APPENDICES

APPENDIX A

HISTORY OF YOUNGS BAY WATERSHED

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APPENDIX A
HISTORY

Young's Bay 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
- 12,000 years ago last Ice Age floods scour the Columbia River
- 10,000 years ago Native Americans inhabit the region (earliest documentation)
- 1700s – early part of the century last major earthquake
- 1780 estimates of the Chinook population in the lower Columbia Region:
  2,000 total - 800 Chinooks (proper), 300 Clatsops, 300 Wahkiakums, and 450 Kathlamets
- 1770s-1790's - Europeans explore and settle Oregon and region, bringing with them disease/epidemic (smallpox) to native populations. Some native coastal populations wiped out.
- 1790's Robert Gray and other Europeans came to Oregon Coast for exploration and trading
- 1792 Lieutenant William Robert Broughton, of Vancouver's expedition, explored and named Young's Bay and River
- 1805-06 Lewis and Clark expedition, winter camp at Fort Clatsop
- 1811 Fort Astoria established by the Pacific Fur Company of John Jacob Astor
- 1812 –1820 Fur trade at its peak
- 1812 – War of 1812
- 1825 Native population half what it was at European contact
- 1830's epidemics of malaria, measles and small pox strike again, native populations decimated; from the Dalles to the Mouth of the Columbia, few Chinook Indians left
- 1840 missionaries (Lee and Frost) come to the mouth of the Columbia River
- 1840's Young's Bay area settled
- 1842 William Hobson, early settler sent back to Europe for Scots Broom seed
- 1844 three permanent families in Astoria
- 1845 Dairy agriculture was established. But it wasn't as popular as other business ventures ~ easier money could be made at the logging camps, fishing and claming.
- 1850 Donation Land Law, large pieces of Oregon Territory land were donated to settlers
- 1850's Finnish and Scandinavians immigrate to the region
- 1851 One of the earliest Sawmill operations in the region opens ~ Harold Logging Company and Sawmill at Ft Clatsop.
- 1853 Preston Wilson Gillette, receives three boxes of fruit trees, seeds and ornamental shrubbery from his father in Ohio
- 1853 – Gillnets introduced to the salmon fishery
- 1861 - 150 European settlers in Clatsop County
- 1862 Federal Homestead Act, 160 acre parcels could be purchased for a small fee
- 1885 first 1000 feet of South Columbia River Jetty, 1894 completed, 1913 - 2.75 mile extension
- 1863-94 1000 people applied for land through the Homestead Act in Clatsop County
- 1883 reached a peak for canneries (55) at the mouth of the Columbia (both sides), 4000 employed - mostly Chinese workers
- 1884 first logging of Lewis and Clark Basin above tidewater; first logging above Young's River Falls above falls
- 1887 Walluski River watershed area settled

- 1888 right of way secured by the Astoria and South Coast railway
- 1889 other salmon besides Chinook are canned
- 1898 RR completed Portland to Seaside to Astoria –Columbia River Railroad co.
- 1889 steam donkey first used in Clatsop County in Logging
- 1893 fire out of the east, within the Walluski basin
- 1894 flood year
- 1900's - 27 dairies delivering milk to Astoria (includes Young's, Skipanon and Nicolai-Wickiup)
- 1902 (September 12) Forest fire begun at Matson Camp within the Walluski
- 1913 Klaskanine Hatchery is built
- 1915 – 1920 Palmer Logging Company logs the Walluski Valley
- 1917 Columbia River North Jetty Completed, ~ 2 miles long
- 1920s-30s Scots Broom Festival in Clatsop County
- 1933 Flood Year
- 1955 Flood year
- 1969 logging roads begin to cover the forests
- 1972 Eldon Korpula (Astoria High School Hatchery Program) establishes coho and Chinook plantings in Young's Bay.
- 1977 Clatsop County Economic Development Council's Fisheries Project (Net Pens) begins
- 1996 Flood year
- 1998 Young's Bay Watershed Council formed
- 2000 Astoria High School Hatchery Program releases 5,000 coho and 10,000-20,000 Chinook

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 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

The primary soils of the lowlands for the Young's Basin are Coquille-Clatsop and the Grindbrook-Walluski-Hebo. Both these soil types are found on flood plains, terraces, and dunes in the fog belt. The C-C soils are very deep, very poorly drained silt loam and muck and are located on tide influenced flood plains. The G-W-H soils are deep to very deep soils, moderately well drained and poorly drained silt loam and silty clay loam; on terraces (Smith and Shipman, 1988).

The primary upland soils of the Young's Basin are Skipanon-Templeton-Svenson, Klootchie-Necanicum-Ascar, and the Caterl-Laderly- Murtip. The S-T-S and K-N-A soils are found on mountains in the fog belt. The S-T-S soils are deep and very deep, well drained gravelly silt loam, silt loam, and loam. The K-N-A soils are deep and moderately deep, well drained silt loam, gravelly loam, and extremely gravelly loam. The C-L-M soils are cold soils found on the mountains and are deep and moderately deep, well-drained gravelly silt loam, very gravelly loan, and loam (Smith and Shipman, 1988).

Schlicker, et al. (1972) assigned several separate geologic units to the sediments of the Young's Bay estuarine river floodplains. They separated the units into terrace alluvium, flood-plain alluvium, peat, sand and tidal flats (Boley, 1975).

Alluvial terraces are formed when uplift of land causes rivers to cut downward through floodplain deposits. As downward and lateral erosion within the valley produces a younger floodplain 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 floodwaters commonly rise above the banks of the down-cutting river, several feet of fine-grained sediment usually mantle the terraces. 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).

Young flood plain alluvium predominates in the lowlands along Young's Bay. Major expanses of silt, clay and related sediments are widespread. Seaward from the bay, silt and clay merge with the tidal flats, and upstream they form a mantle of decreasing thickness over interbedded gravels and fine-grained sediments. The thickness of the young floodplain alluvium is generally less than 15 feet (Seaman, 1972).

Peat and organic soils are present in Young's Bay estuary. 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 and other 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).

The Clatsop Dunes, a probable source of wind blown sediments in Young's Bay, are post-glacial in age and owe their development to the immense quantities of sand that are deposited to the sea by the Columbia River and also to repeated cascadian subduction zone events. Most of the tidal flats within Young's Bay are made up of fine sand and silty clay at the surface and underlain with thick deposits of fine-grained unconsolidated sediments (Boley, p. 95, 1975).

Bay Circulation

The Bay was significantly different at time of exploration than today, and probably quite different from what it was just 25 years ago. To be able to get a glimpse of what the bay's circulation might have been requires an understanding of the forces that are at work on the bay. A qualitative idea of the circulation in Young's Bay may be obtained from a variety of models. In 1975 the Alumax (OSU) group used the Corps of Engineers' scale model of the Columbia River Estuary to look at bay circulation. The flows in the model only approximated those in the Columbia River Estuary and in the sub-area of Young's Bay. There were many influences not integrated into this model.

Their summary of circulation patterns for 1975 gives the reader some idea of the forces at work in the bay, for example tides, fresh water inputs, and winds. The study team looked at flows by compiling a series of photographs of the flows (from the model charts) which demonstrated surface circulation at different tide stages in Young's Bay for freshwater flow of 215,000 cfs. A different pattern would result under different freshwater flow conditions, because the circulation patterns are dependent upon the degree of salinity intrusion. Young's Bay is also subject to northwesterly and southwesterly winds that strongly influence circulation patterns (Boley, 1975).

Circulation and Salinity Patterns in Young's Bay and its Tributaries

The OSU team measured a variety of parameters at 23 stations in the Bay and tributaries four times between June 1974- and January 1975.

The tides and the Columbia River freshwater flow play a major role in the circulation in Young's Bay. The additional controlling influence of the bay is the fresh water flow of its tributaries. The temperature and salinity patterns in Young's Bay result from the mixing of ocean water, main stem river water, and water from the Young's Bay tributaries. The seasonal variations in flow of both the main stem and the Young's Bay tributaries should be considered in tandem when characterizing the bay. The seasonal river flow patterns of the main stem and Young's Bay tributaries are nearly inverse to one another. The main stem shows a very strong peak in the spring and early summer (April to July) that is fed by the melting snowpack and a weaker winter maximum. The Young's Bay tributaries show, in contrast, very low runoff from June to September and a very strong winter maximum (November to April) (Boley, 1975).

The Alumax sampling program was designed to provide coverage of these seasonal flow variations both in relation to timing of sampling and of sample/site locations. No samples were taken during the spring, however.

The June survey was taken during a very high Columbia River runoff period and fairly low tributary runoff. Accordingly, Young's Bay and River and the Lewis and Clark River contained only freshwater, mostly from the Columbia River. Water temperature is shown as a function of river mile in Young's Bay and River. The Columbia River water has a temperature of about 14 C (57 F) and Young's River water temperature is about 11 C (52 F). The water in the Young's River was Columbia River water to river mile 6, even at low tide. High levels of dissolved oxygen were found throughout the bay (Boley, 1975).

Since time of 'discovery' much has influenced the Bay and its circulation. With the building of the (modern) Astoria Bridge, dams on the Columbia River, and the diking of wetlands around the bay a significant portion of flow in and out of the bay has been affected, thus changing

circulation patterns, depositional patterns, habitat distributions, etc. One can only imagine what the bay would have looked like and how it would have responded to tides, winter storms, and tributary inputs.

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.

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 source, 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**.** However, Indian villages were found near the Walluski River and the Klaskanine River was used extensively by the Tlatskani as a route from the Columbia River to their village in the Nehalem valley. 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 Journals1V, 102-103, in Cutright, 1969).

Sturgeon was also taken in quantity from the Columbia by Indians and is the largest of the freshwater 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 Journals 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 better if their trip had been planned during these three decades.

Monthly Average Climatic Data (relatively "dry" years)
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) 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 and Clark Journals IV, 41). Lewis also measured those things of minimal size, the leaf of the broad-leaf maple was eight inches long and 12 wide.

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 used to make clothing (Cutright, p. 269, 1969).

U.S. President Thomas Jefferson, who dispatched 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). 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 region's earliest bud breakers. On March 22, the day before the group leaves Fort Clatsop, Lewis wrote, "*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). 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 dozen roots and an equal number of fruits that were food sources 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, Grey, 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. Lieutenant William Robert Broughton, of Vancouver's expedition (1792) came by boat across the Columbia and explored and named Young's Bay and River (McArthur, 1992).

European Settlement
Astoria & Fur trading

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. 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).

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 1830s. 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 and Diked Land 1870s-1930

Agricultural development was confined to the narrow river valleys and the small alluvial benches along the Columbia and near the mouths of the **Young's and the Lewis and Clark** Rivers. The tillable land, together with the pastureland adjacent to occupied farm units, amounted to 31,300 acres in 1930. Dairying was the most important kind of farming in the county. Root crops and peas were grown. Farming was intensive, with small ownerships and complete utilization of clear areas. In the late 20s and 30s farmers converted extensive areas of rough cut-over land to grazing through artificial seeding.

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 adjacent to Clatsop Plains Country, also along the **Lewis and Clark River, Young's River, Walluski River**, John Day River, and at Westport and vicinity. 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**. 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 right 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. Other diked tidelands were also found at the mouth of the Walluski, on the Lewis and Clark at Fort Clatsop, on Nowlen's slough, two-three miles from the mouth on the Lewis and Clark (Beemer, 1888). On the Young's, Haven Island was farmed and diked early and dry stock was run in the summer on Fry Island.

Young's Bay Watershed - Settlement

The first settlers of the lower Young's Bay 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, 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.

By 1900 there were 27 dairies supplying milk to Astoria from the lowland areas of Young's Bay, Skipanon River and Brownsmead.

Young's River and Lewis and Clark River

Young's River – the naming of
Named for Sir George Young of the Royal Navy by Lieutenant William Robert Broughton, of Vancouver's expedition. Lewis and Clark renamed the bay Meriwether bay for Meriwether Lewis. The Lewis and Clark maps indicate that the Young's River was originally called Kilhowanahkle River. However, authority on Clatsop History, Silas B. Smith ascribes this name to a place on the river (McArthur, 1992).

Lewis and Clark River – the naming of
Named in honor of the explorers who wintered on this river in 1805-06. Lewis and Clark maps show the name of the river as *Netul,* however authority Silas B. Smith ascribes this name to a place on the river, not the river itself (McArthur, 1992).

The logging of Young's Bay watershed began in earnest in the 1850's. The early techniques used were primitive compared to today's logging technology. The primary mode of logging was "jackscrew' logging, in which large logs felled lengthwise and greased were used to roll trees to the river. One of the earliest mills on the **Lewis and Clark** was established in 1851. Logging initially supported the markets of California but by the 1860's this market ended and logs were only used locally (Vaughan, 1980).

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 river bank at tidewater where logs would then be transported by water (shipped or floated) to the saw mills. Often a sawmill was located at this junction between railroad and river.

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, 1982).

The Eastern and Western 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, past the current Willamette Industries' Headquarters (Old Crown Camp), running around and south of Humbug mountain and finally up into the headwaters of the Lewis and Clark - on the south east side of Saddle Mountain. Spurs go up numerous creeks, alongside and right up, and no less than 12 spurs are noted on the last section of this railroad.

Another significant rail begins at the west bank of the **Young's River**, at tidewater and just below the old town of Wise. Locals identify this area as 'the old dump site.' From the 1933 railroad map the rail runs south following the west bank of the Young's River and spurs numerous times. It finally ends in multiple spurs, which reach into the headwater creeks of the Young's River.

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 1890s Clatsop County was a spider web of tracks carrying billions of board feet of fir and spruce (Vaughan, 1980).

The rivers that were used most heavily by commercial logging above the head of tide were **Young's River** and the **Lewis and Clark River**. Young's River logs were taken over the Young's River falls during winter high water. John Chitwood logged the Saddle Mountain area from 1884 to the 1890s. He floated logs down the river and over the falls to tidewater. Chitwood was credited for being the first logger in Clatsop County to use a steam donkey in his logging operation (Cumtux, 1982).

Another logger of that period and within the Young's Basin was Elmer Warnstaff. He recalled that the river was a good logging stream and could rise as much as seven feet, making it possible to float logs out overnight. Reporting on a less than successful log drive in 1888, Warnstaff recounts: "It was the summer or fall of '88 when the logs were put in. John Smith and me were together on Young's River and we had something like about three million feet of logs laying in Young's River and we only had one freshet. It caused a jam of logs in the river and we only got out about 400,000 out of three million. Edna Warnstaff added that the jam was right above the falls and that the logs had to be removed the following year because a dam was being built at that site for a pulp mill located a short distance below the falls (Cumtux, p. 11, 1982.).

Also at this time, a small dam was built just above the falls for a mill located just below the falls. The water above the Young's River falls was a small mountain stream, flowing through a thickly wooded district, without any considerable amount of agricultural land, and used chiefly as a logging stream. It was not unusual to **not** have enough water to run a downstream pulp mill (Cumtux, 1982).

The Fishery

"Anadromous fish in the Lower Columbia tributaries spawn about a month earlier than fish elsewhere in the north basin and therefore encounter more difficulty in their early fall migrations. The 1949 legislative withdrawal of the Clatskanie River and its tributaries, Klaskanine River and its tributaries, Lewis and Clark River and Big Creek from any future legal appropriations other than for fish life, was a significant step toward perpetuating runs in these streams. The protection of all existing unappropriated water during the late summer and early fall in the remaining Columbia sub-basin streams is likewise needed to maintain the present resource. Withdrawals which create significant
flow deficiencies during the natural low flow period include: municipal diversion on the Young's River and Lewis and Clark River" (Thompson and Fortune,1968).

In this same 1968 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.

Lewis and Clark River (1948-1972 Oregon Fish Commission survey notes)
The Lewis and Clark River originates in the Saddle Mountain area and flows in a northerly direction, finally emptying into Young's Bay. The river is about 25 miles long, of which the lower six miles is a tidal slough. The 7.5 miles of the river from tidewater to a deep canyon section has low banks that are usually flooded each spring. This part of the river is bordered by pastureland and brushy slopes. The canyon is approximately one mile long and very steep. The remainder of the upriver section is covered by second growth and partially logged off land in the hills. The riparian area is generally bordered by alders

The gradient is moderate in the lower section, increasing to fairly steep upstream. The area within the box canyon and up to the Crown Zellerbach bridge (~ 3 miles) is about 40 percent bedrock and 60 percent large boulders, affording no spawning area. The remaining length of stream averages 5-10 percent gravel.

Obstructions and diversions (1952) As observed and reported by aquatic biologists for the Fish Commission on the Lewis and Clark River
An abrupt 2.5 ft falls over boulders located about one mile above the mouth of Loowit Creek. Obstruction not serious.
A 2.5 foot falls over boulders and large fallen log forming a nearly vertical drop, located 100 yards above the entrance to the box-canyon. This is a partial block.
A 6.5-foot falls over bedrock and boulders 200 yards above the entrance of the box-canyon, forming a 35-40 degree slope. Two other six-foot falls. May be passable at high water. Silvers and steelhead seen above this area.
A 17 foot dam with 'adequate' fish ladder known as the Warrenton domestic water supply dam. Allotted diversion of 20 cfs. Diversion pipe with an estimated 30-inch diameter, covered by grating with about 1 inch between bars. Originally this dam was lower in the canyon and without a ladder, but was replaced in 1946. Another dam (for Warrenton water supply) with no ladder is about 0.25 miles up the South Fork, no spawning area above due to steepness of terrain
Log jam 250 yards above Warrenton dam.
Two log jams together about 350 yards above dam, left channel. May slow upstream and downstream migrants.
On the right channel about 250 yards above dam, another logjam. Appears passable.
A large logjam about a mile below the Saddle Mountain Road bridge. May hinder the run.
Impassable 13 ft falls about 5/8 mile below Saddle Mountain bridge.

It was estimated in the 1950s by Fish Commission biologists that the main stem of the river had about 15 miles of spawning area available; the tributaries adding another six miles. The fall chinook run was estimated at between 50 to 250 fish. Fish biologists' estimates of the 'potential' production were 1000 fall chinook based on habitat quality and quantity.

The current run of silvers was estimated to vary between 500 to 1500. And again, estimates for 'potential' populations were placed at 7,000-8,000 fish. Chum salmon populations were estimated at 200-500 fish and the potential was estimated at 1,000 fish.

Lewis and Clark River Main Stem Surveys (Oregon Fish Commission) 1948-52

Year	Date	Miles surveyed	Fish
1948	Oct 4	.33 mile	4 chinook
1949	Dec ?	1.5 miles	3 silver 1 chum 20 unidentified
1950	Dec 13	4 miles	5 chinook 47 silvers 2 chum 73 unidentified
1951	Dec 10	1 mile	23 silver 30 chum 7 unidentified
1952	Oct 22	.25 mile	6 chinook

Stavebolt Creek
During the early survey records (1952) biologists identify Stavebolt as the "best salmon producing stream in the Lewis and Clark system". They note at least .75 miles of good spawning area, a well timbered upland, with some recent logging at the mouth. Gravel was walnut to egg size, larger gravel found in the upper reaches. No obstructions to fish migration. No water diversions. Good run of silvers within a one mile section surveyed.

Hartill Creek
The spawning area in this stream is cut off by an abrupt falls (50 ft). Only about 400 yards of spawning area is available.

Klickitat Creek
The 1952 spawning survey on this creek showed a count of 12 spawning silvers within a one-mile area. Biologists note a recent logging operation on the creek which left much logging slash in the stream bed. Beaver activity was particularly high, at least eight beaver dams were observed. Biologists estimate the creek having the potential to support 50-100 spawning adults.

Loowit Creek
Biologists' survey work noted spawning gravel quality as good throughout the creek length (3 miles). However due to limited flows in the upper two miles only one mile was available for spawning fish. Habitat survey work suggested that there was higher spawning potential than numbers suggested (i.e., 13 silvers over .5 miles) during a 1952 survey.

Shweeash Creek
This creek is 3 miles in length with an estimate of at least half of this good quality spawning habitat. Biologists noted some obstruction concerns, especially during low flows: an abrupt three foot falls, felled timber in the stream compounded by steep gradient, and beaver dams. Estimates for potential silver populations were place at about 500. A survey in December, 1952 counted 51 spawning silvers within a one mile segment.

Walford Johnson Creek
This three-mile creek has an impassable falls, which limits spawning habitat to about a half mile. Biologists estimated the potential of this creek to hold about 25-50 salmon; however the 1952 survey failed to indicate if the stream was being utilized by spawning fish.

Heckard Creek
Only the extreme lower ¼ mile of this three mile creek is suitable for spawning because of an obstruction. The 1952 survey work noted terrific amounts of logging slash in the lower area, an impassable culvert at about ¼ mile above tidewater and a series of cascades 1/3 mile above the aforementioned impassable culvert. Five silvers were observed during the 1952 survey.

Johnson Creek
Johnson Creek is approximately 4 miles in length with the lower one mile of this distance slough like and unsuitable for spawning. The stream is branched just above tidewater and both branches run through farmland. A dense stand of second-growth hemlock covers the upper reaches of the left branch. A good supply of spawning gravel was found in this area and potential of this creek is estimated at 100-200 spawning chum or silvers. Local resident reported having seen 50-60 chum salmon, three or four years before the 1952 survey. The survey found only one dead silver.

Obstructions at this time included a large amount of recent logging debris on the left fork. A mink farm was drawing water from the left fork by an electric pump.

Lindgren Creek
This 1 square mile drainage has meager flow and lacks clearance in the upper rivers. The 1952 survey found 9 silvers utilizing the Creek and estimates of potential put the Creek at about 25.

Walluski -Early Settlement History
*Walluski **(Wallooskee) River – the naming of***
Bears the name of a small band of Indians that lived near the river. They were of the Chinook tribe. In 1851 there was one member (Walloska) of this band surviving (McArthur, 1992).

Norwegian immigrants settled the Walluski area in the late 1880's. Many having traveled first from Norway to South Dakota or Minnesota and then onward to Oregon and the Walluski. To get to the Walluski, settlers went by boat from Astoria, up the Young's River and then to the Walluski "following this stream several miles until it narrowed considerably at a place known as the 'landing'. Here logging trains unloaded their huge logs, dumping them into the stream, down which they floated to sawmills at Astoria. (Lillenas in Lillenas-Peeke, 1958,unpublished).

In the early years of settlement men found work in the area at the Trullinger Camp. Soon after, the camp closed and men were obliged to work in town, travelling over very poor roads or by boat to Astoria, staying the week and travelling home on weekends. At that time, a days wage at the sawmills was $1.50. It was difficult to "eke out a living among those trees and stumps." The settlers depended on each other, living at the subsistence level: hunting, trapping and fishing, growing such things as potatoes, strawberries and root crops for beef, gathering salmonberries and huckleberries, even eating sour grass in hard times. Settlers were lucky to keep a few sheep, chickens, steers and cows (letters and written memories from Lillenas-Peeke,1958, unpublished).

Except as a tool for clearing a homestead or road, the Walluski forests had not yet seen the logger's axe, "I remember one big tree that was blown down in a storm – it fell across the road about a mile from Kleppey's place. They cut steps in it so they could climb over it. It took two men a whole week to cut it and then split it with black powder – so they could get the pieces small enough to move them off the road" (Krager, from a letter to Dorothy Lillenas-Peeke (undated) in Lillenas-Peeke, 1958, unpublished).

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 forest 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 regions waterways within their tidal portions. S.P Marsh had one camp on the Walluski in 1881 and logged much of the timber near the banks utilizing the river to store logs as well as move them to market. Two years later Moore added another camp in the Walluski. By 1885 the John C. Trullinger Co. was gearing up to harvest the timber further back from the river. The Trullinger Camp was located on property later owned by Kelley Larson, above Kissville. "They dammed the Walluski near the camp, rocked the sides and bottom and made a turbine wheel which gave them the power to grind grain and turn grindstones for axes" (Lillenas-Peeke, 1958, unpublished).

In the 1880's railroads began to traverse the forests of the Walluski watershed. A railroad (1886) on the Walluski traveled from tidewater to the headwaters, crossing over the ridge into the Klaskanine basin and the John Day basin.

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. In another literary description for that time period, a small hand logging operation on the John Day put in almost one million feet (Cumtux, 1982).

At the turn of the century there was again a flurry of logging activity on the Walluski. The Blaisdell brothers logged extensively. That same year Jack Ryan partnered with a Mr. Richardson and then with John Johnson and set up another camp on the Walluski. By this time most of the big trees on the Walluski were gone, the hills from Irving Bridge to the ridge were cleared and burned (Cumtux, 1991).

Between 1915-1920, Palmer Logging Company again logged parts of the Walluski Valley. "After the Palmer Logging Company was thru logging, parts of the woods were more open, when the south-westers blew I would have to wait until the trees that were left standing started to straighten up before going past them." A trestle bridge was also built over the Walluski by Palmer Logging (Lillenas-Steele from Lillenas-Peeke, 1958, unpublished).

Klaskanine River

the naming of

The Klaskanine River affords a route of travel from the mouth of the Columbia River to the place in the Nehalem Valley where part of the Tlatskani Indian tribe lived. Indians were not in the habit of naming streams - *Tlatskani* was the word applied to the route taken to get to their village. This word was used for both the Young's River and the Klaskanine River (McArthur, 1992).

The Fishery 1950-1972

Oregon Fish Commission Survey Notes & Fish Commission Reports on Watershed Development and Rehabilitation

The Klaskanine River enters Young's River about seven miles above the Young's Bay Highway bridge. It originates in the area south of Wickiup Mountain and drains the west slope of Wickiup ridge. The combined length of the North and South Fork of the Klaskanine River produces a total '"linear drainage of about twenty-four miles".

An Oregon Fish Commission Hatchery is located on the North Fork about two miles above "Smiley's Hole". This hatchery was built in 1913 from a legislative appropriation of $5000. "I anticipate that the Klaskanine hatchery, by reason of its extremely favorable location will prove one of the most valuable in the state. Among the advantages of the new hatchery are: its nearness to tidewater, and the fact that there are many small streams in its immediate vicinity - which may readily be brought under control for the retention of young fish, to say nothing of the large number of other streams in the neighborhood in which fish may safely be liberated - there to remain until their inclination leads them to the waters of Young's Bay in their migration to the ocean." Master Fish Warden – R.E. Clanton.

The original hatchery stock for the Klaskanine was primarily local in origin: coho, chinook and winter steelhead. Later stock was gathered from the McKenzie, South Santiam, Brietenbush and Rogue River among others. Releases varied from year to year with as many as 4 million a year (chinook) released for one species. Big Creek hatchery served as the egg bank for the Klaskanine.

The original hatchery dam was nine feet high and was replaced with a dirt cofferdam which diverted the flow through a side channel. In 1952 it was one of the hatcheries under expansion for the Lower River Program. Before 1951, it was the policy of the hatchery to allow only those fish in excess of the hatchery's egg taking requirements to pass above the hatchery.

The main stem of the Klaskanine, bordered by pasture land and large alders extends for about two miles, the lower part of which (1.75 miles) is tidal slough. The remaining quarter mile offers a fair amount of spawning gravel. On September 28, 1950, 49 fall chinook were observed in this upper section. A small creek (Olney Creek) in the lower section of the main stem was surveyed in 1950. Fifty-one spawned out silvers were recorded, none were hatchery marked.

The Oregon Fish Commission's policy during the late 1940's for the Klaskanine Hatchery was to rack both the North and South Fork of the Klaskanine River for the purpose of taking chinook eggs. This apparently eliminated the runs of fall chinook to the South Fork. In 1949, the owner of the land on which the hatchery racks were placed refused to allow the Fish Commission to construct racks, so the procedure was discontinued.

North Fork

It is mentioned in these 1952 survey notes that the Klaskanine Hatchery dam, located on the North Fork is the "uppermost limit of upstream migration of salmon." However it is then noted that "there is suitable spawning area for at least 1300 fish above this dam."
Thus, the "limit' must be the barrier ~ the hatchery dam and not the habitat. The survey notes go on to expect that " this area can be put into production in the very near future."

The two mile area below the hatchery was assessed to support at least 700 pairs of salmon. For 2.5 miles above the hatchery the river courses through rugged hills, at moderate steepness and through "good stands of second-growth timber. The river then goes through a bedrock canyon to Barth Falls, a low water barrier and then on upstream, again at moderate steepness with a bed of grapefruit sized rubble/gravel. There is about 7 miles of potential spawning area above the hatchery. Barth falls is really three separate falls; the uppermost falls forms a five foot differential over 45 degree chute (probably passable); the second falls consist of a six foot drop over 70 degree chute (partial barrier); the third falls cascades over a 20 degree bedrock slope. Above these falls beaver activity was noted.

South Fork

The South Fork of the Klaskanine River is about 15 miles long and joins the North Fork at a large pool known as "Smiley's hole". The gradient is moderate over most of the course, increasing steeply in the upper section. The flow, in the upper part of the stream, is interrupted by four falls. A twenty foot falls, located six miles above Smiley's hole is a complete block to upstream migration. The three remaining falls are partial or complete barriers depending on water stage.

A small tributary enters at the east bank of the South Fork about a half mile above the mouth. The tributary is only about a half mile long and of meager flow, not more than a ditch in character; however as many as 70 adult silvers have been observed in this half mile of creek.

It is also noted (1955) in a memo by a fish commission biologist that a splash dam existed on the North Fork at this time The memo notes that the biologist, Mr Asplund requested to the

landowner, Mr. Fahlstrom that the dam be removed immediately. Mr. Fahlstrom's reply requested assistance from the state in creating a fish passage hole in his dam so that if he needed the dam in the future (to maintain bottom grazing land) he could still use it. Mr. Asplund advised him that the state would not support this idea No other mention of this dam is mentioned in these notes.

The notes also discuss the **South Fork** of the Klaskanine, which has "sufficient spawning area to support at least 5000 fish in the area below the falls and an additional 1000 above." Hatchery plantings were being made at the headwaters of the North and South Forks at this time.

The following table represents spawning ground counts for three seasons. Please note that this data was found in Fish Commission survey notes and that this data is identified as one-day counts for the season of 1950 and 1951 and four-day counts for 1952. Thus, it makes it difficult to compare the spawning seasons as the efforts vary, spawning timing varies, etc.

Spawning Ground Counts for Klaskanine 1950-52
(It is assumed that the counts are from the same two mile stretch.)

Year	Day	area surveyed	# and kind of fish
1950	**September 28**	**2 miles**	**348 fall chinook**
1951	**December 8**	**2 miles**	**45 silver** **5 chum** **15 unidentified**
1952	**October 1**	**2 miles**	**26 chinook**
1952	**October 9**	**2 miles**	**30 chinook** **1 silver**
1952	**November 14**	**2 miles**	**13 silver**
1952	**November 19**	**2 miles**	**30 silver**

1968 Recommended Minimum Flows for Fish Life
North Coast Basin Plan, Appendix 1 (ODFW), *cubic feet per second* (cfs)

Name	Location	Dec-Apr	May	June	July	Aug	Sept	Oct	Nov
N Fk. Klaskanine	Mouth	40	25	15	10	5	30 40	40	40
S Fk. Klaskanine	Mouth	40	25	15	10	5	30 40	40	40
Lewis & Clark	RM 10.8	45	30	20	15	6	30 45	45	45
Young's River	.1 below falls	40	30	20	15	7	20 40	40	40
Bear Creek	.7 mi above mouth	15	10	7	5	3 2	10 15	15	15
Big Creek	1.1 mi above mouth	50	40	30	25	20	30 50	50	50

The Railroad
The railroad begins at the juncture of the main stem of the Klaskanine River, the South Fork of the Klaskanine and Green Mountain Road. The rail runs along the east side of the South Fork of the Klaskanine River crossing the river repeatedly until the river swings east. At this point the rails stay on the east side of the River as it travels east and then south again toward Highway 202. Here the rail ends.

Young's River
The Fishery
(Oregon Fish Commission Survey Notes – 1953)
The Young's River , which has an impassable 57 foot high falls several hundred yards above the head of tide was in 1953 supporting small runs of fall chinook, silver, chum, and steelhead. At this time a survey was completed to evaluate stream suitability for a fishway project under the Lower Columbia River Salmon Rehabilitation Program. It was 'remembered' by locals that historically this system once had large runs when "the fish apparently were so thick as to crowd one another out of the stream."

The survey began 13 miles above the falls and worked its way downstream to the falls. In addition the South Fork, Barney, Fox and Rock Creeks were also surveyed. The following map shows the general stream spawning quality as surveyed by the Fish Commission biologists.

Temperature and Flow Data (1953)
The Young's River has a great annual range in rates of flow. Extreme flows were recorded by the U.S. Geological Survey which showed that the maximum in previous years to 1953 was on November 24, 1927 (6300 cfs) and a minimum flow of only 3.7 cfs on September 22-23, 1938. The fall of 1952 was also a very dry year and lowered the stream flow at the falls to 4.36 cfs on October 1st. Early on, because of low flows, this river had been eliminated as a prospective hatchery steam. However, the winter and spring flows are comparable with those of the Lewis and Clark and the South Klaskanine Rivers.

River temperatures do not range much above the mid 60's during summer months. A maximum temperature reading during the years 49-53 was obtained on June 27, 1951 and was 65° F. There was good forest cover for the first seven miles above the falls.

At the time of this survey most of the forest land of the watershed was owned by Crown-Zellerbach Corporation. The forests that bordered the first seven miles were of hemlock and spruce.

Spawning Ground Potential -1953
Spawning Count potential was assessed at all the survey areas (see above). Below are the totals for the main stem. The biologists cautioned in the survey report that these numbers were estimates only – neither the maximum nor minimum and acknowledged variability of potential from year to year. They also noted that they didn't look at all the tributaries and knew that some had good spawning potential.

Spawning Ground Potential Redd Counts Within the Young's River 1953

Area Surveyed	*Survey distance*	*Silvers-redds*	*Chinook-redds*	*Steelhead-redds*
Forks down to south fork	2.7	61		73
South fork-fox cr. bridge	1.7	295		92
Fox cr. Bridge-Osgood cr.	.8	165		175
Osgood-rock cr.	.8	152		20
Rock cr	.1	15		15
Head of canyon	.2	56		50
Head of canyon - .5 mi below canyon	1.5	50		60
.5 mi below canyon to mouth of Barney cr.	1.0	90		100
Barney cr. – 1 mile above falls	3.5	190	608	250
1 mi above falls	1.0	0	**-------**	**-------**
TOTALS	**13.3**	**1,074**	**608**	**835**

So… what does such a survey tell us when an impassable falls removes the potential for anadromous fish use? It may only help articulate the quality of the in-stream habitat in 1953 and its benefits to resident trout. Throughout the survey notes the gravel is "excellent' for steelhead and silvers and that there were few obstructions.

Young's Bay Gillnet fishery 1961-63

The commercial gillnetting in Young's Bay below the mouth of the Klaskanine was allowed to harvest surplus adult coho return to the Klaskanine hatchery. The following table represents three years of the fishery.

Young's Bay Gillnet Fishery - Catch Records

Year	**Adults**	**Jacks**	**Estimate/Lbs**
1961	459	131	5,377
1962	2,059	663	20,000
1963	4,074	2163	42,000

Clatsop County

Economic Development Council's Fisheries Project - The Net Pen Project

Working cooperatively with the Oregon Department of Fish and Wildlife the CEDC Fisheries Project began (1975) investigating salmon enhancement opportunities in Young's Bay. In 1977 the project made its first release of salmon smolts (50,000) from the bay. Production increased to about 3.5 million smolts per year by 1981. In 1985 the freshwater sites were at capacity and CEDC began investigating other sites for additional production. Estuarine net pen production

was tested and a program in Young's Bay was implemented. By 1994, over 3 million salmon smolts were released from Young's Bay net pens.

Forests - 1930s From *"Forest Statistics for Clatsop County", Oregon Department of Agriculture, Pacific North West Forest and Range Experiment Station, 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 in this data. Information presented here will use the data about county lands but will try to articulate general trends for each basin.

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 nonforest 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.

Stands where Douglas fir was the primary species occurred chiefly in the eastern half of the county and occupied an area of nearly 112,000 acres. These lands are now within the Nicolai-Wickiup, Upper Nehalem and Upper Young's Bay watersheds. Approximately 45 percent of this area supported stands of saw-timber size, 23 percent second-growth stands less than saw-timber size, and the remaining 32 percent seedling and sapling types less than six inches DBH (diameter at breast height).

Types dominated by primarily western hemlock and Stick spruce are distributed over 214, 000 acres of forestland 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, Stick spruce on 24,000 acres, and the balsam firs on 7,000 acres.

Coniferous Saw-Timber Types

This group was comprised of all the coniferous forest types in the county in which the timber was of commercial value and most of the volume is in trees about 20 inches or more in DBH. There are 7 such types extending over 155,000 acres, 32 percent of the County's forest land. In 1933 the same group of types covered 192, 000 acres or 40 percent of the forest land. The depletion of 37,000 acres of saw-timber types in the county between September 1, 1933, and November 1, 1937 was due chiefly to cutting, fire having affected these types only slightly

during the period. Of the seven saw-timber types in the county three were predominately Douglas fir, while western hemlock, Sitka spruce, western red cedar, and balsam firs dominate in one each of the other four.

Approximately 88 percent of the total area of Douglas fir type in this category were occupied by large old growth (type 6). Small old growth (type 7) and large second growth (type 8) are of little importance because together they occupy only 6,200 acres. The timber stands in type 6 average about 350 years in age and trees range from 48 to 70 inches in DBH. Approximately 80 percent of the volume is Douglas fir, 15 percent is western hemlock, and the remainder is Sitka spruce, western red cedar, and balsam firs. Over certain areas where past fire loss was heavy, the stands have a low volume per acre.

Saw-timber types other than Douglas fir occupy 105,500 acres in Clatsop County. Western hemlock stand cover 80,000 acres, Sitka spruce 17,000 acres, the balsam firs 7,000 acres and western red cedar 1,500 acres. Western hemlock stands occurred as a practically unbroken block over 55,000 acres in the southwestern part of the county and in smaller bodies in the north and west-central parts, primarily the Necanicum basin, forests above Astoria, and in a few areas within the Lewis and Clark watershed. Spruce, balsam fir, and cedar types occur as islands interspersed in the hemlock stands. These islands seldom exceed 1,000 to 1,500 acres in area, while most of them are considerably less.

Nearly 24,000 acres that were still occupied by pulpwood stands of saw-timber size were logged selectively. Practically all this logging was done prior to 1933 and was the result of the demands for Sitka spruce, western red cedar, and high-quality Douglas fir. Most of the stands were lightly cut and the remaining volume often exceeded the amount removed. In almost all instances the remaining stands are predominately western hemlock even were other species constituted most of the volume prior to cutting.

The area of saw-timber types other than Douglas fir in 1933 was 122,500 acres. This shows that the acreage of these types was reduced during the period September 1, 1933, to November 1, 1937 by 17,000 acres. As in the Douglas fir types logging was the chief cause of this depletion. Based on the area of saw-timber types in 1933, Douglas fir types have been reduced by 28 percent and types dominated by the pulpwood species and cedar by 16 percent.

Immature Types

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 6 inches or more in d.b.h. occupied 55 percent of the area of immature types, while types composed of stands in which most of the trees were less than 6 inches in d.b.h occupied 45 percent.

Pole Stands
Immature types 6 inches or more in d.b.h consisted of 69 percent hemlock types, 27 percent Douglas fir types, and 4 percent Sitka spruce types. The age of the hemlock stands ranges from 20 to 80 years, of the Douglas fir stands 20 to 50 years, and of the spruce stands 30 to 80 years. Stocking conditions are mostly satisfactory in this group. Little change in total acreage took place between 1933 to 1037 but the distribution of age classes changed considerably. The area occupied by stands in the 20, 30, 40 year age classes was 26,000 acres less than was shown in 1933, while the area occupied by stands in the 50,60 and 70 year age classes was 30,000 acres more. Some of this change was due to stands advancing to an older age class during the elapsed time and some to more intensive field work.

Seedling and Sapling Stands
Immature types less than 6 inches in d.b.h. were comprised of 51 percent western hemlock types, 46 percent Douglas fir types, and 3 percent Sitka spruce types. The area occupied by this group increased from 38,000 acres in 1933 to 79,000 acres in 1937. During the initial survey all areas clear cut since the beginning of 1920 were typed as recent cutovers and stocking conditions were not determined. This type amounted to 105,000 acres in 1933. In 1937 areas logged prior to 1930 were examined and typed according to cover. Most of the trees on these areas were less than 6 inches d.b.h and the acreage was added to the seedling and sapling group, thus accounting for most of the 40,000 acres increase. Almost half of the area typed as recent cutover in 1933 and examined in 1937 was not restocking. Seedling and sapling stands range in age from 10 to 30 years with a great majority in the 10 year age class. There were 15,000 acres unstocked.

Deforested Areas
The total amount of forest land deforested in 1937 in Clatsop County was 79,000 acres, exclusive of areas clear cut since the beginning of 1930. Of this, 50,000 acres was logged-off land not restocked and the remainder was deforested burn. The deforested area of the county in 1933 was 40,000 acres not including areas clear cut since the beginning of 1920.

Approximately 7,000 acres of the area clear cut prior to 1920 was found to be nonrestocked in the 1937 examination, which is about the same acreage found in the 1933 inventory. Of the area clear cut between 1920 and 1930, 43,000 acres was nonrestocked in 1937. This acreage is approximately 41 percent of the total area clear cut during the period. The possibility of stocking conditions improving naturally in the near future is remote because of the lack of seed supply.

The area of deforested burn has become less since 1933. In that year it was 33,000 acres, in 1937 it was 29,000 acres. Most of this acreage is the result of the Wolf Creek fire of 1933.

The area clear cut since 1930 amounts to 61,500 caress. While some of this area was being restocked in 1937, the seedlings were not fully established and the area they occupied was not segregated from the whole.

Coniferous Saw-Timber Volume
The total coniferous saw-timber volume of Clatsop County was 7.9 billion board feet. Western hemlock leads all other species with 3.4 billion, Douglas fir was second with 2.5 billion, and Sitka spruce is third with 1.1 billion. The remaining 0.9 billion consists of western red cedar, silver fir, lowland white fir, and noble fir. The depletion of saw-timber volume since September

1, 1933, amounts to 1.8 billion feet, nearly 60 percent which was Douglas fir and the remainder pulpwood species.

The Douglas fir volume was segregated into four classes based on size and age. The large old growth class (DA) contains 85 percent of the total Douglas fir volume and is of high quality. From 1933-37 approximately a billion board feet of large old-growth Douglas fir had been cut. This is 30 percent of that remaining in the county in 1933 and 45 percent of the 1937 volume. The other Douglas fir classes containing 15 percent of the volume were reduced by 17 percent.

Hardwoods and Minor Forest Products

Hardwood trees occupy approximately 10,000 acres of forest land in Clatsop County. The occur over small areas on favorable sites as long stringers along streams. One-fourth of the area of the hardwood types is covered by stands of merchantable size and three-fourths by stands of smaller trees. Red alder is the dominant species in both the merchantable and the second-growth hardwood stands. Its common associate is bigleaf maple.

Total hardwood volume was 53 million board feet, 73 percent red alder, and 27 percent bigleaf maple. A considerable amount of hardwood volume was often destroyed during logging of coniferous timber. The total hardwood volume was slightly reduced from 1933 to 1937.

Available minor forest products contributed somewhat to the total value of the county's forest resources. Cascara bark, sword ferns, and Christmas trees were marketed by local people. The total income derived from these products annually varied from year to year, owing chiefly to market fluctuations . The average yearly income returned on their sale was 10,000 dollars.

Cascara bark is the most important of these products. Bark of the cascara was gathered primarily in the north and western part of the county. This area would include the Nicolai-Wickiup, Lower Young's and Skipanon watersheds. Gathering of the bark has been carried on for many years. The more available cascara stands had already been depleted by 1937 and their replacement is very slow due to the common practice of peeling trees as small as 1.5 to 3 inches in diameter. However, cascara stands located in the more inaccessible sections of the county provided a source of supply for some time after 1937. Regeneration of cascara was noted both in second-growth hemlock and spruce stands and on clear cut areas situated within the trees habitat. The annual production of cascara bark in the county was usually about 60 to 75 tons. For the 5-year period 1932 to 1936, the average annual water shipment of this product from the port of Astoria was 73 tons. A small percentage of this tonnage comes from outside the county.

Forest Ownership

Approximately 87 percent of the forest land 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 been obtained through tax delinquency. The county's forest land and timber volume doubled from 1933 to 1937. In 1933 it owned 27,000 acres of forestland and 148 million board feet of timber; by 1937 it owned 60,000 acres of forestland and 380 million board feet of timber.

Forest Industries

A large part of the industrial development of Clatsop County has been based on the harvesting and manufacturing of its forest resources. Both Astoria and Warrenton had sawmills of

importance in 1937 and the rafting of logs for water transportation at the mouth of the Lewis and Clark River and in Young's Bay 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.

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.

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. Disposal of slash was required by law as a safety measure against fire.

With tractor yarding and truck hauling well established in the county, a change in the method of cutting was developing. Instead of following the practice of clear-cutting generally used in the region, some operators were logging selectively. Only trees considered valuable enough to show a profit when marketed were removed and the remaining stand was left as a reserve for a future crop. Many of the stands being logged in this manner consist of scattered mature high-value trees and an "understory of thrifty well-stocked second growth".

Log dumping, rafting and storage and their impacts

Logs were rafted within Young's Bay and upriver on the Young's, Lewis and Clark, Walluski and Klaskanine Rivers. Log dump sites were found on the Walluski near where the river narrows and the railroad ends at about river mile two. A floating saw mill preceded the Palmer Rail Road at this location (Cumtux, 1980). On the Klaskanine River, a log dump area was located between Grant Island and the confluence of the Walluski. On the Lewis and Clark a log dump site was located on the west bank, below tidal extent and just upriver from the winter camp site of Lewis and Clark (Fort Clatsop National Memorial) (Palmer Henningsen personal communication).

On the Young's River the major logging dumps were the "Crown Camp" dump, about a half mile from the Young's River Falls turnoff, and a Van Fleet logging dump located near the old Young's Bay Bridge (across from the Astoria Yacht Club). There were also at least two booms in operation on the Young's: one opposite Battle Creek and the other at the end of Binders Slough Road (Keith Kahl personal communication).

These practices posed impacts, on both the physical and chemical aspects of the river. Research findings 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 results 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).

Although all active in-water dumping and rafting sites are no longer found in the basin, old dump sites and existing storage facilities still remain. The volume of logs dumped and handled in Young's Bay was significant and the zone of extensive dumping and rafting and storage is large.

Appendix 1.

NOTE: The historic data presented here is of limited "use" because of the time span to short) in which it was collected or the consistency of methodology (e.g., flow may have been taken at different points on the river). The data is presented only to give the reader some understanding (albeit limited) of some past water parameters of some of the rivers.

Water Data Collected from 6 Rivers by ODFW from 6/10 – 11/7/66
Missing October data which can be a very low flow month

1. Bear Creek data collected: 6/10/65 – 11/7/66
Flow

Average flow from 9 miscellaneous flow measurements***:***	**9.0 cfs**
Lowest flow 9/14/66 (recent rain):	**1.9 cfs**
Highest flow 7/16/65	**26 cfs**

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements:	**55 F**
Lowest temp 11/7/66	**45 F**
Highest temp 8/8/66	**64 F**

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2. Big Creek data collected 6/10/65- 11/7/66
Flow

Average flow from 9 miscellaneous flow measurements***:***	**39 cfs**
Lowest flow 9/16/66 (recent rain):	**22.5 cfs**
Highest flow 6/10/65	**59 cfs**

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements:	**54 F**
Lowest temp 11/7/66	**44 F**
Highest temp 8/8/66	**62 F**

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3. N Fk Klaskanine 6/10/65 – 9/14/66

Average flow from 9 miscellaneous flow measurements***:***	**14.6 cfs**
Lowest flow 8/8/66 (recent rain):	**3.2 cfs**
Highest flow 4/29/65	**43 cfs**

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements:	**58 F**

Lowest temp 4/29/66 **48 F**
Highest temp 8/8/66 **67 F**

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4. S Fk Klaskanine 6/10/65 – 9/14/66

Average flow from 9 miscellaneous flow measurements***:*** **14.6 cfs**
Lowest flow 9/14/66 (recent rain): **4.1 cfs**
Highest flow 4/29/65 **35 cfs**

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements: **58 F**
Lowest temp 4/29/66 **47 F**
Highest temp 8/8/66 **66 F**

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5. Lewis and Clark River 6/10/65 – 9/14/66

Average flow from 10 miscellaneous flow measurements***:*** **26 cfs***
Lowest flow 9/14/66 (recent rain): **6.5 cfs**
Highest flow 4/29/65 **76 cfs*** *

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements: **61 F**
Lowest temp 4/29/66 **49 F**
Highest temp 8/8/66 **70 F**

---

6. Young's River 6/10/65 – 9/14/66

Average flow from 9 miscellaneous flow measurements***:*** **17 cfs**
Lowest flow 9/14/66 (recent rain): **4.3 cfs**
Highest flow 4/29/65 **40 cfs**

Average water Temperature

Average H20 temperature from 9 miscellaneous temp. measurements: **59 F**
Lowest temp 4/2966 **48 F**
Highest temp 8/8/66 **67 F**

Monthly mean, maximum, and minimum water temperatures for years of record on some streams in the North Coast Basin.

Stream	Years		oct	nov	dec	jan	feb	mr	apr	my	jun	jul	au	sep
Gnat *2mi above Big Noise*	**1960 to 1962**	*M*	48	43	43	42	44	43	46	48	53	55	56	53
		Mx	54	50	46	46	48	48	50	56	58	61	59	59
		Min	43	38	36	34	35	37	42	45	48	50	52	50
Big Cr *.3 miles below mill city creek*	**1950 to 1955**	*M*	51	47	45	43	43	43	46	50	52	56	56	54
		Mx	56	53	48	48	47	47	51	55	61	61	62	60
		Min	46	39	38	37	38	37	41	43	47	50	51	47
Young's *RM 9.4*	**1947 to 1958**	*M*	51	46	44	43	45	45	48	52	55	61	61	56
		Mx	60	52	50	49	51	50	57	64	67	70	69	65
		Min	42	37	38	34	32	35	43	44	44	47	49	47
NF Klask *2 miles above NFk of Nfk*	**1950 to 1955**	*M*	51	46	45	43	43	43	47	50	54	57	58	56
		Mx	59	52	48	48	48	49	53	60	65	65	65	66
		Min	43	34	34	37	36	35	41	42	46	51	51	47

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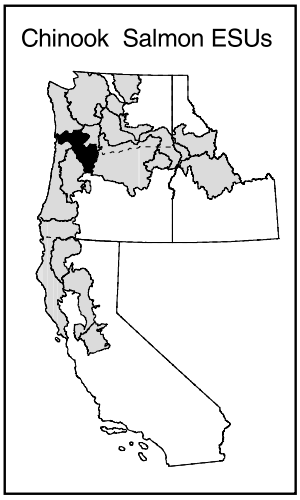
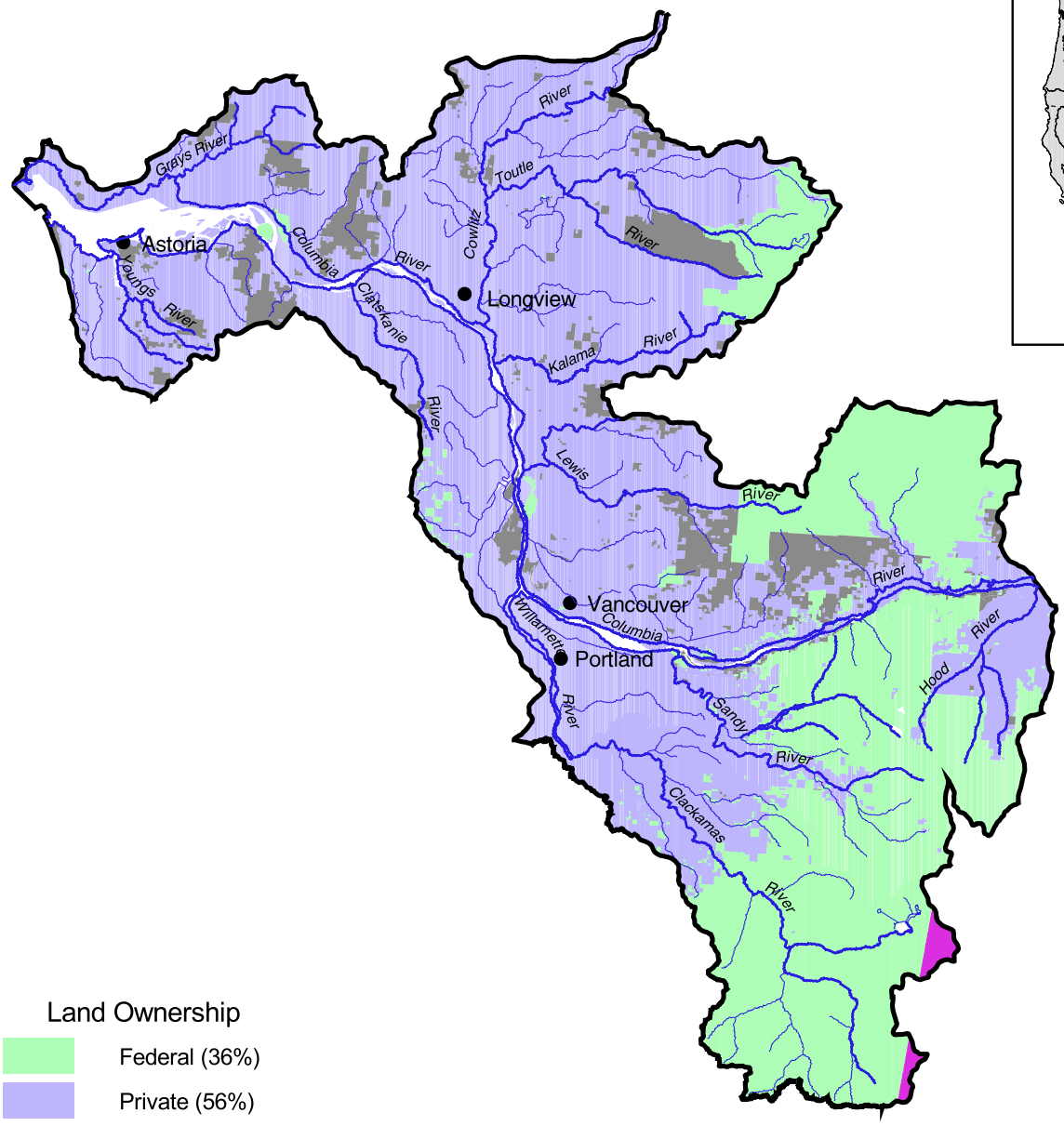
APPENDIX B

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.
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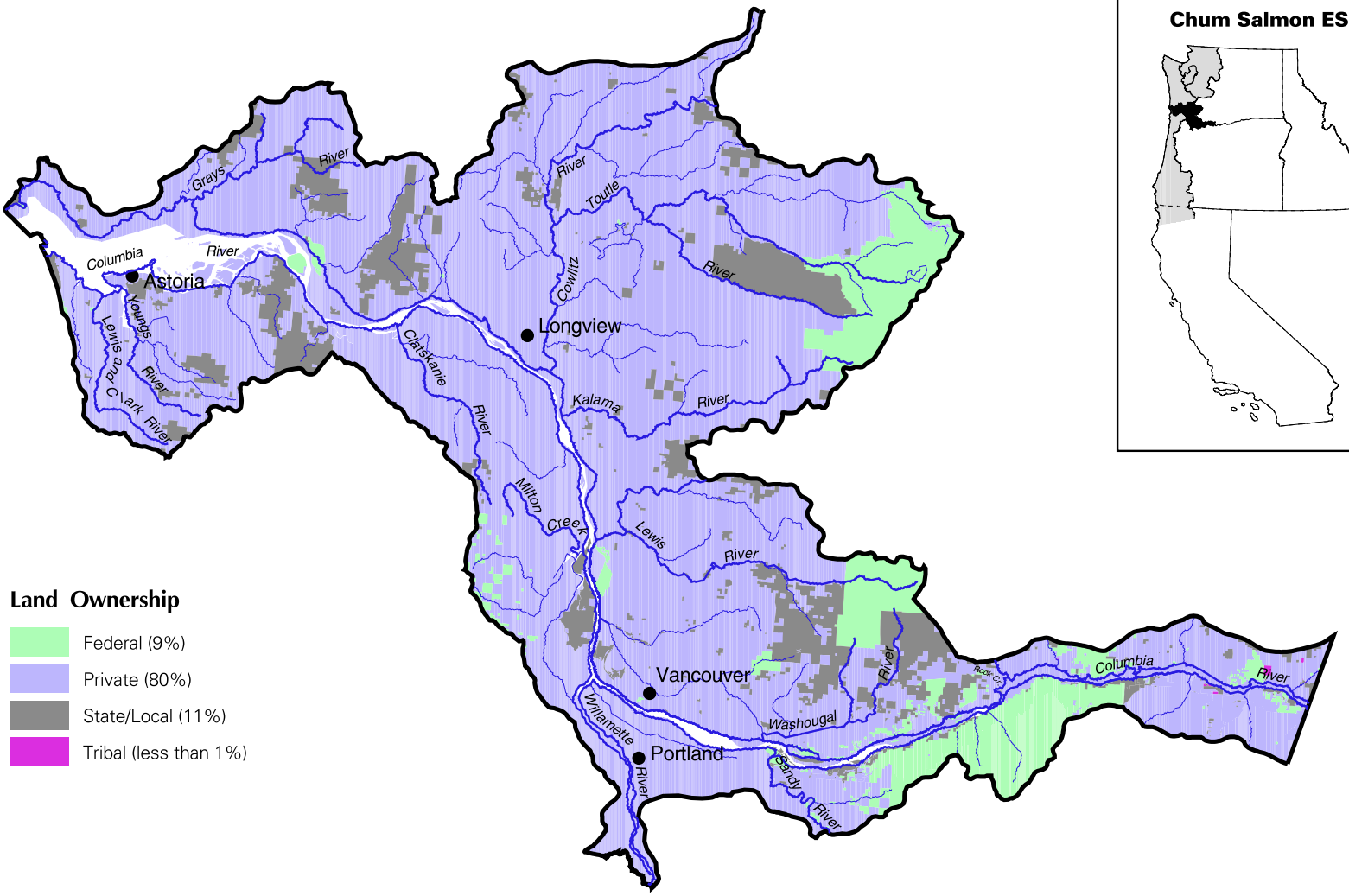
Note: Map is for general reference only.

COLUMBIA RIVER CHUM SALMON ESU



Land Ownership

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

United States Department of Commerce
National Oceanic & Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
HABITAT CONSERVATION DIVISION
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Portland , OR 97232
Tel (503) 231-2223

Scale:

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MAP DATE 2/23/99

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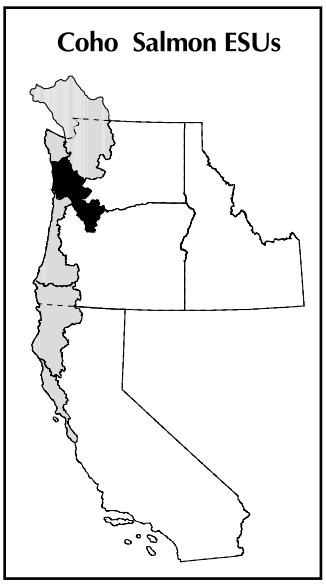
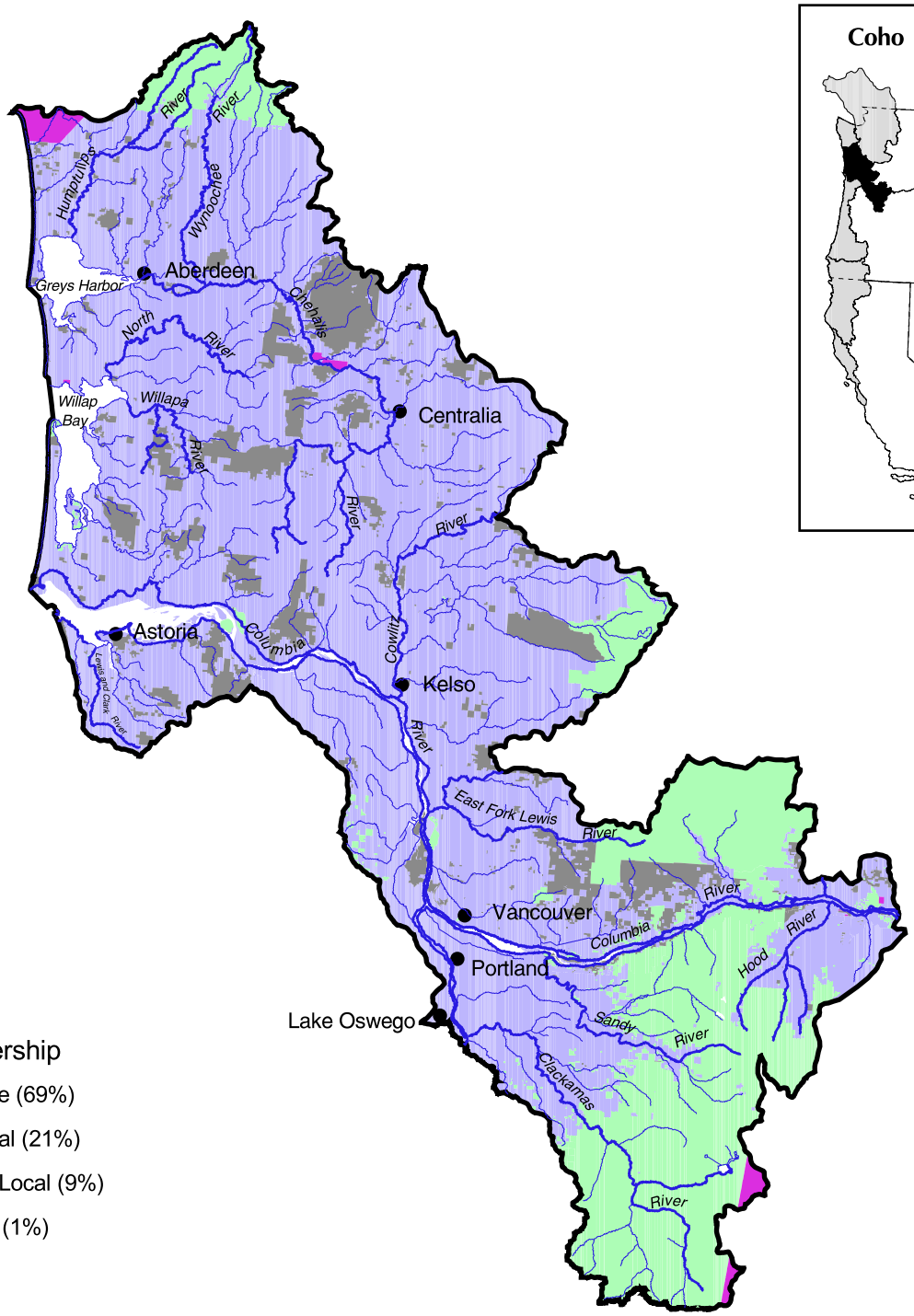
Note: Map is for general reference only.

SOUTHWEST WASHINGTON / LOWER COLUMBIA RIVER COHO SALMON ESU





Land Ownership

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

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Portland, OR 97227
Tel (503)-231-2223

Scale:

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MAP DATE 2/20/99
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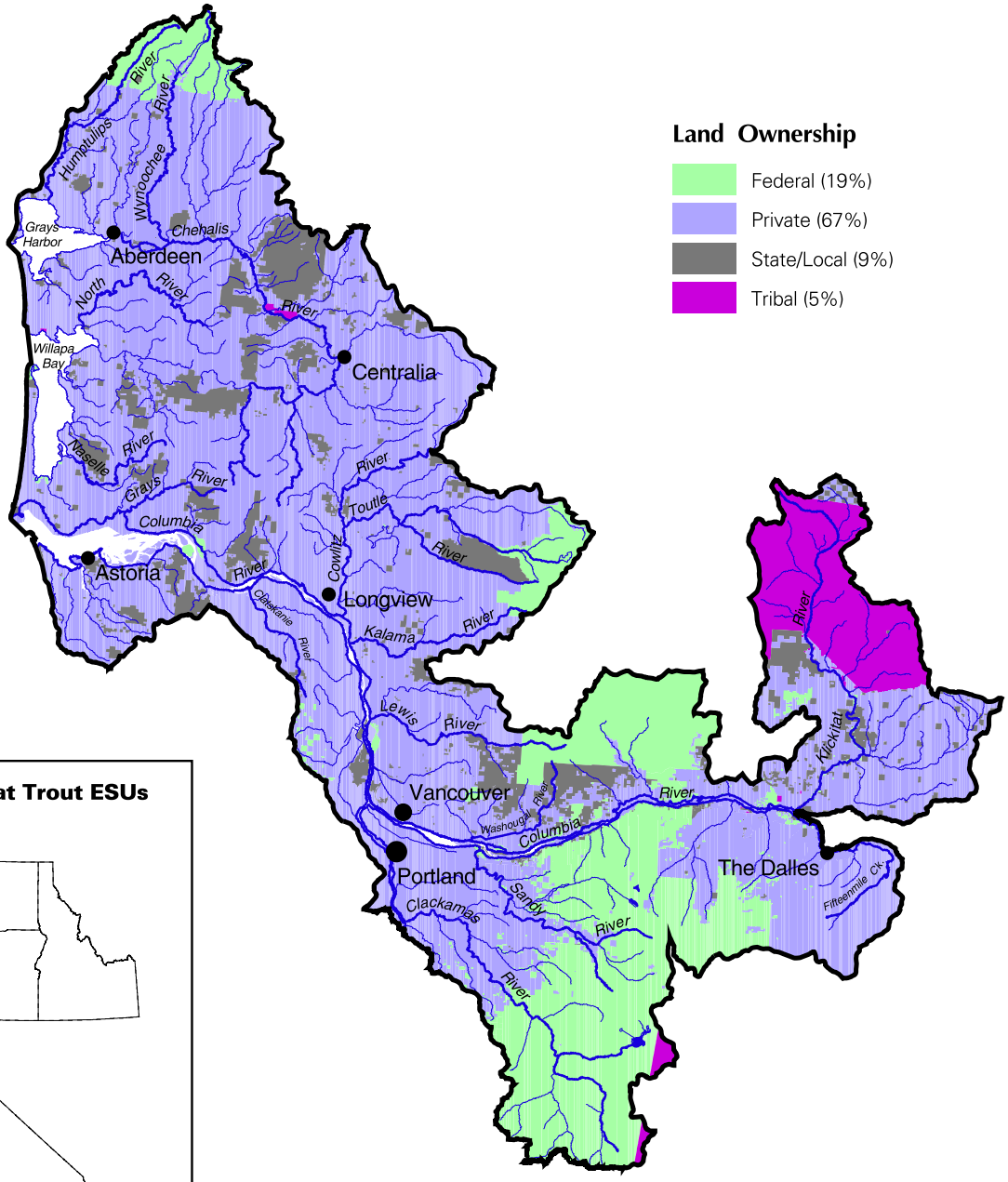
Note: Map is for general reference only.

SOUTHWESTERN WASHINGTON/COLUMBIA RIVER CUTTHROAT TROUT ESU



Cutthroat Trout ESUs

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:

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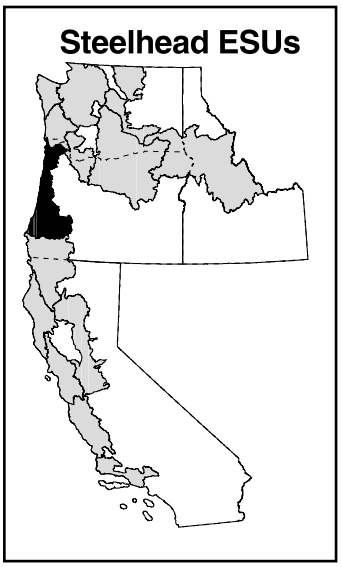
10 0 10 20 30 40 Kilometers

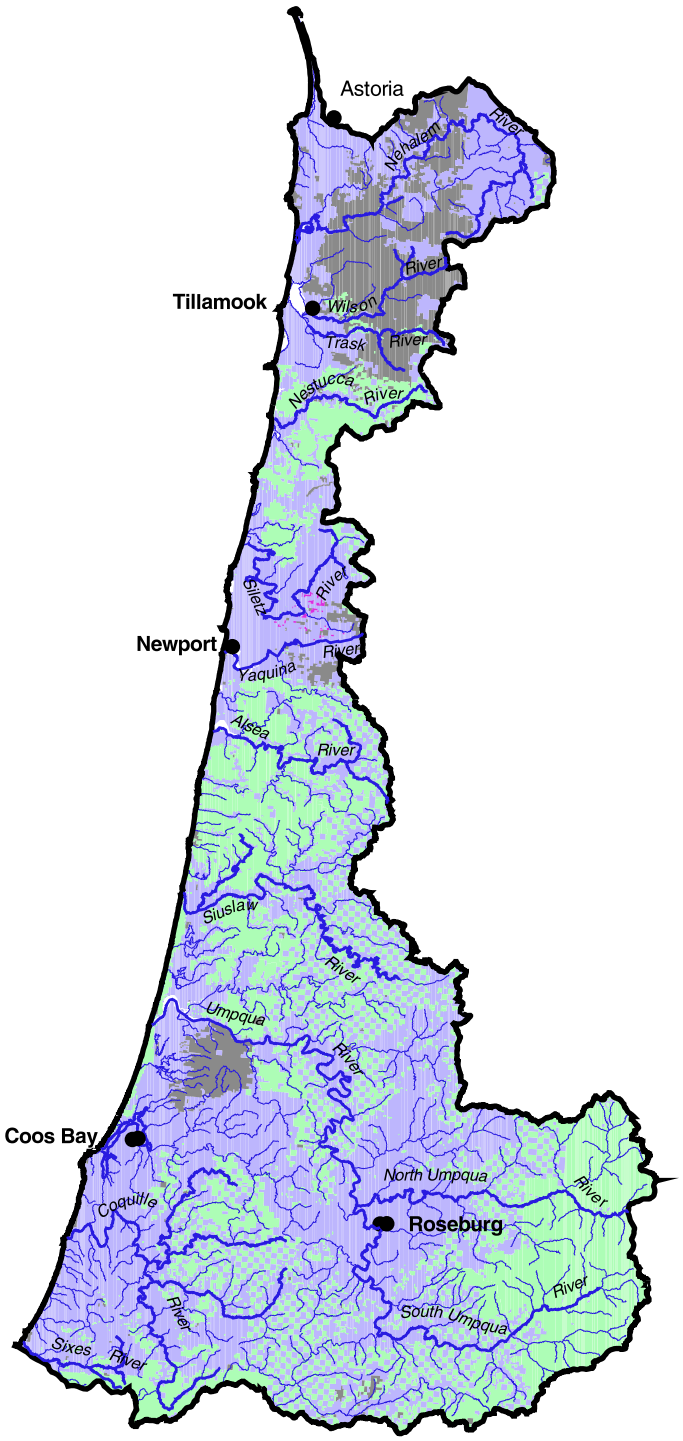
MAP DATE: 2/24/99

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:
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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.