as Estuarine, intertidal, emergent, regularly flooded (E2EMN). Characteristic species of this community include Lyngby's sedge (Carex lyngbyei), salt grass (Distichlis spicata), pickle weed (Salicornia virginica), creeping bent grass (Agrostis alba), bulrushes (Scirpus spp.), western lilaeopsis (Lilaeopsis occidentalis), seaside arrowgrass (Triglochin maritimum) and Baltic rush (Juncus balticus).

Less common are examples of irregularly flooded salt marsh. These are classified as Estuarine, intertidal, emergent, irregularly flooded (E2EMP). Characteristic species of this community are

tufted hair grass (Deschampsia caespitosa), Pacific silverweed (Potentilla pacifica), Dock (Rumex sp.), Douglas aster (Aster subspicatus) and fleabane (Erigeron sp.)

Classification of these emergent communities of the estuary is often difficult due to the plant species present. Many of these species occur growing in mixes which seem to defy the tidal flux. To further complicate matters, many otherwise freshwater plant species grow in these "salt marshes", apparently able to survive due to the large amount of freshwater flowing down the Columbia River.

RIVERINE SYSTEM

In the Riverine system; tidal, lower perennial, upper perennial and intermittent subsystems are represented. The Columbia River from the downstream end of Puget Island to the upstream or eastern study area boundary is Riverine, tidal, unconsolidated bottom, permanent-tidal (R1UBV). Within and along the river are areas exposed during periods of low flow. These are classified as Riverine, tidal, unconsolidated shore, seasonal-tidal or temporary-tidal (R1USR or R1USS). There are also areas of flat exposed daily by tidal action. These are classified as Riverine, tidal, unconsolidated shore, regularly flooded (R1USN). Other areas of tidal Riverine systems exist where tributaries enter the Estuarine portion of the Columbia River.

Lower perennial rivers and creeks are found within broad agricultural areas and larger flood plains. These are classified as Riverine, lower perennial, unconsolidated bottom, permanently flooded (R2UBH).

Upper perennial rivers and creeks are found within the mountains and often extend down to the Columbia River. These are fast-flowing rivers with a high dissolved oxygen content and for the most part have a steep gradient (minor areas of lower gradient may occur). The substrate is generally rubble, cobble-gravel or sand. In some places the water may flow over bedrock also. Medium to large named rivers (at lest in part upper perennial) include the Lewis River, Lacamas Creek, Salmon Creek, Grays River, the Naselle River, Skamokawa Creek and the Clatskanie River. These are classified as Riverine, upper perennial, unconsolidated bottom, permanently flooded (R3UBH). Gravel bars which expose during periods of annual low flow are classified as Riverine, upper perennial, unconsolidated shore, seasonally or temporarily flooded (R3USC or R3USA). These are generally made up of sand, cobble-gravel or rubble. Some of these gravel bars are vegetated by trees and/or shrubs. When the vegetation, usually willow (Salix spp.) or red alder, covers ten percent of the area or more these communities are placed in the Palustrine system.

When Riverine systems and their adjacent vegetated wetlands were too narrow to be mapped separately, at this scale, the vegetation

took precedence and they were included in the Palustrine system. Water regime for these communities was determined based on the class of stream on the U.S.G.S. topographic map. Wetland vegetation occurring along perennial streams was given the seasonally flooded water regime (C) while wetland vegetation occurring along intermittent streams was given the termporarily flooded water regime (A).

Intermittent riverine subsystems were based on U.S.G.S. quadrangle information. Seasonal intermittents were well defined channels or streambeds (R4SBC), usually bright white and easily followed on tne pnotography or else in well vegetated valleys. Temporary streambeds (R4SBA), were more of a gray color and less distinct. Intermittent streams carry water for only part of the year and normally exist witnin steep areas of the mountains.

LACUSTRINE SYSTEM

Lakes occurred as natural and impounded water bodies. Some of the natural bodies within the flood plain of the Columbia River are tidally influenced. These are classified as Lacustine, limnetic, unconsolidated bottom, permanent-tidal (L1UBV). Two examples of this type are Vancouver Lake and Sturgeon Lake. The areas of tnese tidal lakes which are exposed periodically due to tidal change are classified as Lacustrine, littoral, unconsolidated snore, regularly flooded (L2USN). Areas exposed for periods longer tnan daily are classified as Lacustine, littoral, unconsolidated snore, seasonal-tidal or temporary-tidal (L2USR or L2USS). Some areas expose only during the driest times of the year. Tnese are classified as Lacustrine, littoral, unconsolidated bottom, semi-permanent-tidal (L2UBT).

Areas of exposed substrate in non-tidal lakes were classified as Lacustrine, littoral, unconsolidated shore, seasonally flooded or temporarily flooded (L2USC or L2USA). Areas of permanent water are classified as Lacustrine, limnetic, unconsolidated bottom, permanent (L1UBH).

Both tidal and non-tidal lakes are generally deep and cold and are greater tnan 20 acres by definition. Where impounding has caused the lake, the impounded special modifier (h) is added to the end of the appropriate label.

Shallows of lakes, both tidal and non-tidal can support aquatic vegetation. These communities are classified as Lacustrine, littoral, aquatic bed, permanent or permanent-tidal (L2ABH or L2ABV). Characteristic species here are spatterdock (Nuphar luteum)and water lily (Nymphaea sp.).

PALUSTRINE SYSTEM

Ponds exist within the study area as natural bodies of water as well as impoundments and excavated areas. Natural occurrences are classified as Palustrine, unconsolidated bottom, permanently or

semi-permanently flooded (PUBH OR PUBF). When ponds occur as a result of an impoundment, the impounded special modifier (h) is added while excavated occurrences have the excavated special modifier (x) added to the label (i.e., PUBHh or PUBHx). Shallow areas might be found to support aquatic vegetation. Classification for thee communities would be Palustrine, aquatic bed, permenently flooded or semi-permanently flooded (PABH or PABF). Species here include spatterdock, water lily, pond weed (Potamogeton spp.), duck weed (Lemna sp.) and water milfoil (Myriophyllum spp.).

Herbaceous wetlands within this system were found as wet pastures, wet meadows, depressions, swales, shallow marshes and along the shores of rivers, lakes and ponds. One special type of herbaceous wetland occurs along the coast in dune areas. These are the deflation plains. They are formed when sand is removed by wind action until layers at or just above the water table, which are too heavy to be blown, are reached. These sands are stable enough for plants to become established. Species occurring here are slough sedge (Carex obnupta), Pacific silverweed, creeping spike-rush (Eleocharis macrostachya), Salt rush (Juncus lesueurii) and swordleaf rush (Juncus ensifolius). Water regimes in these deflation plains are seasonally flooded and temporarily flooded (PEMC and PEMA).

The species composition for the other types of herbaceous wetlands is very similar from one to another. Most wet meadows, wet pastures, shallow marshes and depressions were seasonally flooded and had reed canary grass (Phalaris arundinacea), slough sedge and soft rush (Juncus effusus). These communities are classified exactly the same as seasonal deflation plain wetlands. Temporarily flooded examples of these herbaceous wetlands are slightly different in species frequency of occurrence. Slough sedge is seldom, if ever, present while soft rush dominates with reed canary grass.

Where herbaceous communities fall within the Palustrine system, but have a tidal influence, as along the tidal rivers or lakes, the classification changes even though species remain fairly consant. Classifications here are Palustrine, emergent, seasonal-tidal, temporary-tidal, semi-permanent-tidal or regularly flooded (PEMR, PEMS, PEMT or PEMN). In the case of the tidally influenced freshwater marshes, bulrushes and cattail (Typha latifolia or Typha angustifolia) become dominant or common.

A very few semi-permanently flooded herbaceous marshes occur around lake and pond margins or within depressions. These are classified as Palustrine, emergent, semi-permanently flooded (PEMF). Species dominating these communities are cattail, water sedge (Carex aquatilis) or bulrushes.

Scrub-shrub wetlands ocurred as shrub swamps or thickets, along rivers and creeks, on lake and pond margins, around the edges of

herbaceous wetlands and in deflation plains. Deflation plain examples were seasonally or temporarily flooded (PSSC or PSSA). Typical species encountered were Hookers willow (Salix hookeriana) and shore pine (Pinus contorta subsp. contorta). The typical herbaceous species of delfation plains can be found intermixed with the shrubs especially in more open areas.

The most common scrub-shrub wetlands were seasonally flooded. The typical or characteristic species of the depressions, lake and pond margins, shrub swamps and thickets are willow, hardhack (Spiraea douglasii) and young red alder. As the coastal and estuarine areas of the Columbia are approached, shrub swamps become increasingly more dense willow and red alder. Understory species are principaplly slough sedge, reed canary grass, rushes Juncus spp.) and skunk cabbage (Lysichiton americanum). Freshwater scrub-shrub wetlands were classified as Palustrine, scrub-shrub, seasonally or temporarily flooded (PSSC or PSSA). Temporarily flooded communities were mainly composed of red alder, blackberry (Rubus spp.), salmonberry (Rubus spectabilis) and rose (Rosa sp.). When shrub communities had a tidal influence, they nad the seasonal-tidal (R), temporary-tidal (S) or semi-permanent-tidal (T) water regimes. Some semi-permanently flooded willow swamps were encountered. These were virtually monotypic stands of willow with slough sedge scattered underneath.

Along rivers and on gravel bars, scrub-shrub wetlands occurred as temporarily or seasonally flooded communities. Species here include those alrady mentioned together with redosier dogwood (Cornus stolonifera). Reed canary grass is usually interspersed in the understory of these communities.

Palustrine forested communities occur in depressions and along the edges of rivers, creeks and lakes. Typically, these communities are seasonally or temporarily flooded. In areas of tidal influence the appropriate fresh tidal water regimes are used. Typical seasonal (C) or seasonal-tidal (R) species are red alder, Oregon asn, sitka spruce, western redcedar, black cottonwood and willow. Typical understory of these communities contains overstory sapplings, hardhack, reed canary grass, sedges (Carex spp.), rushes and skunk cabbage. Temporary (A) or Temporary-tidal (S) communities include mainly red alder, Oregon ash, black cottonwood, western redcedar and western hemlock. Understory components are hardhack, snowberry (Symphoricarpos sp.), viburnum (Viburnum sp.), rose, salmonberry, blackberry, vine maple (Acer circinatum), rushes, sedges, grasses and ferns.

Near the coast and along the estuarine portions of the Columbia River, swamps are dominated by red alder, sitka pruce and black cottonwood. Understory components are the same as previously mentioned together with redosier dogwood.

As is the case with shrub wetlands occurring on river gravel bars, forested communities in these situations are seasonally or

temporarily flooded (PFOC or PFOA). Characteristic species are red alder, willow and black cottonwood. Understories are made up of sapplings, reed canary grass, sedges and rushes.

Many of the plant species growing in wetlands can also grow in non-wetland situations. Because of this, location relative to topography and hydrology is very important in determining wetland boundaries and water regimes.

TABLE 1: WETLAND COMMUNITIES

NWI CODE	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/SUBSTRATE
M1UB	Marine, Subtidal Unconsolidated Bottom	Pacific Ocean	Unvegetated
M2US	Marine, Intertidal, Unconsolidated Shore	Beaches, Ocean Shore	Unvegetated; Sand
M2RS	Marine, Intertidal, Rocky Shore	Rocks, Rocky Beach, Jetty	Unvegetated; Rubble
E1UB	Estuarine, Subtidal, Unconsolidated Bottom	Columbia River Estuary	Unvegetated; Sand, Mud
E2US	Estuarine, Inter-Tidal, Unconsolidated Shore	Beaches, Tidal Flats	Unvegetated; Sand, Mud
E2AB/US	Estuarine, Inter-Tidal, Aquatic Bed/Unconsolidated Shore	Tidal Flats, Grass Flats, Grass Beds	Eelgrass (Zostera marina) Japanese eelgrass (Zostera japonica) Unvegetated; Sand, Mud
E2RS	Estuarine, Inter-Tidal, Rocky Shore	Jetty	Unvegetated; Rubble
E2EM	Estuarine, Inter-Tidal, Emergent	Salt Marsh	Lyngby's sedge (Carex lyngbyei) Creeping bent grass (Agrostis alba) Salt grass (Distichlis spicata) Pickleweed (Salicornia virginica) Bulrushes (Scirpus spp.) Western lilaeopsis (Lilaeopsis occidentalis) Seaside arrow grass (Triglochin maritimum)

NWI CODE	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETTION /SUBSTRATE
E2EM (cont'd)			Baltic rush (Juncus balticus) Tufted hair grass (Deschampsia caespitosa) Pacific silverweed (Potentilla pacifica) Dock (Rumex sp.) Douglas aster (Aster subspicatus) Fleabane (Erigeron sp.)
R1UB	Riverine, Tidal, Unconsolidated Bottom	Columbia River, Willamette River, Tidal Creek, Tidal River	Unvegetated; Sand, Mud
R1US	Riverine, Tidal, Unconsolidated Shore	Beaches, Shoals, Gravel Bars, River Shores	Unvegetated; Sand, Mud
R2UB	Riverine, Lower Perennial, Unconsolidated Bottom	Rivers, Streams, Drainage Ditches	Unvegetated; Sand, Mud
R2US	Riverine, Lower Perennial, Unconsolidated Shore	River Shores, Beach, Gravel Bar	Unvegetated; Sand, Mud, Cobble-Gravel
R3UB	Riverine, Upper Perennial, Unconsolidated Bottom	River, Mountain Streams, Trout Streams	Unvegetated; Cobble-Gravel, Rubble, Sand
R3US	Riverine, Upper Perennial, Unconsolidated Shore	River Shores, Gravel Bars	Unvegetated; Cobble-Gravel, Rubble, Sand
R4SB	Riverine, Intermittent, Stream Bed	Creek, Wash, Ravine, Intermittent Stream	Unvegetated; Sand, Cobble-Gravel, Rubble

NWI CODE	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/SUBSTRATE
L1UB	Lacustrine, Limnetic, Unconsolidated Bottom	Lake, Reservoir	Unvegetated; Sand, Mud, Silt, Cobble-Gravel
L2US	Lacustrine, Littoral, Unconsolidated Shore	Lake Shore, Flat, Gravel Bar	Unvegetated; Sand, Silt, Mud, Cobble-Gravel
L2AB	Lacustrine, Littoral, Aquatic Bed	Lake Marsh, Deep Marsh	Spatterdock (Nuphar luteum) Water lily (Nymphaea sp.) Duck weed (Lemna sp.)
PUB	Palustrine, Unconsolidated Bottom	Pond, Stock Pond	Unvegetated; Sand, Mud
PAB	Palustrine, Aquatic Bed	Deep Marsh, Pond	Spatterdock (Nuphar luteum) Water lily (Nymphaea sp.) Duckweed (Lemna sp.) Pondweed (Potamogeton spp.) Water milfoil (Myriophyllum spp.)
PEM	Palustrine, Emeregent	Wet Meadow, Wet Pasture, Depression, Shallow Marsh, Deflation Plain	Reed canary grass (Phalaris arundinacea) Soft rush (Juncus effusus) Slough sedge (Carex obnupta) Water sedge (Carex aquatilis) Pacific silverweed (Potentilla pacifica) Creeping spike-rush (Eleocharis macrostachya) Salt rush (Juncus lesueurii) Swordleaf rush (Juncus ensifolius)

NWI CODE	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/SUBSTRATE
PEM (cont'd)			Skunk cabbage (Lysichiton americanum) Cattail (Typha latifolia) (Typha angustifolia) Bulrushes (Scirpus spp.) Common reed (Phragmites communis) Water parsley (Oenanthe sarmentosa)
PSS	Palustrine, Scrub-shrub	Shrub swamps, Shrub thickets, Swamps, Riparian, Flood Plain Thicket, River Bar Thicket, Deflation Plain	Red alder (Alnus rubra) Hooker's willow (Salix hookeriana) Willow (Salix spp.) Hardhack (Spiraea douglasii) Redosier dogwood (Cornus stolonifera) Rose (Rosa sp.) Salmonberry (Rubus spectabilis) Blackberry (Rubus spp.) Shore pine (Pinus contorta subsp. contorta) Snowberry (Symphoricarpos sp.) Viburnum (Viburnum sp.) Vine maple (Acer circinatum)
PFO	Palustrine, Forested	Forest Swamp, Swamp, Riparian, Wet Forest, Flood Plain Forest, River Bar Forest	Red alder (Alnus rubra) Black cottonwood (Populus balsamifera) Western redcedar (Thuja plicata) Western hemlock (Tsuga heterophylla)

NWI CODE	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/SUBSTRATE
PFO (cont'd)			Bigleaf maple (*Acer macrophyllum*) Oregon ash (*Fraxinus latifolia*) Willow (*Salix* spp.) Sitka spruce (*Picea sitchensis*) Shore pine (*Pinus contorta* subsp. *contorta*)

BIBLIOGRAPHY

Anonymous. 1980. Identification and Mapping of Vegetative Communities of the Columbia River Estuary. Phase 1 - Winter Reconnaissance Survey. Washington Department of Game.

Bailey, Robert G. 1980. Description of the Ecoregions of [illegible] Publication No. 1391.

Brown, Duncan, et. al. 1986. Wetland and Wilflife Habitat Inventory for the Columbia Corridor. Preliminary Draft. Bureau of Planning, City of Portland.

Brown, Duncan, et. at. 1987. Columbia South Shore. Analysis of Economic, Social, Environmental and Energy Consequences for Open Spaces, Scenic and Historic Areas, and Natural Resources. Bureau of Planning of Portland.

Rogers, Ralph Thomas. No Date. Wetland Determination Seaside, Oregon. U.S. Army Corps of Engineers.

Tabor, James E. 1976. Inventory of Riparian Habitats and Associated Wildlife Along the Columbia River. Volume 2B. Oregon Cooperative Wildlife Research Unit, Oregon State University and U.S. Army Corps of Engineers, Wildlife Work Group, North Pacific Division.

Thomas, Duncan W. 1980. Study of The Intertidal Vegetation of the Columbia River Estuary. Washington Department of Game.

Weinmann, Fred, et. al. 1984. Wetland Plants of the Pacific Northwest. U.S. Army Corps of Engineers, Seattle District.

Young, Keith, et. al. 1985. Hydric Soils of the United States 1985. U.S.D.A. Soil Conservation Service, National Technical Committee for Hydric Soils.

Soil Survey of Astoria Area, Oregon. 1949. U.S.D.A., Soil Conservation Service.

Soil Survey of Clark County, Washington. 1972. U.S.D.A., Soil Conservation Service.

Soil Survey of Columbia County, Oregon. 1986. U.S.D.A., Soil Conservation Service.

Soil Survey of Cowlitz Area, Washington. 1974. U.S.D.A., Soil Conservation Service.

Soil Survey of Multnoman County, Washington. 1983. U.S.D.A., Soil Conservation Service.

Soil Survey of Skamania County, Washington. 1956. U.S.D.A., Soil Conservation Service.

Soil Survey of Grays Harbor County Area, Pacific County, and Wahkiakum County, Washington. 1986. U.S.D.A., Soil Conservation Service.

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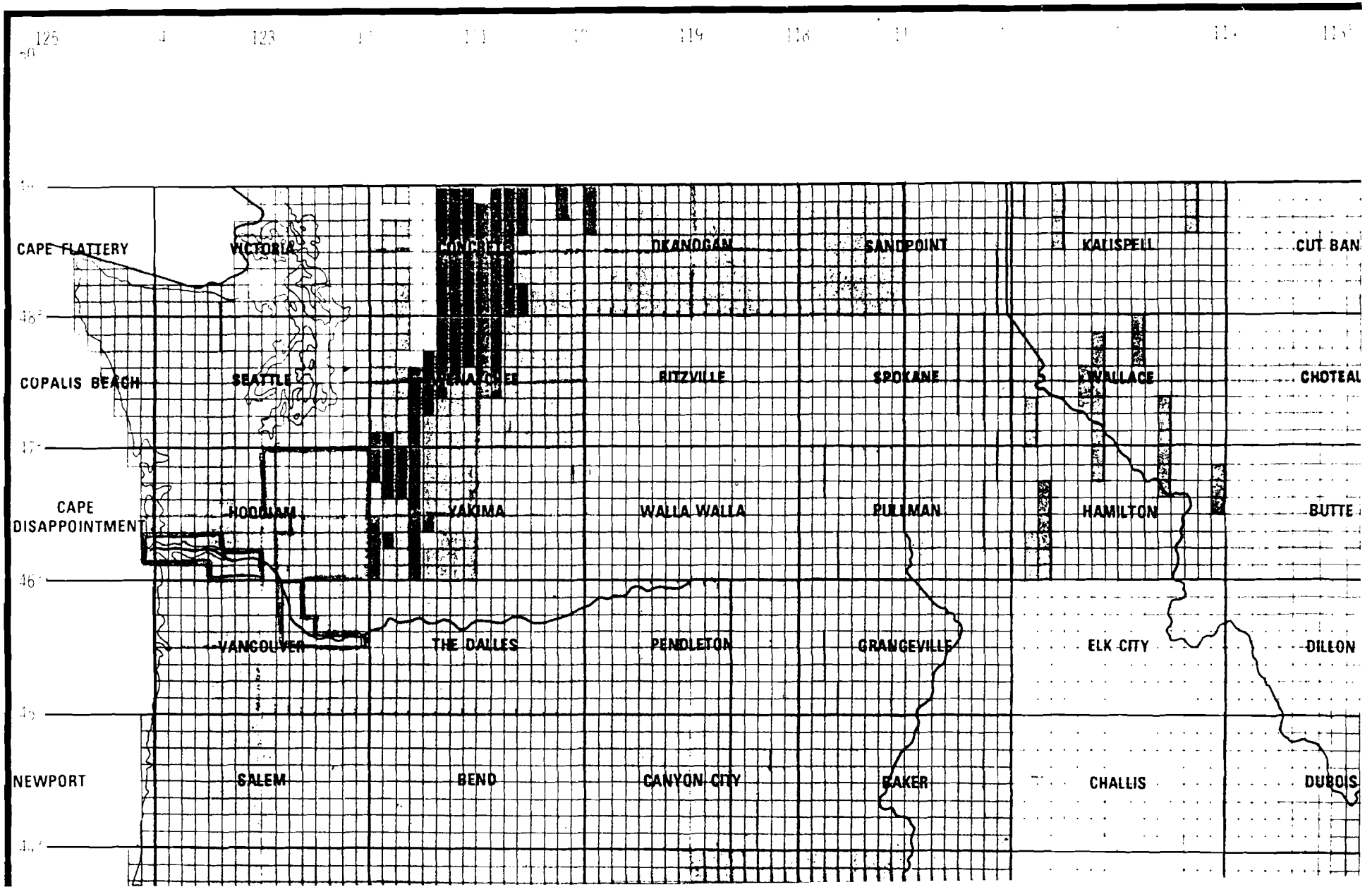

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