APPENDICES

APPENDIX A

HISTORY OF SKIPANON RIVER WATERSHED

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APPENDIX A
HISTORY

Skipanon River Watershed Natural History

TIMELINE

- 45 million years ago - North American Continent begins collision with Pacific Ocean Seamounts (now the Coast Range)
- 25 million years ago Oregon Coast began to emerge from the sea
- 20 million years ago Coast Range becomes a firm part of the continent
- 15 million years ago Columbia River Basalt lava flows stream down an ancestral Columbia River
- 12,000 years ago last Ice Age floods scour the Columbia River
- 10,000 years ago Native Americans inhabit the region (earliest documentation) - Clatsop Indians used three areas within the Skipanon drainage as main living, fishing and hunting sites: Clatsop Plains, Hammond and a site near the Skipanon River mouth, where later D.K. Warren (Warrenton founder) built a home.
- 4,500 years ago Pacific Ocean shoreline at the eastern shore of what is now Cullaby Lake
- 1700's early part of the century last major earthquake
- 1780 estimates of the Chinook population in the lower Columbia Region: 2,000 total – 300 of which were Clatsops who lived primarily in the Skipanon basin.
- 1770's-1790's Robert Gray and other Europeans explore and settle Oregon and region, bringing with them disease/epidemic (smallpox, malaria, measles, etc.) to native populations
- 1805-1806 Lewis and Clark Expedition, camp at Fort Clatsop and travel frequently through the Skipanon Watershed
- 1811 Fort Astoria established by the Pacific Fur Company
- 1840-1841 Methodist missionaries (Lee and Frost) come to the mouth of the Columbia, establish a mission at what is now Hammond
- 1840 earliest county land claims initiated, Solomon Smith land claim at Clatsop Plains
- 1841 store at the mouth of the Skipanon established, served as transfer point between overland and water travel on Young's Bay
- 1842 Scots Broom seed imported to the area
- 1844 Lexington (now part of Warrenton) became the county seat of Clatsop County and first town to be platted
- 1850 Donation Land Law, large pieces of Oregon Territory land donated to settlers
- 1853 gillnets introduced to the salmon fishery
- 1853 first fruit trees, seeds and ornamentals (other than Scots Broom) imported to the area
- 1862 Federal Homestead Act, 160 acre parcels could be purchased for a small fee
- 1863 – 1894 1000 people applied for land through the Homestead Act in Clatsop County
- 1878 first dikes built on Skipanon River, built by D.K. Warren, several hundred acres
- 1879 first work on the Skipanon 'canal' begins; also known as Carnahan Ditch
- 1883 reached a peak of canneries (55) at the Mouth of the Columbia (both sides), 4,000 employed - mostly Chinese workers
- 1883-1895 Columbia River South Jetty (4.5 miles length) built
- 1888 right-of-way secured by the Astoria and South Coast railway

- 1889 other salmon besides Chinook are canned
- 1898 Portland – Seaside - Astoria Railroad completed, Columbia River Railroad Co.
- 1899 Warrenton established
- 1900's - 27 dairies (Young's, Skipanon and Nicolai-Wickiup basins) deliver milk to Astoria
- 1901 first railroads built through Warrenton, railway section from Warrenton to Hammond
- Early 1900's 300- 400 Warrenton population
- 1903 –1913 Columbia River South Jetty extended to 6.5 miles in length
- 1913 – 1917 North Jetty built
- 1904 work continues on Carnahan Ditch
- 1915 expecting a population boom, 18 streets in Warrenton vacated for industry
- 1917 earliest 24-hour service of power granted to Pacific Power and Light
- 1917 Clatsop Cranberry Association established
- 1917 clay plant opened on the waterfront, clay locally gathered
- 1918 five cars in Warrenton area
- 1918 dredging of the Skipanon River begins
- 1918-1919 most of the present HW 104, known as main street (Warrenton), running north and south was built
- 1919 – 700 Warrenton population
- 1919 2-pile bulkheads and two reclamation districts using dredge materials from the river filled nearly 50 acres of Warrenton's downtown area
- 1920's - 1930's Scots Broom Festival in Clatsop County
- 1920's - 1930's big ships came into the Skipanon River to do business at the 5 sawmills
- 1969 logging roads begin to cover the forests
- 1924 first golf course on the Clatsop Plains, Astoria Golf and Country Club
- 1930 – 650 population of Warrenton
- 1930 – 1060 persons employed in County in fisheries (US Bureau Census)
- 1930 – 2,295 persons employed in County in forestry (US Bureau Census)
- 1930 – 884 person employed in County in agriculture (US Bureau Census)
- 1931 – government dredges the Skipanon channel to a 30 foot low water depth and a 200 foot wide bottom width with a 600 foot wide turning basin
- 1933 flood Year
- 1939 plan approved for U.S. Corps of Engineers' modifications of dikes
- 1940's daffodils grown in Clatsop Plains, WWII affects markets and agricultural production in Europe, short boom for county growers
- 1940 – Warrenton population at 1365, grew rapidly during WWII, for example - 60 new water taps in 1949, $50 a county lot in 1950
- 1950 – Warrenton population at 2000
- 1955 flood year
- 1958 Warrenton Mooring Basin 'dedicated' and the land/water interface within the mooring basin was modified: squared off, filled and dredged
- 1960 U.S. Soil Conservation Service (now U.S. Natural Resources Conservation Service) Project (PL-566) begins on the Skipanon River, three dams completed by 1964
- 1960's brief whaling history, Bio-Oregon processes products from whales

- 1965 Young's Bay Bridge was built and immediately began collecting sand on each side of the bridge.
- 1977 Clatsop County Economic Development Council's Fisheries Project (Net Pens)
- 1980 new Highway 101 Warrenton bypass opens
- 1996 Flood year
- 1997 Skipanon Watershed Council formed
- 1997 'windows' cut into 8th street dam /tidegate structure for fish passage and water quality improvement
- 1999 Corps of Engineers' dredges (180,000 cubic feet) the lower Skipanon River
- 2000 – Warrenton population at 4040
- 2000 – Clatsop County population at 35,000
- 2000 – Natural Resources Conservation Service complete hydrology study of the Skipanon River and its water control structures

Natural History Setting

Geology

Oregon is the product of a prolonged 45 million-year collision between the North American continent and the Pacific Ocean floor. Northwest Oregon consists of sedimentary and volcanic rock that at one time formed the Pacific Ocean floor. The Oregon coast began to emerge from the sea 25 million years ago and by Miocene time, about 18 million years ago, the coast's configuration looked much as it does today.

One of the most dramatic episodes occurred about 15 million years ago as basalt lava flowed down the ancestral Columbia River channel toward the coast. At least twelve large flows of Columbia River basalt streamed more than 300 miles from vents in eastern Oregon and Washington. During the last part of the most recent Ice Age, about 12,000 years ago, catastrophic floods, more than a 120 separate events swept repeatedly from Montana across central and eastern Oregon and down the Columbia River. Among other things, these floods polished and widened the Columbia River. Oregon's Coast is still forming, lifting at the north end as the ocean floor slides under the continent shelf (Bishop and Allen 1996).

Soils

A large component of the Skipanon Watershed is made up of the Clatsop Plains, which is sand dunes, tidal flats or floodplain alluvium. The Clatsop Dunes are a series of sand ridges formed by wind. The source of these dunes is sediment from the Columbia River deposited since Pleistocene time and constantly reworked by wind, waves and rain. In some parts of the dunes the sand is over 150 feet deep. Floodplain alluvium occurs along the Columbia River and Skipanon River at the Northern End of the Clatsop Plains
(Hansen and Harris, 1974).

Since the development of the Columbia River Jetties (1883-1917) movement of sand along the beach , offshore and north has changed. Initial work (1970's) showed beach accretion south of the jetties increasing by as much as 275 feet (Paul See personal communication), however as time has progressed specific areas (e.g. beach at Fort Stevens) are now loosing beach sand.

Although the Columbia River South jetty may now trap the sand that normally moved offshore and north, sand delivery to the beaches from the Columbia River has lessened due in part to sediment trapping by dams (BI-State Littoral Cell Sand Study, presentation to Clatsop County Planning Commission, 2000).

Schlicker, et al. (1972) have assigned several separate geologic units to the sediments of the Young's Bay estuarine river floodplains, which includes the estuarine area of the Skipanon River. They have separated the units into terrace alluvium, floodplain alluvium, peat, sand and tidal flats (Seaman, 1972).

Alluvial terraces are formed when uplift of land causes rivers to cut downward through flood-plain deposits. As downward and lateral erosion within the valley produces a younger flood-plain at a lower elevation, the fragmented and uplifted remains of the older flood plain are seen as terraces along the sides of the valley. Because silt-laden flood waters commonly rise above the banks of the down-cutting river, the terraces are usually mantled by several feet of fine-grained sediment. Alluvial terraces are best developed in the lower reaches of larger valleys. Terraces along streams such as the Walluski, Lewis and Clark and Skipanon Rivers which are far removed from igneous terrain are composed primarily of unconsolidated, massive to faintly bedded, light-gray to buff silt and clay. In contrast, streams draining terrain of predominately igneous rock and having relatively steep gradients are lined with gravel terraces (Seaman, 1972).

Peat and organic soils are present in the Skipanon system. Peat forms in swamps, lowlands and tidal flats where the water table remains at or near ground surface for large parts of the year. Peat and organic soils form thick deposits in areas where a slow steady rise of the water level induces a continued steady growth of spaghum moss (found in the Cullaby Lake area) and other wetland plants. Because sedimentation is complex in such areas, silt and other material may cover deposits of peat. In regions of high water table, peat may occur in the subsurface in areas where there is no direct surface indication of its presence. Because sea level has risen as much as 300 feet since the close of Pleistocene time, this subsurface accumulation of peat and interstratified alluvial and beach sediments may be present (Seaman, 1972).

Soil Type

The primary soils of the lowlands for the Skipanon Basin are the Coquille-Clatsop, Grindbrook-Walluski-Hebo, and Waldport-Gearhart-Brailler. All three of these soils are found in the fog belt. The C-C soils are very deep, very poorly drained silt loam and muck and are located on tidally influenced flood plains. The G-W-H soils are deep to very deep soils, moderately well drained or poorly drained silt loam and silty clay loam and found on terraces. The W-G-B soils are very deep, and are either excessively drained, somewhat excessively drained, or poorly drained fine sand, fine sandy loam, or mucky peat found in dunes and swales (Smith and Shipman, 1988).

The fourth soil within the Basin is found in the uplands of the fog belt and is Skipanon-Templeton-Svensen soils. The S-T-S soils are deep and very deep, well-drained gravelly silt loam, silt loam, and loam found in the mountains. Mountains in this basin are below 500 ft (Smith and Shipman, 1988).

Watershed Resources at the Time of Exploration/European American Settlement 1792 – 1900

Introduction

Native Americans of this region, specifically the Lower Chinook and Clatsop have coexisted with the salmon in the Lower Columbia for at least 10,000 years. The human population was denser than most hunter-gathering people due to the abundance of year round food. Edible roots, nuts, berries, and greens could be foraged; fish, shellfish and fresh sea kelp from the sea and rivers were fished, raked and gathered; seals, sea lions, whales and shark were utilized if found on the beach; and wild fowl and land mammals were hunted and trapped.

Though European explorers were in this area as early as the late 18th century, some of the best writings about this 'land of the Clatsops' was by those individuals within the "Corps of Discovery" exploration party - the Lewis and Clark expedition. This group journeyed across North America at the turn of the 19th century, ending (winter 1805-6) the first half of their trip encamped on the shore of what is now the Lewis and Clark River. It is the journals of these early explorers that helps articulate what the region's natural resources were like at the time of exploration / settlement, and how the native populations lived on the land and utilized these resources. Although the Lewis and Clark group were camped in the watershed just east of the Skipanon, they made many trips overland, through the Skipanon for hunting, fishing and to get to their salt works near the coast.

In later years (1851-65) land surveyors listed the major trees and shrubs and general descriptions of the structure of bottomland vegetation, floodplain lakes, and riparian forests. They were not required to describe herbaceous plants. Of all the native vegetation along the riparian edge, the herb layer has suffered the greatest impacts from grazing, exotic weeds, and flood control, and is the most problematic to reconstruct (Christy and Putera, 1992).

Vegetation, food resources, and climate

Meriwether Lewis (1806) describes in his journal a number of roots and fruits, which played important roles in the Indian dietary economy: *"Shannetahque"* (edible thistle, *Cirsium edule*), rush (horsetail, *Equisetum telmateia*), fern (western bracken, *Pteridium aquilinum pubescens)*, cattail (*Typha latifolia*), and wappato (*Sagittaria latifolia*). According to Lewis, the Chinook and Clatsop Indians relished the fruit of a number of local plants: salal, evergreen huckleberry, cranberry, saccacommis or bearberry (*Arctostaphylos uva-ursi*) and Oregon crab apple (Cutright, p. 264, 1969).

Lewis also describes the use of whale meat as a food source for the local Indians.
In early January of 1806 members of the Clatsop tribe brought meat to the fort obtained from the body of a whale recently washed ashore… From Meriwether Lewis' journal ~ he found it to be "*very palitable and tender*" and resembling "*the beaver or dog in flavor*" (Lewis and Clark Journals III, 312-313 in: Cutright, 1969).

Salmon, high in fat and protein was the preeminent food source – generally abundant, relatively easy to gather and store and capable of supplying the tribes throughout periods when other food sources were scarce. Of the five different species of salmon, the most important by far was the Chinook or king salmon. Lewis regularly referred to it as the

"common salmon" (he encountered it more often than any other species) and said it was this species that "*extends itself into all the rivers and little creeks on this side of the Continent, and to which the natives are so much indebted for their subsisitence"* (Lewis and Clark Journals IV, 163 in: Cutright, 1969).

The Indian villages were mostly along the Columbia River and the streams were used as special fishing places, especially certain areas where salmon concentrated at falls and rapids**.** The Clatsop Indians used three areas within the Skipanon drainage as main living, fishing and hunting sites. These included the Clatsop Plains, Hammond and a site near the Skipanon River mouth, where later D.K. Warren, founder of Warrenton built a home (Diane Collier, personal communication). The local people were skilled fishermen, using nets for smaller fish and fish traps in many of the streams. The Lower Chinook people were also known for their canoes and their ability to navigate the tricky waters of the Lower Columbia region.

Salmon were not the only prized fish in the area; halibut, sturgeon as well as Eul-a-chon (smelt) were highly sought. Smelt oil was traded with up-river people. Eul-a-chon were a small fish, with a length of 10 to 12 inches and unknown to science when discovered by Lewis and Clark. In late February 1806 Clark wrote in his journals at Fort Clatsop about Eul-a-chon:

> *This evening we were visited by Comowool the Clatsop Chief and 12 men, women and children of his nation… The Chief and his party had brought for sail a Sea Otter skin, some hats, stergeon and a species of small fish which now begin to run, and are taken in great quantities in the Columbia River about 40 miles above us by means of skimming or scooping nets… I find them best when cooked in Indian stile, which is by rotating a number of them together on a wooden spit without any previous preparation whatever, they are so fat they require no additional sauce, and I think them superior to any fish I ever tasted, even more delicate and luscious than the white fish of the lakes which have heretofore formed my standard of excellence among the fishes* (Lewis and Clark 1V, 102-103 in: Cutright, 1969).

Sturgeon was also taken in quantity from the Columbia by Indians and is the largest of the fresh-water fish. The largest on record was taken at Astoria and weighed 1,900 pounds (Vaughan, 1980).

Since the main food location was the water (Columbia River, Pacific Ocean, and local rivers and streams), little land modification, such as annual burning to enhance large grazing animal forage, was necessary. However some land modification was initiated. For example, the Chinook Indians smoked the dried, crumbled leaves of bearberry – as did members of the Lewis and Clark party at Fort Clatsop – and they sometimes mixed these leaves with those of their own species of tobacco. The latter of which was planted and cultivated in specially prepared fields, usually at some distance from the village so as to allow it time to mature (Douglas, 1904-5 in: Cutright, 1969).

The earliest records of climate, terrain, vegetation and food resources of this region come also from the journals of Lewis and Clark. From these journals it is clear that the winter was wet and cold, and that the expedition group were, at the very least, quite miserable during their winter stay at Fort Clatsop.

"Day in and day out, the job of obtaining food out-rivaled all others. This was made doubly difficult by adverse weather conditions. Rain was the great recurring wretchedness – cold, penetrating, disabling, and persistent. During their four month stay at Fort Clatsop, rain fell every day except 12 and skies remained cloudless only six" (Cutright, p.250, 1969).

From Clark's journal *"rained all the last night we covered our selves as well as we could with Elk skin, and set up the greater part of the night, all wet I lay in the wet verry cold"* (Lewis and Clark III, 281 in Cutright, 1969). As hunters travelling a distance from the fort, they had to negotiate numerous bogs or "slashes," immersed to midriff and clamber with a hunter's burden over the great fallen timbers of the forest (Cutright, 1969).

Although climate is cyclical and presently much is being made of the prediction that the next 20 years of weather in the Pacific Northwest will be wetter than the past 20; either way you look at it - weather and rain are dominant forces in a temperate rainforest. The following table shows monthly averages for precipitation, temperature and cloud cover data from 1940 –1970. Lewis and Clark would not have fared much better if their trip had been planned during these three decades.

Monthly Average Climatic Data
Astoria, Oregon
Based on data from 1940-1970
From: Department of Commerce, 1975

	Precipitation **(Inches)**	***Temperature*** **(F)**	***Number of Days*** **Cloudy**	**Heavy Fog**
January	9.73	40.6	25	4
February	7.82	43.6	22	3
March	6.62	44.4	23	2
April	4.61	47.8	22	2
May	2.72	52.3	20	2
June	2.45	56.5	20	2
July	0.96	60.0	15	2
August	1.46	60.3	15	5
September	2.83	58.4	14	6
October	6.80	52.8	19	7
November	9.78	46.5	22	4
December	10.57	42.8	25	4
Annual	66.34	50.3	242	43

As the winter of Lewis and Clark's encampment progressed, their major food source, elk moved farther a-field. This meant that the hunters, after killing and butchering the animals, had to haul the meat several miles on their backs through morass and heavy undergrowth. They also had to contend with mild temperatures, which hastened the spoilage of their meat. Sergeant Gass from the exploration group reported that in the period from December 1 to March 20, the hunters killed 131 elk (Cutright p. 251, 1969).

As the new-year (1806) began and Clark continued his mapmaking, Lewis went to work on animal biographies and plant descriptions - filling notebooks with ethnobotanical and ethnozoological data. "At no other time during the entire trip did he display such initiative as a naturalist and provide such quantitative evidence of his skill as observer and reporter of the biological scene" (Cutright, p. 258, 1969).

Lewis referred to three dozen plants while at Fort Clatsop, devoting much of his time to two groups in particular: (1) conifers - Douglas fir, western hemlock, grand fir, western white pine, and Sitka spruce, and (2) those edible roots and fruits (Cutright, p. 258, 1969). From Lewis' Journal: the Sitka spruce "*grows to imence size…in several instances we have found them as much as 36 feet in the girth or 12 feet diameter perfectly solid and entire. They frequently rise to the hight of 230 feet, and one hundred and twenty or 30 of that hight without a limb.*" Lewis also measured those things of minimal size, the leaf of the broad-leaf maple was eight inches long and 12 wide (Lewis and Clark IV, 41, in: Cutright, 1969).

The western red cedar held a special place in the lives of the Chinook people. They used it for building boats, bowls, platters, and spoons and in the building of their homes. The fibers of the bark were utilized for making everything from nets and fish lines to material for bundling infants. Shredded bark, similar in texture to cotton was also used to make clothing (Cutright, p. 269, 1969).

U.S. President Thomas Jefferson, who embarked Lewis and Clark on their journey also instructed Lewis to pay attention to "*climate as characterized by …the dates at which particular plant put forth their flowers or leaf*" (Lewis and Clark Journals VII, 249, in: Cutright, 1969). Lewis and Clark's wintering at Fort Clatsop didn't provide much in the way of bloom or spring leaf. However, Lewis does capture some of the regions earliest bud breakers. On March 22, the day before the group leaves Fort Clatsop, Lewis writes, "*the leaves and petals of the flowers of the green Huckleburry have appeared. Some of the leaves have already obtained ¼ of their size*" (Lewis and Clark Journals VI, 210, in: Cutright, 1969). The day after the Corps had abandoned Fort Clatsop, Lewis writes again, "*the brown bryery shrub with a broad pinnate leaf has begun to put fourth it's leaves. The polecat Colwort (probably western skunk cabbage) is in blume*" (Lewis and Clark Journals VI, 210 in: Cutright, p. 260, 1969).

Lewis devoted considerable space in his journal to about a half -a - dozen roots and an equal number of fruits that were food source for the Chinook and the explorers (see above).

European Americans came as explorers to the area before the landward journey of Lewis and Clark. Their names still mark land features of the Oregon Coast: Heceta, Cook, Gray, and Vancouver. As well - Captain Robert Gray (1792) entered the Columbia River sailing the *Columbia Rediviva* and it is this ship whose name the great river now holds.

European Settlement

It wasn't long after Lewis and Clark wintered at the mouth of the Columbia that a first attempt at settlement was made…and failed. The next attempt was by John Jacob Astor, a German who arrived in America in 1738. Astor sent two groups of men to the region to establish (1811) a fur trading company, the Pacific Fur Company.

Warrenton's settlement didn't occur until more than 30 years later when the community of Lexington (where Warrenton now stands) was established and became both the first county seat and the first town platted (Diane Collier, personal communication).

Clearing the land was no easy task. A particularly good articulation of the forests of the area at that time was presented by Astor's clerk, Alexander Ross, "studded with gigantic trees of almost incredible size, many of them measuring fifty feet in girth… It sometimes required two days or more to fell one tree (Vaughan, 1980). The earliest land claims (1840 - 43) in the county were established in the Skipanon area.

Fur trading was at its peak during the early years of Astoria (1812-20) with both settlers and Lower Chinook participating extensively. "Lower Chinook woman also came to be of great importance during the fur trading period, often traveling to the forts or paddling out to the ships to conduct trading themselves" (Vaughan, p. 4, 1980). Beaver populations and concurrently the rivers, streams and wetlands of the region were adversely affected by this intensive enterprise.

The Lower Chinooks and the Clatsops were among the first Indians in Oregon to be exposed to white civilization's diseases (small pox, syphilis, malaria, etc.). Disease cut the populations in half within 50 years of European contact and just as the tribes began to regain their numbers - another epidemic hit in the 1830's. By 1855, the Hudson's Bay Company data identify only 175 Lower Chinook left from the Dalles to the mouth of the Columbia to the coast (Vaughan, p.5, 1980).

Even at this early period, changes in the ecosystem and abundance of fish was noted. As white settlement increased, the removal of already dwindling tribes to reservations began to take place. In 1851, Anson Dart, Superintendent of Indian Affairs, first proposed to the Clatsops the ceding of their land to the government. The Clatsops' first counter-proposal (which was not accepted) insisted first on the removal of two sawmills that were driving fish away (Vaughan, p.7, 1980).

Agriculture, settlement and diked land 1870's-1930

The first settlers of the Skipanon River watershed found that the climate and grass provided good grazing for stock which many of them drove across the Coast Range or up from California. Some of the earliest settlers of the North Coast region brought the first cows from San Francisco by ship. Although only wolves were a serious threat to domestic animals in the 1840's (Vaughan, p. 34, 1980); those grazing animals on the tidelands had to be somewhat vigilant of stranded animals caused by tidal changes, storm surge, or river flooding which could put animals at risk. It wasn't long before the farms had enough milk surpluses to sell at market.

Agricultural development was confined to the narrow river valleys and the small alluvial benches along the Columbia and near the mouths of the Skipanon, Young's and the Lewis and Clark Rivers. Dairying was the most important kind of farming in the county. As early as 1900 there were 27 dairies supplying milk to Astoria from the lowland areas of Young's Bay, Skipanon River and Brownsmead.

Root crops and peas were grown. Farming was intensive, with small ownerships and complete utilization of clear areas. For many, the North Coast of Oregon proved an excellent farming possibility. "There is not perhaps a limited distance in the U.S. equal to the east side of the

Clatsop Plains for the production of rutabaga turnips..." from John Minto's 1845 journal, excerpt printed in the Oregonian, February 1, 1904. By the late 1920's and 30's farmers converted extensive areas of rough cutover land to grazing through artificial seeding. The tillable land, together with the pasture land adjacent to occupied farm units, amounted to 31,300 acres in 1930.

The portion of tidelands that were diked early in Clatsop County include: lands along Young's Bay, from Fort Steven's along the Bay and including Clatsop Plains area as well as the Skipanon, Lewis and Clark, Young's and Walluski Rivers. The amount of wetlands diked in the County by 1888 was approximately 5,000 acres. At this time nearly one-fourth of this diked land was cultivated grasses, for meadow and pasture and a small part devoted to grains and vegetables. D.K. Warren, founder of Warrenton, owned 630 acres of these tidelands having diked 300 acres in 1879, with the remainder diked in 1887. The first dike built by Warren was 2.25 miles in length, 10 foot base, five feet high and four feet wide at the top. Much of this reclaimed land lies on the west side of Young's Bay; to the west and east of the Skipanon River. After this time - dikes were made larger, usually 12-16 feet wide at the base, five-six feet in height and six feet across the top (Beemer, 1888).

An article in the *Astorian* (*August* 4, 1888) explains that these tidelands once supported a large old growth spruce forest on the west side of Young's Bay, probably between the mouth of the Skipanon River and Lewis and Clark River. The writer asserts that "the natural surface of the ground in this forest latterly being about four feet below the present level, having been much higher during the growth of these tress, then afterward sunk through some convulsion of nature." The article goes on to talk about the current (1888) forest tree species: spruce, hemlock - but little fir; alder, crabapple and Oregon willow (Beemer, 1888).

The writer also describes some other details of dike construction, these details expose other negative impacts on the system, for example, filling nearby tidal creeks and sloughs to support the dike and to withstand pressure from incoming tides. Warren filled a deep tidal creek 180 feet wide for about 80 feet for a dike foundation strong enough to withstand the tide. Another parcel (500 acres) that adjoined Warren's in the Skipanon Basin near Tansy Point was also diked at this time (Beemer, 1888).

In 1887 a group of landowners diked an area on the east bank of the Skipanon which extended along Young's Bay to the mouth and a short distance up the Lewis and Clark River. This dike was approximately 6 miles in length and enclosed about 2,000 acres of tideland. The cost of the dike amounted to about $1,000 per mile, or $6,000 total. Additional costs ($3,000) were associated with filling the tidal sloughs, additional repairs and foundation strengthening (Beemer, 1888).

This 'reclaimed' tideland proved productive for landowners. D.K. Warren at this time claimed at least 6 tons of cured hay per acre per year on 165 acres of diked tideland. The usual average was between three-five tons per acre. Others grew fruit trees and berries, and raised horses. Still others tried their hand at growing rutabagas, which did very well, and wheat and oats, which didn't. Dairies prospered throughout the region. A couple of colonies of honeybees were noted on the Lewis and Clark River. The vine maple honey was "nearly the color and much the taste of fresh genuine maple syrup" (Beemer 1888).

Diked tidelands spread out quickly on the Lower Columbia. By 1939 The U.S. Corps of Engineers was tasked to begin improving and restoring existing dikes as well as building new ones.

Railroads

When the railroads came so did the revival of the logging industry and also the profitable trade with China. Railroads were built along rivers, often running the length of a river from tidewater to headwater. Literally following or leading the cut. Most often, the railroad would 'end' at a riverbank at tidewater where logs would then be transported by water (shipped or floated) to the sawmills. Oftentimes a sawmill was located at this railroad and river junction.

Use of tidal waters for log transport was not without its critics. In 1890 the Oregon Supreme Court ruled that the waterway below mean high tide was navigable, and that above the MH tide was not. Two decades later, a landowner adjacent to Tucker Creek, a tidal slough of the Young's River basin complained when the Colwell-Fowler Logging Company drove pilings in that waterway in order to construct a logging boom. When completed the boom prevented the landowner from using the creek for navigation (Cumtux, p. 11, 1982).

A right- of-way from Portland to Seaside was secured by the Astoria-Columbia River Railroad Company as early as 1888. The Portland to Seaside component of the rail was completed in 1898. In the early 1900's the rail was continued to Warrenton and on to Hammond. The rail ran from Seaside to Warrenton just west of the Skipanon River and Cullaby Lake / Cullaby Creek valley and like Highway 101 the rail took advantage of the north south extending Clatsop Plains' Ridges. It then spurred to Hammond and continued east crossing the Skipanon River, then Young's Bay and then on to Astoria. The rail carried both passengers and resource products, including timber. At the time the railroad was built, fill was placed in the wetland areas that joined the Skipanon Slough and the Skipanon River proper. This fill essentially cut off the Slough from the Skipanon River (Diane Collier personal communication).

The Lewis and Clark Railroad ran from tidewater on the Lewis and Clark River up to its source near Saddle Mountain. A 1933 railroad map shows the railroad beginning south of Fort Clatsop, near tidewater, on the west side of the Lewis and Clark River. The rail follows the river south and then heads east, finally ending up into the headwaters of the Lewis and Clark. On its journey it swings across the uppermost portion of Cullaby Creek, now part of the Skipanon Watershed.

In 1889, the steam donkey began to replace ox teams in Clatsop County, this combined with the mainline railroads moved logging operations away from the Columbia River and into the interior. By the 1890's Clatsop County was a spiderweb of track carrying billions of board feet of fir and spruce (Vaughan, 1980).

Clearing the land

Many of these hemlocks, Sitka spruce, Douglas fir, and western red cedar were "twelve feet thick at the base and could not be cut down with a saw or axe. It became necessary to burn them down. To accomplish this, a large hole was drilled at the 35-degree angle and a smaller hole horizontally to meet the first one. This being done, small red-hot hardwood coals were dropped into the large hole. A pair of hand bellows furnishing a strong draft, which would ignite the coals into a small blaze. This would begin to burn within the tree and would continue many days, creating a constantly enlarged cavity until there was within that tree a good-sized room, around

the walls of which the fires would continue to blaze until, with a terrific roar, the huge forest giant fell with earth-shaking reverberations" (Lillenas-Peeke, 1958, unpublished).

It wasn't long after settlement that the forests began to be seen as more than something that had to be cleared for farming. Because of its strategic location to the Hawaiian and Californian Markets, Clatsop County had some of the earliest commercial sawmills in Oregon. For example, the Harrall or Harold Lumber Company near Fort Clatsop, on the Lewis and Clark River was built before 1851 (Cumtux, 1982).

"Thousands of square miles of hemlock, spruce and fir forests are found near the vicinity of Astoria, and the quality of the timber here is the same high quality found on the best parts of Puget Sound Country. Trees are found in these forests of over 250 feet in height, measuring 3-12 feet in diameter. The sawmills at or near Astoria have made shipments, principally to Mexico, South America, Australia, China and other parts of the United States. Three large sawmills, in addition to planing mills and a number of box factories, are now running in Astoria" (The Oregonian Publishing Company, p. 296, 1894).

Log flotation occurred on most of the region's waterways within their tidal portions. The Skipanon River was no exception. In September 1887, "AH" wrote to the Oregonian a full report on J.C. Trullinger's logging camp on the Walluski. He described in detail how five yoke of oxen were used to snake logs to the railroad cars which in turn dumped them into a chute and into the tidal portion of the river (Cumtux, 1982). The Skipanon River was used extensively for log storage. Before logs were milled and sent out to market they were stored and boomed within the tidal portion of the Skipanon River. A number of log dump sites were also on the lower part of the river. A log dump site owned by A. & I. Nygaard was situated on the Skipanon at the end of 5th Street. Loaded trucks brought logs from many miles. In 1949 - 44,390,000 feet of logs were dumped at this site (Hensley, 1950).

The Skipanon River

The naming of

Lewis and Clark called this stream the Skippernawin Creek on their charts. Silas B. Smith is authority for the statement that the Clatsop Indian name Skippernawin referred to a point at the mouth of the stream rather than the stream itself (McArthur, 1992).

Land modifications - wetlands and waterways

When Warrenton was young, the Skipanon was a shallow stream barely 12 inches deep at low tide (Hensley, 1950). The mouth of the Skipanon River was originally low and marshy. The river channel was widened and deepened and several tributary sloughs closed off. Federal aid provided revenue for the continual dredging of the Skipanon River mouth and the development of a harbor. One of the earliest dredging operations deepened the channel enough to allow boats drawing 23 feet to dock (Hensley, 1950).

The **Skipanon Peninsulas** were created by fill during the late 1920's-30's. These large fills have severed **Alder Cove** from Young's Bay and caused the Skipanon River to empty into the main channel of the Columbia River, rather than into Young's Bay (City of Warrenton, Baseline Community Profile). By 1931, the US Government authorized a navigation channel and dredged the tidal portion from the mouth to the boat basin: 30 foot low water depth, 200 foot wide bottom width and a 600 foot wide turning basin. Maintenance dredging operations continued every few

years. The channel work and turning basin were complete in 1939. The **Mooring Basin**, essentially a dredging and filling exercise was completed in 1957 and fill stabilization work was complete in 1958. The Mooring Basin was officially 'dedicated' in 1958 (Hensley, 1950).

The **Hammond Boat Basin** was developed much later (1975). This project, just north of Hammond and to the west of Tansy Point includes a breakwater and entrance channel. A channel 10 feet deep, 100 feet wide, and 1300 feet long connects to the Columbia River Channel (Hensley, 1950).

Alder Cove – The marsh area on the east side of Alder cove, a small portion of which is in the mouth of the Skipanon has developed since the construction of the Skipanon peninsulas in the 1930's. The biology of Alder cove is similar to Young's Bay, of which it was once part. Salinities are somewhat higher in Alder Cove, however since it is closer to the ocean with no major tributaries, the benthic populations are very high, particularly amphipods, and the area gets extensive use by downstream migrant juvenile salmon and other fishes. The Warrenton sewage lagoon effluent drains into the Cove. Alder cove tidal marshes and flats are widely recognized as a unique area (Nature Conservancy, 1974).

Except during the winter months, fresh water flow in the **Skipanon River** is low (average flow 50 cfs) and Columbia River water and ocean water are the main water masses observed below the 8th street dam. Salinity intrusion occurs here whenever salinity is present in the adjacent Columbia River waters. Despite the low fresh water flow, strong vertical differences in salinity occur during the fall, and bottom waters may become stagnant. Dissolved oxygen levels well below state and federal standards have been observed (Boley, 1975).

Almost all the flow in the Skipanon River is derived from groundwater. Discharge increases as the river flows downstream. Measurements made by the U.S. Geological Survey in the late 1960's in September indicated that flow over the spillway at Cullaby Lake was about 0.5 cfs at a time when inflow from Cullaby Creek was non-existent. Thus, groundwater flow to Cullaby Lake is sufficient to compensate for evaporation from the lake surface and still provide some excess for discharge to the Skipanon River (Boley, 1975). Today, it is not unusual for flow over the Cullaby spillway to cease in July (Jim Scheller personal communication).

Clatsop Canal Project – Carnahan Ditch

The Skipanon River did not naturally connect to Cullaby Lake as a navigable waterway. Originally the primary outlet of Cullaby Lake was the east fork of Neacoxie Creek and the area between the Lake and the Skipanon River was a series of marshy areas and open water ponds. The 'canal project' was initially conceived by pioneers as an alternate outlet to Cullaby Lake. At this time (1879) the west fork of Neacoxie Creek was being encroached by moving sand which placed a blockage in a narrow area near Sunset Lake between the present communities of Sunset Beach and Surf Pines. The east fork of the Neacoxie ran north to the south end of what is now Ridge Road and then turned south, flowing through Gearhart and entered the Necanicum Estuary. The blockage was causing lake and creek levels to rise as well as the flooding of farmland (Pickering in: C*umtux*, 1998) (Jim Scheller personal communication).

The present 'Carnahan Ditch' starts just north of the original Neacoxie Creek outlet, where now a bridge crosses to Carnahan County Park. It then travels north about two miles meeting the original southern fork of the Skipanon River (Pickering in: *Cumtux*, 1998).

The idea of the canal began as a simple one. Connect the small lakes within the swamplands by digging ditches between them. Thus connecting the Skipanon River to Cullaby Lake and draining the swales and bogs (potential fertile farmland) to improve pasture and row crop capability (Robert Stricklin personal communication). An 1879 newspaper article by James Taylor reported on the benefits of such a system: supporting commerce, draining farmland and benefiting produce delivery (Pickering in: *Cumtux*, 1998). Other, perhaps not so beneficial changes, affected the natural system as well. For example, the hydrodynamics of the system were changed considerably: the water table of Cullaby Lake and swamp area immediately east of the dunes and old railroad dropped several feet; and the Cullaby Lake outflow was directed away from its historic channel (Robert Stricklin personal communication).

By 1904 work had begun again on the canal, this time with greater seriousness and with some financial support. This re-development of the canal was to be 10 feet deep, 16 feet wide at the bottom and 20 feet wide at the top. Cost estimates ran between $6000-8000. It was also estimated that the project would drain approximately 1200 acres. Payment for the canal was drawn from the owners of the property to be drained as well as the collection of fees on logs to be transported. N.B. Bain was the first to run logs from Cullaby Lake to tidewater, floating a million board feet of logs down the River in 1905
(Pickering in: *Cumtux*, 1998). The canal was also as a source for irrigation of local crops; cranberry growers especially utilized this resource.

Roads and bridges
The earliest roads in the Skipanon Watershed were sand wagon roads, followed by "puncheon" roads and then plank roads. One of the first roads ran parallel to the Skipanon River. The earliest bridge crossing of the Skipanon was just south of the Mooring Basin (where the bridge is now) and at 3rd and Albany. Most of Warrenton's main street was built in 1918-19. In 1948, using state gas tax revenue, a street paving program was initiated, the plan was to pave four to six blocks every two years (Hensley, 1950).

8th street dam
The original purpose of the tidegate structure at 8th street was to reduce upstream flooding by minimizing high tail-water conditions caused by high tides. This water control project was the first of its kind (Public Law 566) for the U.S. Natural Resources Conservation Service (formerly the U.S. Soil Conservation Service). The project was completed by the NRCS in 1962-63 and with its completion it effectively divided the Skipanon River into two bodies of water. At the same time, two other structures were built on the system. One was a dam at the outlet of Cullaby Lake. This dam's purpose was to maintain 'adequate' summertime water levels (Kraynick and Stoevener, 1981).

The other structure built was the 'Plyter dam' which is downstream of the Cullaby outlet. There is some disagreement as to its original purpose. Kraynick and Stoevener (1981) contend that it was "originally built to maintain saturation of the peat soils in the area." However, local knowledge maintains its original purpose was designed to "keep the peat soils drained to about 30 inches below the surface enabling them to be used for agriculture, without oxidizing (the soils) more rapidly than necessary" (Robert Stricklin personal communication). The total project was built over 5 years (1962-67) and at a cost of $621,000. The project proved beneficial to development interests at Cullaby Lake and but agricultural plans (livestock and cranberries) were

not developed (Kraynick and Stoevener 1981). Recreational development (Cullaby Lake) was also supported financially by Clatsop County (Jim Scheller personal communication).

Mountain Water

In the early 1900's there were a few wells from which water was secured. Water was also collected from tall wooden tanks that caught rainwater from the roof.
In support of a growing population it was necessary to develop a reliable water supply for Warrenton as well as a number of beach communities. At the headworks in the mountains, water was piped 20 miles from the Lewis and Clark River to Warrenton. The city of Warrenton has perfected water rights issued by the Oregon Water Resources Board totaling 7.0 cfs (4.5 mgd) on the main stem of the Lewis and Clark and its tributaries and a permit allowing for an addition 20 cfs (13 mgd) on the main stem of the Lewis and Clark (1921). Sources in 1950 were the main Lewis and Clark River, the south fork of the Lewis and Clark, the south fork of the south fork of the Lewis and Clark and in the late 1940's, Camp Creek a tributary of the Lewis and Clark was added. Replacing a wooden dam with a cement dam in 1946 helped insure a continuous water supply. In 1940 a water line was built by the WPA to insure water for Fort Stevens (Hensley 1950).

Industry

Fishery

Long before the salmon fishery was exploited by white traders and settlers, the Indian fishery thrived along the Columbia. One study hypothesizes an approximation of the number of salmon consumed by Indians along the Columbia per year, around the beginning of the nineteenth century. The number estimate is eighteen million pounds of fish which is considerably lower than salmon and steelhead trout landing from 1874 to 1937 (Vaughan, 1980).

In the early years of settlement, fish was either used fresh or dried. Some experimentation by the Hudson Bay Company tried pickling the salmon, but were informed by recipients that the product was unusable. Canning was not brought to the Columbia until 1866. The fish canning industry peaked on the Lower Columbia River in 1883; 55 canneries were in production at this time. Up until 1889, all the salmon canned was king Salmon (Vaughan, 1980). The year 1889 marked the first year other salmon was canned on the Columbia and perhaps announced a decline in kings.

In Warrenton history the east side of the lower Skipanon River became home to fish canneries and storage facilities. Also, because of early dredging of the shallow Skipanon River mouth a good sized fishing fleet called the Skipanon its home port.

At the turn of the century claming was a major occupation in the region. Crabbing also began to be developed as a fishery in 1914. Early canneries on the Skipanon included the Warrenton Clam Company and the Clatsop Clam Company (employed 100 diggers, 25 cannery workers). Until the 1940's claming licenses were not required. Claming began to decline in 1930-35 (Hensley, 1950), which is the same time the extension of the Columbia River South Jetty was completed.

The San Juan Fishing and packing company was located in Warrenton in 1944. Its production line included fresh fish, fillet fish, frozen fish and shell fish, as well as a small crab canning line added later.

As early as 1926 Bio-Products (Now Bio-Oregon) pioneered the production of fish liver oils, preservation of salmon eggs for trout bait and the addition of salmon oil to fancy pack Chinook salmon. A variety of successful products continue to be produced annually (Hensley 1950).

Salmon on the Skipanon
Very little historic information exists about the salmon stocks of the Skipanon River. Local anecdotal information suggests that at one time coho salmon spawned in Perkins Creek. It has also been suggested that fish migrated up the old outlet (Neacoxie) of Cullaby Lake and into the Cullaby Creek system.

The estuarine area of the Skipanon, which once connected directly to the Young's Bay System was an excellent feeding area for juveniles as they waited to enter the Columbia System and then the Pacific Ocean. This system was probably an excellent place for adult salmon to wait for spring freshets to initiate upriver spawning migrations.

The Oregon Department of Fish and Wildlife has very little information on the Skipanon River, the only earlier work is a survey done by Oregon Department of Fish and Wildlife in 1952 on Cullaby Creek. It seems very unlikely that salmon can find their way up the Skipanon River, through the 8th street structure, up the Carnahan Ditch, around the Plyter dam, and over the Cullaby dam to Cullaby Lake and then to Cullaby Creek to spawn in limited habitat. [Please refer to the Fisheries Chapter of the Watershed Assessment for more recent survey data (1990 – 92)].

Cullaby Creek (ODFW survey notes 1952)

the naming of
Named for Cullaby, a well-known Indian on Clatsop Plains (McArthur, 1992).

Cullaby Creek at this time was described as a slow moving and comparatively deep stream, with a ditch like appearance. Hard gravel was observed only in the extreme upper end of the survey; however silvers were observed actively spawning in patches of "gravel like shale" throughout the entire survey. Cullaby Creek was not an ODFW hatchery release site.

The survey describes the lower section of the Creek as flowing through a "park like basin" with very little underbrush. The flow in the upper portion is interrupted by three beaver dams and there is considerable underbrush. A number of beaver dams were found throughout this section of the Cullaby Creek.

The completed survey included about 2 miles of the upper part of the creek. Within the lower section of this survey the biologist found 18 live silvers, including 2 jacks. In the upper section of the survey, the biologist found 102 live silvers, including 27 jacks. Most of the fish observed appeared to be actively on the move and could be seen moving over shallows, jumping small falls or actively spawning. All fish appeared to be exceptionally large and in excellent shape – no sore spots.

Only one fish (33 inches long, tags and caudal fin clipped) that was observed (and this one captured) was a hatchery marked fish.

Non-anadromous fish
In a 1968 ODFW report, fifteen non-salmonid species of fish, many of which were non-natives, were determined (or believed to be) within the waters of the North Coast Basin (i.e., Nestucca Basin and north, including the rivers of the lower Columbia River (east to Clatskanie). These fish included; carp, chiselmouth, chub, sculpin, dace, goldfish, lamprey, peamout, shiners, squawfish, stickleback, suckers, tench and troutperch.

There are also a number of warm water fish found throughout the Skipanon Watershed's lakes. Some of these fish are annually stocked by the ODFW.

Distribution of warm-water game fish (lakes and ponds with public access)
Coffenbury Lake – Yellow perch, brown bullhead
Crabapple Lake – Largemouth bass, yellow perch
Cullaby Lake – White crappie, black crappie, yellow perch, brown bullhead, large mouth bass
Smith Lake – Large mouth bass, yellow perch, bluegill, white crappie, black crappie, and warmouth
Cemetery Lake – Yellow perch, white crappie, largemouth bass, bluegill
West Lake, brown bullhead, yellow perch, largemouth bass
Sunset Lake – Yellow perch, large mouth bass, brown bullhead.

Agriculture
As noted previously, farming was a major industry in the late 1800's and early 1900's within the basin. Livestock, root vegetables, flowers and cranberries were grown early on as agricultural commercial crops. The Clatsop Cranberry Association was established in 1917.

Forestry
A large part of the industrial development of Clatsop County is based on the harvesting and manufacturing of its forest resources. Both Warrenton and Astoria had sawmills of importance in 1937 and the rafting of logs at the mouth of the Skipanon River was a prominent activity. Lumbering led all other industries in the county in the number of persons gainfully employed. According to the Bureau of the Census report of 1930, there was a total of 2,295 persons employed in forestry, which includes all woods work such as logging, pulpwood cutting, planing mills, fire patrol, etc. (Wyckoff, 1938).

For the period 1925 to 1936, inclusive, the average annual production of saw-logs in the county was 385,970 Million board feet. During this period, Clatsop outranked all counties in the state in volume production. Approximately half the logs produced in the
county were exported. Most of these were utilized by mills that obtained logs from the Columbia River Market. However, veneer logs were often sent to Grays Harbor and Puget Sound, large rafts were towed to California ports, and some logs were shipped to other countries (Wyckoff, 1938).
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Largest of Warrenton's industries located on the Skipanon in 1950 was the Prouty Lumber and Box company which turned out about 175,000 board feet of lumber a day. Year round (1950) employment was for 175 men. This was the only mill that ran continuously through the depression. Originally (1913) located in Seaside it was later (1921) moved to the Skipanon (Hensley, 1950).

Other mills in operation during the first part of the 20th century on the Skipanon included a number of sawmills and shingle mills. Logs were boomed up near 3rd street and were boomed there at least until the 50s (Diane Collier personal communication).

1930's Forests

The following information is from: Forest Statistics for Clatsop County, Oregon Department of Agriculture, Pacific Northwest Forest and Range Experiment Station, Steven Wyckoff, Director, July 15, 1938

The forests of Clatsop County were inventoried by the Forest Service first in 1930 as a part of a nation-wide survey of forest resources. In September 1933, following a disastrous Wolf Creek fire (NehalemWatershed), the inventory was brought up-to-date by re-mapping the burned area and adjusting the type area and merchantable timber volume data for both fire and cutting depletion occurring since the original survey in 1930. A statistical report summarizing the data obtained in the original survey and the revision was issued in 1934. In the fall of 1937 the data were again made current, this time through field examination extending over the entire county and recompilation. The data gathered from this inventory and summarized was for the county as a whole - watershed scale analysis was not incorporated. The following is a summary of the Skipanon Watershed. For a complete inventory please see original document.

Clatsop County's forest land in 1937 amounted to about 478,375 acres. For this 1937 survey the land was divided into 21 cover types. The non-forest land, amounting to 47,000 acres or less than 10 percent of total area of the county, was approximately two-thirds under cultivation while one-third consisted of grass, brush, and dunes, barrens and cities. Figure #1 shows the extent and type of areas as of 1937. The forests were divided into two broad groups; those dominated by Douglas fir and those dominated by the pulpwood species, principally western hemlock and Sitka spruce.

Types dominated by primarily western hemlock and Sitka spruce are distributed over 214, 000 acres of forest land in the western and northern parts of the county. These lands now represent primarily the Skipanon, Lower Young's Bay and Nicolai-Wickiup watersheds. This area is about equally divided between types of saw-timber size and those less than saw-timber size. Western hemlock is the key species on 183,000 acres, Sitka spruce on 24,000 acres, and the balsam firs on 7,000 acres.

The Skipanon Basin was generally all 2nd growth forest land and non-forest land. Close to half the land within the Skipanon is identified as non-forest land (Figure 1). The Skipanon Watershed at this time lacks saw-timber lands and burned over / deforested lands. Thus, the general county statistics do not well represent the Skipanon's forest resources.

The primary forest of the Skipanon in 1938 is of immature trees. Immature forest types occupy 171,500 acres in Clatsop County. On approximately 79 percent of this area the original stand

was logged and on the remainder it was depleted by fire. Most of the fire area was within the Nehalem watershed (Wolf Creek area). Although these types are distributed over the entire county, they cover considerably more area in the north half than in the south half. The north part of the county includes the Nicolai-Wickiup, lower Young's and the Lower Skipanon watersheds. Western hemlock was the predominant species for this type class, covering 103,500 acres. Douglas fir covered 61,500 acres, and Sitka spruce covered 6500 acres respectively. Types consisting of stands in which most of the trees are six inches or more in diameter at breast height (DBH) occupied 55 percent of the area of immature types. Types composed of stands in which most of the trees were less than six inches in DBH occupied 45 percent.

Approximately 87 percent of the forest land in the county and 94 percent of the saw-timber volume was privately owned in 1937. The bulk of the remaining forest land and timber volume was in county ownership, having obtained it through tax delinquency. The county's forest land and timber volume doubled from 1933 to 1937. In 1933 it owned 27,000 acres of forest land and 148 million board feet of timber; by 1937 it owned 60,000 acres of forest land and 380 million board feet in timber.

Beginning with bull-team logging about a century ago, methods used in lumbering in the county kept pace with or led other sections of the Douglas fir region. Heavy equipment for high speed logging and rail transportation was still the common method used in 1937, and the trend since about 1930 was toward lighter equipment, consisting of tractors for yarding and trucks for transportation. In 1937 there were over 25 logging operations in the county using trucks exclusively and most of the operations using railroad facilities supplemented these by trucks when practical.

The logging practice most common in the Douglas fir region was to clear cut the forest and to log with powerful donkey engines; which disturbed surface-soil conditions and leaves on the logged areas, in addition to the original duff layer, great quantities of slash were created.

Log dumping, rafting and storage and their impacts
Logs were rafted within the Skipanon River, from Cullaby Creek to the mouth of the Skipanon River and more than one log dumpsite was located in the tidal area of the Skipanon River.

These practices posed impacts, on both the physical and chemical aspects of the river. Research findings on such practices show that log debris, bark and wood leachates resulting from log handling activities impacted water chemistry (quality) and the benthic biological community.

The primary problems with bark debris in water resulted from debris accumulation on the bottom of the river, particularly in or near dumpsites. Past work by Williamson and Schaumburg reported the results of studies on oxygen demand associated with bark deposits. Results for a typical dumping area indicated that organic levels, as measured by

total volatile solids per cubic foot, increased by 2.1 pounds compared with values in a control area. In storage areas the increase in volatile solids was approximately half that for the dump areas. Oxygen uptake rates for the sediments at these sites were 30 to 70 percent higher than control areas (Pacific Northwest Pollution Control Council, 1971).

The effects of this increased oxygen demand are twofold. Dissolved oxygen levels in the overlying waters may be depressed below levels necessary for the maintenance of a productive biological community. Even if the bulk of the overlying water is not significantly affected the demand may be sufficient to create an anaerobic layer near the bottom. Extensive bottom deposits of bark also create a physical barrier to development of a healthy benthic community. Bark and other wood debris can blanket the bottom so thoroughly as to smother existing benthic forms and prevent re-population of the area (Pacific Northwest Pollution Control Council, 1971).

Leachates represent the second major category of wastes originating from water-based log handling operations. Water storage of logs results in a significant release of soluble, organic compounds. These leachates are usually highly colored and can exert a substantial oxygen demand (Pacific Northwest Pollution Control Council, 1971).

Conditions at abandoned, in-water dump sites showed a wide variation to continued impacts. Within rafting areas, divers found that, in general, conditions in the vicinity of the rafts were normal with an abundant population of aquatic plants and animals. The only noticeable effect was a decrease in plants due to shading (Pacific Northwest Pollution Control Council, 1971).

The obvious alternatives to log handling and storage in water are land-based operations. Many mills at this time utilized both land storage and huge cold decks. Some field investigations show leachate runoff that may (or may not) affect neighboring waterways - depending on a number of variables (e.g. dilution factors) (Pacific Northwest Pollution Control Council, 1971).

At present, there exists a rafting and land storage site (Willamette Industries) on the west bank of the lower Skipanon River, as well as an on land storage site (Nygaard) at Tansy Point. Old dumpsites still remain and the historic volume of logs dumped, rafted stored and handled in the Skipanon Watershed was significant.

The Clatsop Plains

The Skipanon River Basin makes up Clatsop County's coastal margin. The Clatsop Plains make up the portion of the basin that lies east of the Skipanon River, parts of which drain south, north, east and west. The Plains extend about 17 miles from the mouth of the Columbia River to Tillamook Head and are about one and one-half miles wide. Bounded on the west by the Pacific Ocean and on the east by the foothills of the coastal mountains, the Plains make up a significant land area of the Skipanon Watershed. They also are a significant component of those watersheds just south of the Skipanon to Tillamook Head. The climate within the Plains is moist, marine and temperate (Frank, 1970).

The Clatsop Plains consist of parallel ridges of stabilized dunes formed by materials discharged by the Columbia River through long-shore currents and then blown inland. Some of the dunes rise to 80 feet above sea level. The dune sands form a coastal shelf lying over bedrock of the Astoria Formation and extending out under the Pacific Ocean. The dunes are very permeable and are the principal water-bearing formation in the Clatsop Plains. Lesser amounts of water are also contained in the Astoria Formation (Frank, 1970).

Direct precipitation is the primary source of water entering the Clatsop plains aquifer, although some natural inflow may occur as underflow from the foothills of the Coast Range or in small ephemeral foothill streams that percolate into the ground at the base of the hills. Water leaves the aquifer by discharge to the ocean, either directly as subsurface flow or indirectly as discharge to surface streams, primarily the Skipanon River and Neacoxie Creek (Frank, 1970).

Most of the precipitation (78.5 annual average), an estimated 50-60 inches, percolates into the ground. It is estimated that the Clatsop Plains dune sand aquifer contains about 900,000 acre-feet of water. Water in some areas of the aquifer has a short residence time, emerging as discharge to surface waters in hours, days or weeks, while water in other portions may be retained for decades (Frank, 1970).

A distinct feature of the Clatsop Plains is the lakes within this dune area. Between these dunes are several long, narrow lakes: Coffenbury Lake, Sunset Lake, Smith Lake, West Lake, Crabapple Lake, Wild Ace Lake, Slusher Lake and Clear Lake. Most of the lakes in the Clatsop plains have no streams entering or leaving them and are formed entirely by surfacing groundwater, and the water level fluctuates with seasonal changes in the water table. Cullaby Lake is the major exception in that it is partially fed by a foothill stream, Cullaby Creek. Water levels in the lakes are directly related to water levels in nearby groundwater wells. Measurements made by the US Geological Survey in the 1960s demonstrated that lake and well water levels closely reflect each other with little time lag (Tolle, 1974).

Data on groundwater quality in the Clatsop Plains are available from several sources. Data from 38 wells in November 1966 indicated that the " water is of generally good chemical quality for most domestic and industrial uses. Most of the groundwater is odorless, has a satisfactory taste, and has a temperature about the same as the mean annual air temperature. Water from the lakes and some of the shallow wells in marshy areas is brown: otherwise the water in the Clatsop Plains is colorless. The brown color probably is caused by dissolved organic material, which was not identified in the analysis (Frank, 1970).

Dunes Reclaimed

Beach grass was planted in 1935 along a 20 mile stretch of beach to stabilize dunes. It has been suggested that the practice of grazing cattle during the early pioneer days (1850-60) was responsible for the cropping of the native grasses and the subsequent dune destabilization (Hensley, 1950).

15,000 pickets every mile were placed along the newly planted beach grasses. The workers were Civilian Conservation Corps Youth, under the direction of the Soil Conservation Service. The goal of the program was to restore vegetation to the dunes. The SCS nursery grew hundreds of different grasses and experimented on their propagation (Hensley, 1950).

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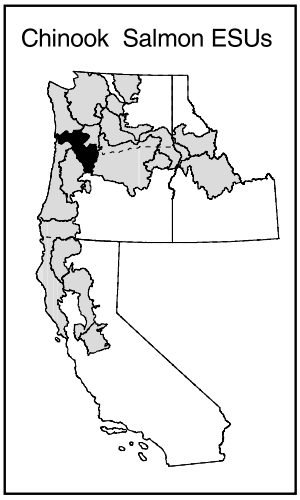
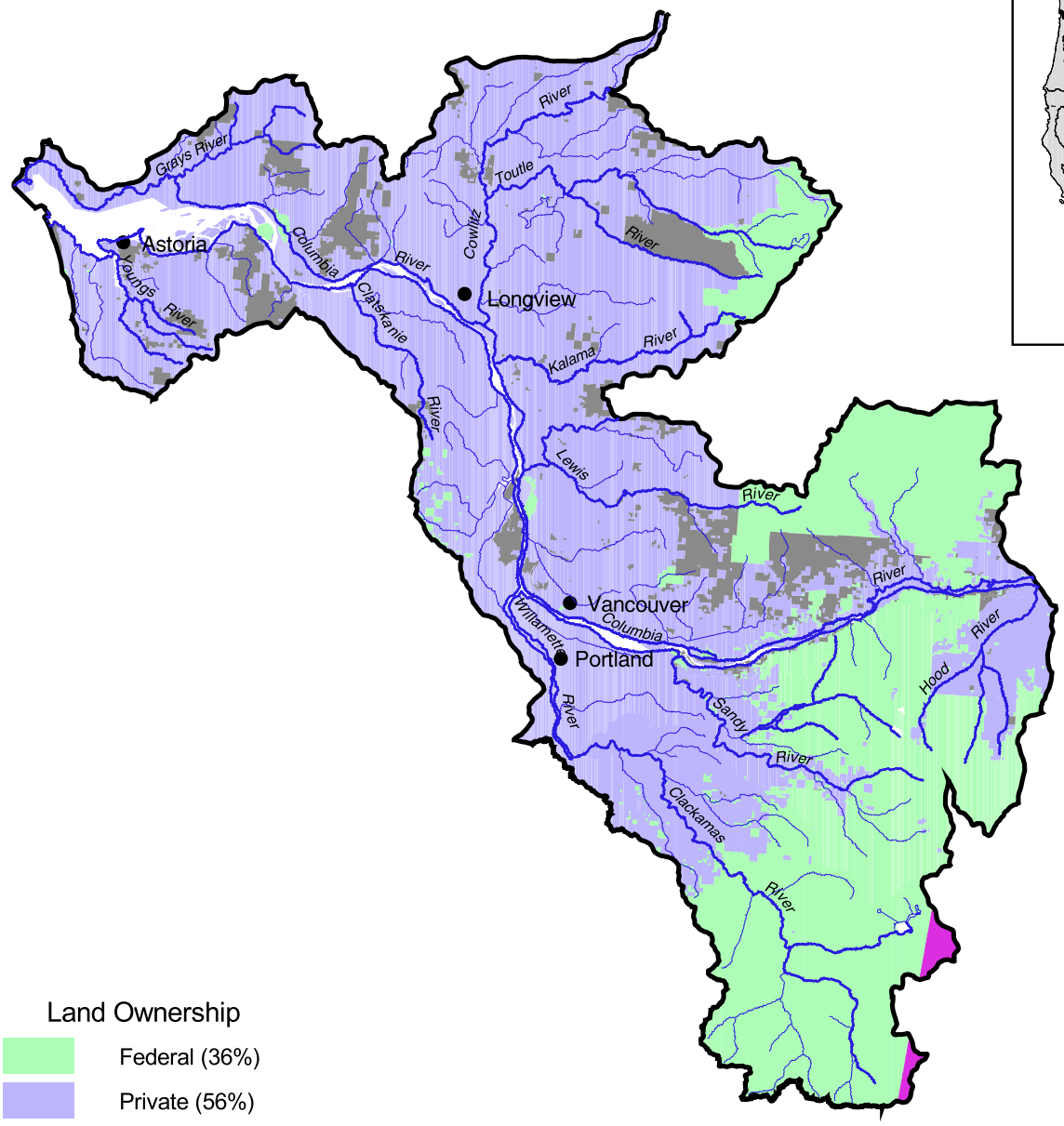
APPENDIX B

SALMONID ESUs

LOWER COLUMBIA RIVER
CHINOOK SALMON ESU





Land Ownership

- Federal (36%)
- Private (56%)
- State/Local (7%)
- Tribal (1%)

United States Department of Commerce
National Oceanic & Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
HABITAT CONSERVATION DIVISION
525 N.E. Oregon St., Suite 410
Portland , OR 97232
Tel (503) 231-2223

Scale:

10 0 10 20 30 Miles

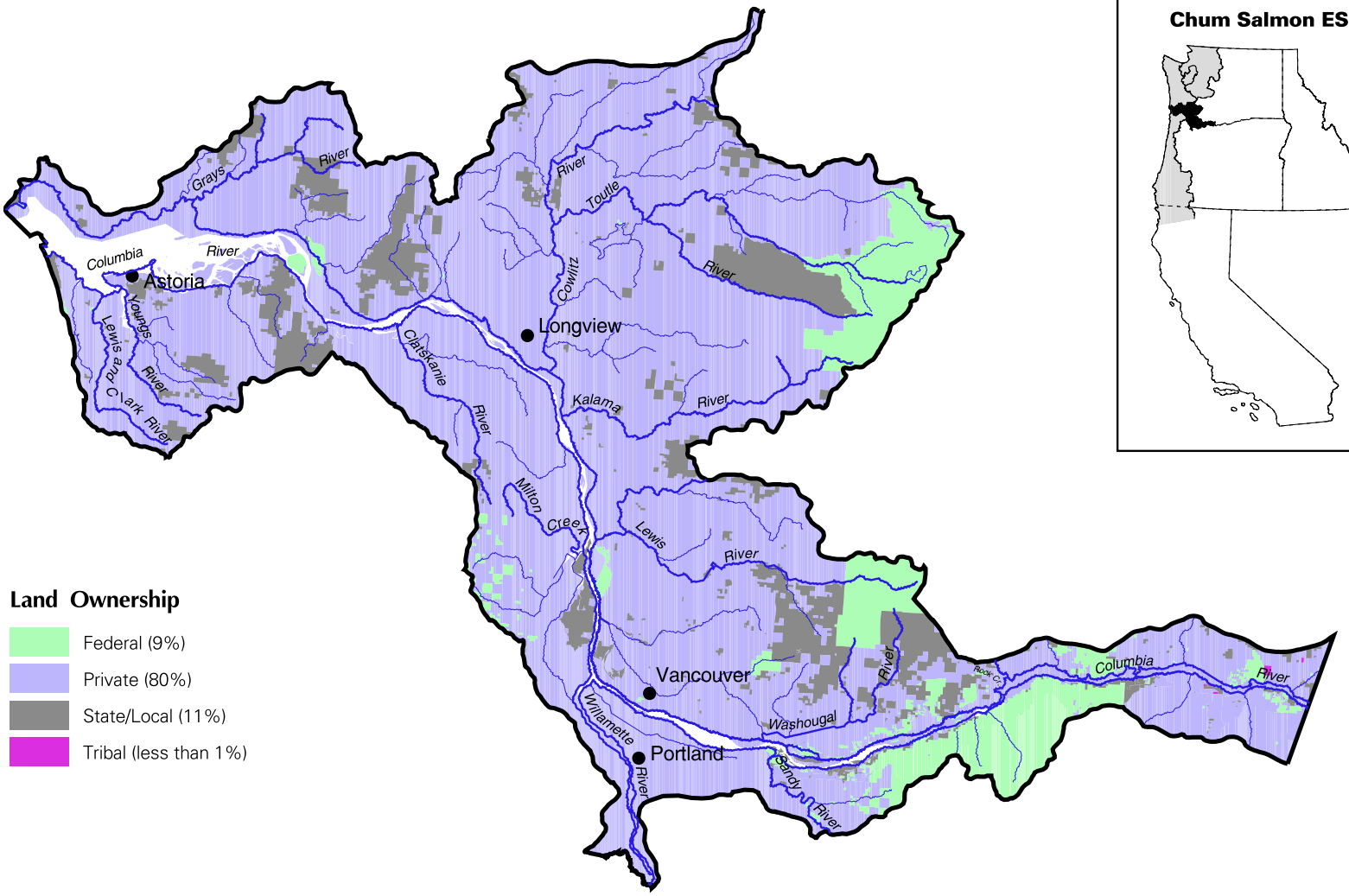
10 0 10 20 30 Kilometers

MAP DATE: 3/9/99

CREATED BY D.A.
HCDGIS\RGN\WS\STONE\CHIN

Note: Map is for general reference only.

COLUMBIA RIVER CHUM SALMON ESU



Land Ownership

- Federal (9%)
- Private (80%)
- State/Local (11%)
- Tribal (less than 1%)

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Portland , OR 97232
Tel (503) 231-2223

Scale:

5 0 5 10 15 Miles

5 0 5 10 15 Kilometers

MAP DATE 2/23/99

CREATED BY: D.H.
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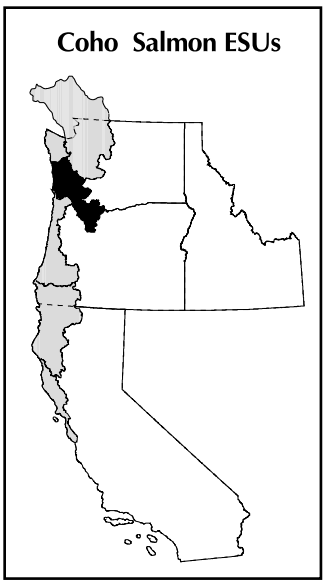
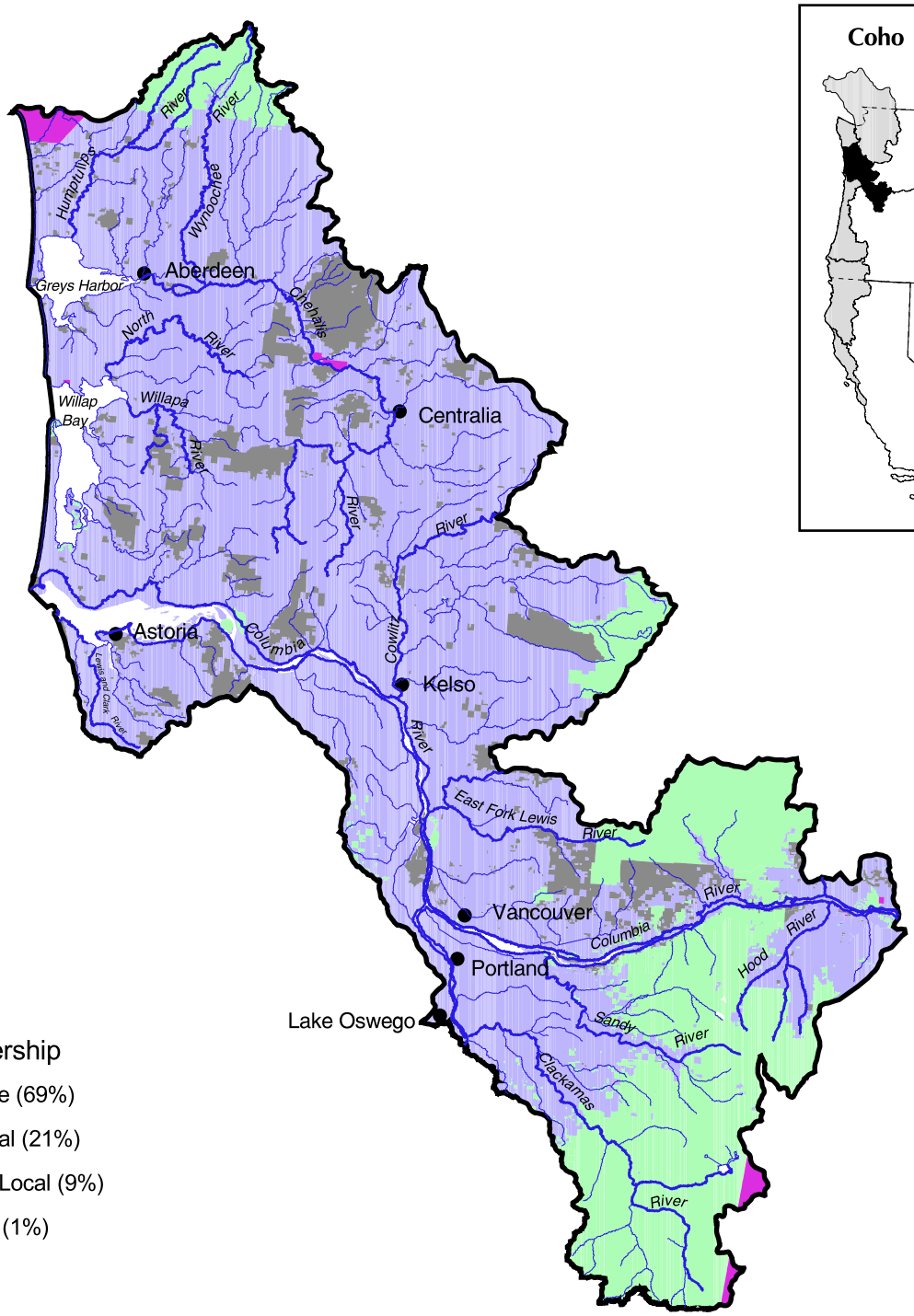
Note: Map is for general reference only.

SOUTHWEST WASHINGTON / LOWER COLUMBIA RIVER COHO SALMON ESU





Land Ownership

- Private (69%)
- Federal (21%)
- State/Local (9%)
- Tribal (1%)

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HABITAT CONSERVATION DIVISION
525 N.E. Oregon St., Suite 410
Portland, OR 97227
Tel (503)-231-2223

Scale:

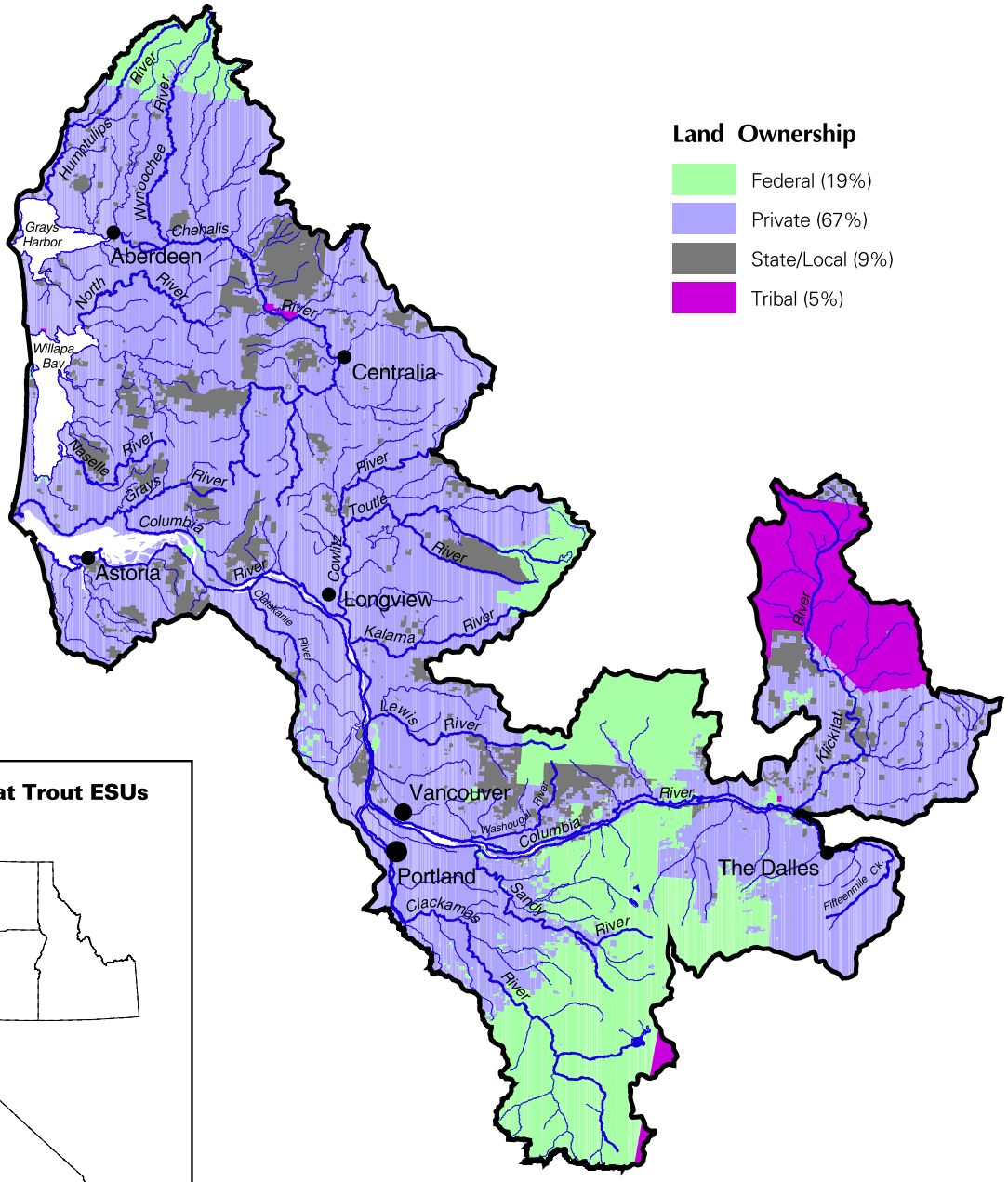
10 0 10 20 30 Miles

10 0 10 20 30 Kilometers

MAP DATE 2/20/99
Created by D.A.
HCDGIS\RGN\WS\STONE\COHO

Note: Map is for general reference only.

SOUTHWESTERN WASHINGTON/COLUMBIA RIVER CUTTHROAT TROUT ESU



Cutthroat Trout ESUs

United States Department of Commerce
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HABITAT CONSERVATION DIVISION
525 N.E. Oregon St., Suite 410
Portland , OR 97232
Tel (503) 231-2223

Scale:

10 0 10 20 30 40 Miles

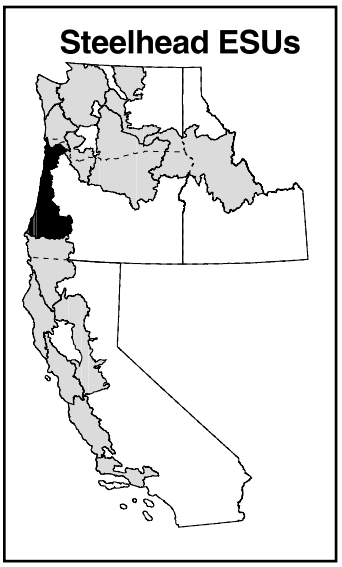
10 0 10 20 30 40 Kilometers

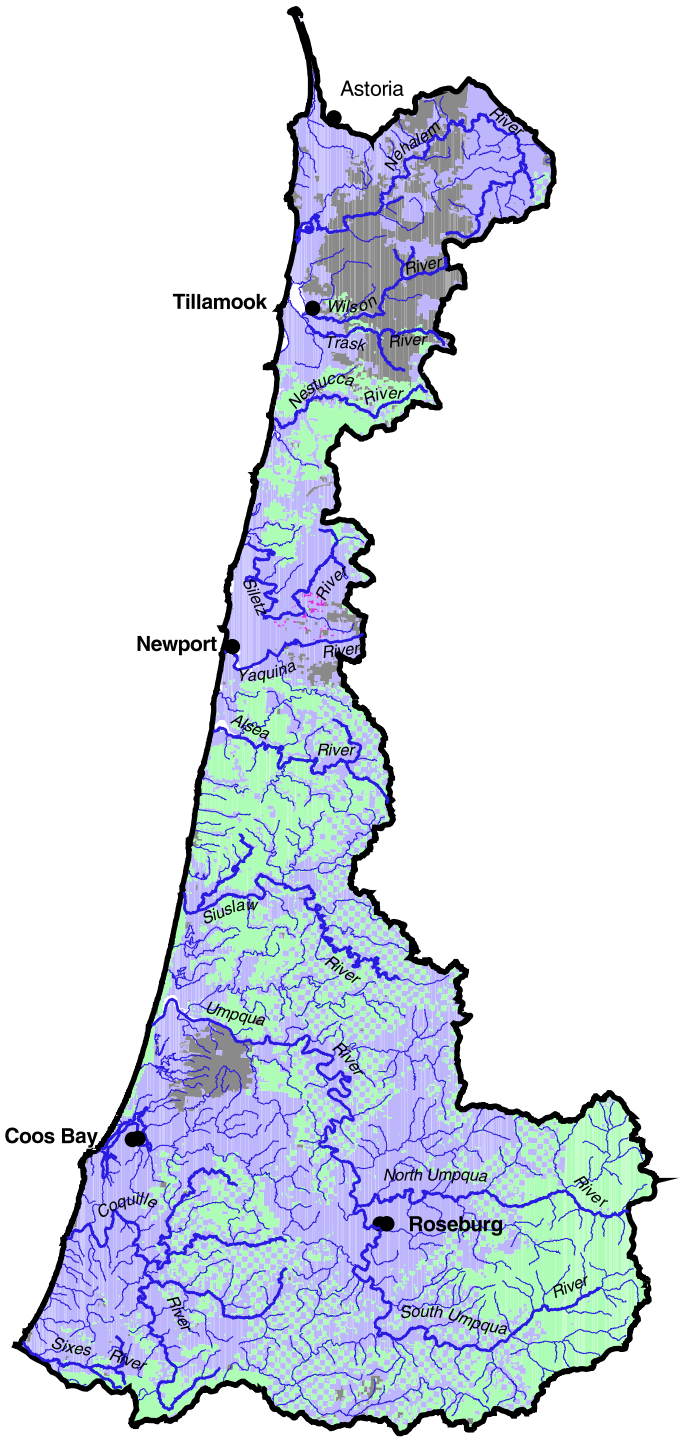
MAP DATE: 2/24/99

CREATED BY: D.H.
HCDGIS\RGN\WS\STONE\CUTTS\

Note: Map is for general reference only.

OREGON COAST STEELHEAD ESU





Land Ownership

- Federal (35%)
- Private (56%)
- State/Local (8%)
- Tribal (less than 1%)

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SCALE:
10 0 10 20 Miles
10 0 10 20 Kilometers

MAP DATE2/17/99

CREATED BY D.A.
HCDGIS\RGN\WS\STONE\STEEL

Note: Map is for general reference only.

APPENDIX C

TIDEGATE SURVEY

Site Description Estimated sizes GPS ID	**Condition**	**Lat./ Long.**	**To do?**	**Comments**
Survey times Summer 1999, Winter 2000				
1 Gate 2.5-3' size MSD210	OK. Moves by hand. Steel culvert, iron flapgate	N 46.15912 W 123.92737	OK	@ west bank drains wetland residential yards
3 Gates 8' X 10' MSD11	All OK Al./steel 1 gate new, 1 gate rebuilt, 1 @ 5 yrs old, bad shape	N 46.15883 N 123.92653	OK	Fish holes in gates (2) 3' X 4' (1) 1'X1'
1 Gate 15" gate MSD212	Not functioning Poor repair, wooden culvert, iron flapgate jammed open, hole @ top	N 46.14989 W 123.92426	OK	N of old HWY 101 @ Bridge, East bank of Skipanon, private culvert and gate, allows wetlands to inundate.
5 gates with Iron Doors ~ 4'x5' ASD11	OK	N 46.1644 W 123.9009	OK	1 with fish door, Middle gate has hole. Incoming from West (Tansy Cr.), East (Alder Creek), outlet faces N East. Good flushing and estuarine input.
1 Gate 4' Gate HSD31	Aluminized steel culvert (newer), with flap gate and fish door	N 46.1644 W 123.9009	OK	Culvert connects Holbrook slough to Columbia River
2 Gates 5'X 5' rectangular concrete culverts w/ flapgates ASD3	One gate fell off last winter. Not much movement of water in and out	N 46.164124 W 123.88983	Change to new aluminum gates with fish doors.	Stagnant water behind gates
1 Gate 3' Gate Wooden culvert, flap gate, east bank MSD21	Back of culvert broken, gate OK at river end	N 46.16867 W 123.91291	OK	No apparent reason for gate, no developed or developable land behind gate, beaver dam, small fish (unk)
NEXT	**NEXT**	**NEXT**	**NEXT**	**NEXT**

Site Description **Estimated sizes** **GPS ID**	**Condition**	**Lat./ Long.**	**To do?**	**Comments**
1 Gate 1' gate steel culvert, iron flapgate, near (N) Harbor street, North of bridge. East bank of S. River MSD22	OK	N 46.16556 W 123.92059	OK But see comments	Drains Marina (north) and Skipanon mooring basin parking lot directly into Skip. River. Point source? Traps? Maintained?
1 Gate 1' Gate Steel culvert, iron flap gate (S) Harbor St bridge, East bank of Skip. MSD23	OK	N 46.16513 W 123.92072	Ok But see comments	Drains Skip. Mooring basin / marina parking lot. Pt source? Traps? Maintained?
1 Gate 5' Gate Steel culvert with iron flaps (s) Harbor street bridge, east bank on Galena. MSD24	OK	N 46.16300 W 123.91762	Replace with larger gates, move away from home, include fish door	Marginally effective culvert that controls SR slough. Significant water quality problems at slough side: aquatics, stagnant water, and erosion at culvert outflow threatens home.
1 Gate 21" Gate South of Harbor Street bridge, west bank of Skip. MSD25	OK	N 46.16523 W 123.92124	OK	Drains wetlands west side of dike, storm drain
1 Gate 1' Gate North and South of canoe ramp (2nd street) MSD26	Marginally effective, difficult to move by hand	N 46.16261 W 123.92215	Replace?	Drains ditched wetlands, drains graveled road and parking lot
1 Gate 1' Gate North of Harbor St. on Skipanon Drive. West bank of Skipanon MSD27	No flap gate, steel metal culvert Entry point is large grate. SHARE entry with MSD28	N 46.16724 W 123.92268	OK Unless flood control is needed	Drains ditch along North side of NE First Street.
1 Gate 4' Gate See above MSD28	Rusted steel culvert, iron flapgate still opens, SHARE entry with MSD27	N 46.16713 W 123.92293	OK	Drains ditch along North side of NE First Street.
NEXT	NEXT	NEXT	NEXT	NEXT

Site Description **Estimated sizes** **GPS ID**	**Condition**	**Lat./ Long.**	**To do?**	**Comments**
1 Culvert 8" Culvert MSPS1	Culvert OK, not a tidegate	N 46.16881 W 123.92049	Point source? Filters? Maintained?	Drains parking lot and Skipanon Drive at Skipanon Marina, West bank of the Skipanon
1 Gate 3-4' Gate MSD29	Steel culvert with iron flap gate, OK, working	N 46.16172 W 123.92646	OK But see comments	Drains ditch on west side of dike, which in turn drains the city park (parking lot, fields, etc.) at 4th Street.
1 Gate 15" Gate MSPS2	No flap, steel incased in concrete culvert	N 46.16201 W 123.92563	OK Check this out with City Public Works. Understand function.	??Appears to be way station ? Water pumped out with force, also grated culvert (3') draining wetland
1 Gate STG30	Wood Culvert Iron Gate Not functioning	N 46.15476 W 123.92190	Repair/Replace Best to have gate open	
1 Gate STG31	Wood Culvert Iron Gate Not functioning	N 46.15568 W 123.92367	Repair/Replace Best to have gate open	
1 Gate STG32	Wood Culvert, Iron Gate, Not functioning	N 46.16115 W 123.92309	Repair/Replace? Leave open?	Drains Skipanon Slough area
1 Gate 1' Gate STG33	Flap gone	N 46.16253 W 123.91900	Open, OK	
1 Gate Old Skipanon Creek OS1-	Culvert placement to high and to small	N 46.13490 W 123.92099	Repair/replace Needs to be lower and larger	On county road
1 Gate Skipanon River near high school SHS-1	Wood culvert, Iron Gate, Not functional	N 46.14674 W 123.92912	OK Open	

* for GPS

Summer 1999 survey ~naming sequence used:

M = Main

S = Skipanon

D = diking district

e.g. MSD21 = Main Skipanon Diking District #2, tidegate #1

Winter 2000 survey ~ naming sequence used:

S= Skipanon

TG = Tide Gate

OS = Old skipanon

SHS = Skipanon at High School