CHAPTER 3: AQUATIC RESOURCES

HISTORIC CONDITIONS

Upland Sediment and Wood Routing

The processes that affect stream function are related to channel gradient and confinement by the surrounding hill slopes. Streams have been separated into geomorphic segments (Appendix G) to explain how water, wood and substrates move through the watershed (Map 7). In general, source reaches provide material, transport reaches move material through, and deposition reaches represent areas where material is deposited. Identifying the location of geomorphic segments are in the watershed allows resource managers to predict where potential fish habitat is and where restoration efforts will be most successful.

This Coastal Lakes Analysis Area contains an unusually high amount *(you mean acres? percent?)* of unconfined deposition area. These particular areas are unique because they contain long, very broad valley bottoms above coastal lakes with a high percentage of wetlands just above the arms of these lakes. These conditions create exceptionally good coho rearing habitat.

The long deposition reaches in the upland valleys include Maple, Fiddle, Fivemile and Leitel Creeks and some of their larger tributaries. They compose a series of valleys above the coastal lakes that have historically contained a wide diversity of habitats. Before human settlement, these long, low gradient valleys contained streams that meandered back and forth between steep adjacent hillslopes. Just above the lake arms and well up into these valleys, there was probably an abundance of side channels and wetlands associated with these streams. Riparian vegetation consisted of alternating patches of sedges, shrubs and trees, producing shady conditions along a majority of these stream lengths.

Up higher in these valleys there were probably stream sections dominated by alder and conifer, and also meandering streams with side channels. During large storms, debris torrents entered the valley from steep side tributaries, introducing large wood to these valley creeks. Streams changed course to accommodate these inputs and because of the low gradient, slow water conditions, large wood stayed in the valley rather than being transported through the system. As streams cut into new locations, it was not uncommon for old, buried large wood to be re-exposed in the banks of streams as is still seen today. High flow events caused water to spill out over stream banks, and stream energy was dissipated quickly in broad floodplains of these valleys.

Wetlands and Deepwater Habitats

Wetlands and deepwater (lake) habitats are distributed throughout the watershed (Map 8--Source National Wetlands Inventory). This wetlands classification (Cowardin, et al 1979), uses five main systems to categorize wetlands and deepwater habitats: marine, estuarine, riverine, lacustrine and palustrine (Appendix H). All five of these systems are represented in the watershed and give some indication of the historic diversity and extent of swamps, bogs and marshes that were so prevalent in the upland valleys, near the lakes and in the dunes after vegetative stabilization.

Within each of these systems are a plethora of subsystems, classes and subclasses (Appendix H) based on vegetation, amount of water present during the year, disturbance factors and bottom characteristics at each location. For this analysis, these divisions have been lumped into the groupings (Map 8).

Table 3.1. Acres of wetland and deepwater habitats in the watershed based on the National Wetlands Inventory.

Wetlands/Deepwater Habitat Category*	Acres	Predominate Locations	Acres and Percentages by System
Estuarine, subtidal and intertidal	66	Near mouths of Siltcoos River and Tahk. Creek	Estuarine = 66 ac. (0.7%)
Lacustrine, limnetic (water > 2m)	5,647	Coastal lakes	
Lacustrine, littoral (water < 2m)	381	Shoal areas of coastal lakes	Lacstr. = 6,028 ac (64%)
Marine, intertidal	147	Beach west of dunal sheet	Marine = 147 ac. (1.6%)
Palustrine, aquatic bed	21	Siltcoos Lagoon and Bear Lake	
Palustrine, emergent vegetation, permanently and semipermanently flooded	516	Larger lake arms; Threemile Creek	
Palustrine, emergent vegetation, flooded part year	947	Maple, Fiddle, Fivemile Creeks; Dunes	
Palustrine, forest, scrub, shrub, flooded part year	1,953	Dunes; Leitel and Threemile Creeks	
Palustrine, unconsolidated bottom, permanently and semipermanently flooded	69	Dunes	
Palustrine, unconsolidated bottom, flooded part year	128	Dunes	Palstr. = 3,097ac. (33%)
Riverine, tidal	50	Siltcoos River	

		and Tahk. Creek	
Riverine, low gradient	28	Siltcoos River and Tahk. Creek	Riverine = 78 ac. (0.8%)
Totals	9,416		

*** Subclasses under the five main systems have been lumped for clearer mapping. See Appendix X for detail on subsystems, classes and subclasses.**

Coastal Lakes

Sixty-four percent of the wetland and deepwater habitats in the watershed are lacustrine (lake), and the nineteen 19 named lakes range in size from under one acre to over 3,000 acres (Map 5). All these lakes owe their existence to the inland advance of the dunes, making them extremely unique.

While so many lakes exist in one area, they are very different in terms of form and productivity. The largest lakes farthest inland are fed predominately by surface streams while others receive inputs from both surface drainage and an extensive dunal aquifer. Several additional unnamed interdunal and ephemeral lakes exist in the dunal sheet and are fed exclusively by the dunal aquifer.

The five largest lakes: Siltcoos, Tahkenitch, Woahink, Cleawox and Threemile.

Table 3.2. Lake characteristics for the five largest lakes in the Coastal Lakes Watershed Analysis area (from North to South within watershed)1/.

Lake Name	Acres	Ave. Depth (feet)	Max Depth (feet)	Shoreline Length (miles)	Shoal Area	Marsh/ Swamp Assoc.	Water Retention Time
Cleawox	87	17	48	5.2	36%	minor	4 mos.
Woahink	820	33	68	14.2	17%	moderate	1.2 yrs
Siltcoos	3,164	11	22	27.8	32%	significant	2 mos.
Tahkenitch	1,674	11	23	25.5	36%	significant	2 mos.
Threemile	63	13	33	2.8	45%	minor	2 mos.

1/ Information taken primarily from Atlas of Oregon Lakes, Johnson et al, 1985.

Siltcoos Lake is the largest coastal lake in Oregon and represents bar formation across the mouth of an old estuary after the last period of glaciation. Its broadness and nondendritic nature make it quite different than any of the other sand dune formed lakes and these qualities are thought to be reasons that migratory waterfowl are so prevalent on this lake. Being very shallow (82% < 15 feet), it is a highly productive (eutrophic), and probably was long before human settlement because of its dimensions. Sunlight penetrates to the

bottom in much of Siltcoos Lake, allowing aquatic vegetation and fauna to thrive. This shallowness also allows complete mixing of waters at nearly all times of year, with subsequent uniform oxygen levels throughout the profile, and higher nutrient and turbidity levels than other lakes. Algae growth is pronounced, giving the lake a characteristic green, murky appearance.

Siltcoos Lake has a 68 square mile drainage basin which includes Maple, Fiddle, Woahink and Lane Creeks. Its outlet is through the 1.5 mile Siltcoos River which empties into the Pacific Ocean. Before human alterations to the lake outlet, periodic salt water intrusions commonly occurred in winter at high tides due to its elevation only 8 feet above sea level.

Siltcoos Lake has a number of islands which support rich stands of riparian vegetation and are used by wildlife and migratory birds. Three of the most prominent islands, Butterfly, Reed and Jernigan Islands, have been proposed for designation as Significant Natural Areas in the past (Johnson et al, 1985). Also important to waterfowl are freshwater marshes (Palustrine, Emergent Vegetation, Permanently and Semipermanently flooded) in Maple and Fiddle Creeks just above Siltcoos Lake (Map 8).

Similar to Siltcoos Lake, Tahkenitch was also submerged at its mouth by the rising ocean after the last period of glaciation and was eventually cut off from the ocean by the advancing dunes. However, Tahkenitch has a more dendritic pattern, common to most cut off river systems, with longer arms and a narrower main body than Siltcoos Lake. At an elevation of approximately 15 feet above sea level, it was not prone to salt water intrusions like Siltcoos Lake.

The drainage basin for Tahkenitch is 34 square miles and includes the Fivemile and Leitel Creek drainages. Due to the morphology of this lake and the valleys above it, there are large, freshwater marshes in two miles of lower Leitel Creek and four miles of lower Fivemile Creek (Map 8). Tahkenitch Creek is the outlet of this lake and flows through dunes for less than one mile before it meets the Pacific Ocean. This creek is somewhat less susceptible to becoming bar bound than Siltcoos because of the larger elevation drop from Tahkenitch Lake to the ocean.

Although some weak stratification has been observed in Tahkenitch Lake, it is usually well mixed by strong sea breezes and shows little tendency to stratify. Subsequently, similar to Siltcoos Lake, it shows similar levels of oxygen throughout its profile. Water in this lake is low in mineral content and soft, and like most of the coastal lakes it is enriched with sodium and chloride because of its proximity to the ocean.

Woahink Lake was once an arm of Siltcoos Lake. Historic records testify that Woahink Creek (the outlet to this lake) once drained into the Siltcoos River, but its outlet became Siltcoos lake in the 1890s when wind action shifted dunes in the area. This creek was again re-routed when Highway 101 was constructed. Woahink Lake is currently adjoined by

dune complexes on its western edge. Unlike Siltcoos and Tahkenitch, this lake is much deeper with steep walls and significantly less shoal area than its larger counterparts in the watershed (Table 4). Its deepest point is 74 feet, or 36 feet below sea level (termed a crytodepression), the lowest of any sand-dune dammed lake on the Oregon Coast (Johnson et al, 1985).

Historically, Woahink has been characterized as one of the most oligotrophic (unproductive) lakes in Oregon. Studies in the late 1960s and early 1970s found that Woahink's water chemistry was very similar to that of Crater Lake in Southern Oregon (personal communication, Larson). Studies in the past have also revealed high clarity due to low organic productivity, high settling velocity of incoming soil materials and sediment deposition in deep, relatively undisturbed waters. Secchi disk readings taken to test clarity (depth of visibility) have been as high as 24 feet (2 stations on Woahink, August, 1972).

In deeper lakes like Woahink, thermal stratification occurs in early spring when winter winds decline. A warmer layer develops at the surface of this lake which does not mix with colder, more dense water below. Summer thermoclines can be found between 20 and 30 feet in Woahink Lake and it is not uncommon for surface water temperature to be from 20-25°F greater than those near the bottom (Larson, 1974). Respiration and decomposition cause some depletion of oxygen and even anaerobic conditions in the lower, isolated layer of the profile during this stratification, especially at the mud/water interface. In fall, surface heating decreases and surface waters cool to temperatures similar to lower depths. Total mixing then continues throughout the winter, and at this time water temperatures at any depth are not lower than 39° F.

A lack of large tributaries that feed this lake is another unique feature about Woahink Lake. The largest of its tributaries is Gibbs Creek which is about three miles in length and half of this length is a forest/scrub/shrub swampy area flooded for part of the year. The entire drainage basin for this lake is only 7.4 square miles. With the small drainage size and few tributaries, lake turnover is longer than any of the other lakes in this watershed; 1.2 years as opposed to 2-4 months in the others (Table 3.2). Seasonal fluctuation of water level of Woahink Lake is only about 1.5 feet (Oregon Fish Commission, 1962)

Dunal Aquifer and Dunal Lakes

The average thickness of the sand deposit at the coastline is about 125 feet to bedrock. The saturated zone of this sand mantle creates a homogeneous, simple dunal aquifer that ranges anywhere from three to thirty feet from the surface throughout the dunes area of the watershed. Groundwater testing by Hampton (1963) showed a drop in the watertable of 2.5 feet from July 1 to October 1 and an increase of 5.15 feet from October 1 to March 1 during a period of 63.6 inches of rainfall in the area. In addition, it has been estimated that over 75% of average annual precipitation reaches the dunal aquifer (Brown and Newcomb,

1963; Hampton, 1963). Although lake levels of Siltcoos and Woahink are higher than the dunal watertable during summer, recharge of the aquifer from the lakes has not been found to be significant (Schlicker, et al, 1974).

Schlicker (1974) estimated that groundwater percolation to the ocean was about 50.3 million gallons per day or 56,400 acre-feet per year. He estimated that total annual discharge to surface water west and east would be 62,750 acre feet per year. Water quality is generally good from the dunal aquifer except for high iron content that requires some treatment.

Cleawox Lake is another coastal lake referred to as a crytodepression due to its depth below sea level. It is fed primarily by the dunal aquifer as well as a few surface tributaries and does not have an outlet. It has historically had very good water quality and studies have confirmed oligotrophic conditions, with high transparency and low productivity as compared to other lakes in the area. Like Woahink Lake, Cleawox also stratifies in summer.

The entire lake is encompassed by the dunal sheet with about half its western shore composed of actively advancing sand dune, once moving northward as much as 20 feet per year prior to vegetation stabilization (Johnson et al, 1985). There are signs that advancing dunes at the southwest corner are slowly filling Cleawox Lake. The remaining 2/3 of the Cleawox basin is vegetated by a pine and scrub complex. Small swampy areas are associated with the tributaries that come into this lake.

Threemile Lake is another dunal lake that is actually a pair of long, narrow lakes joined by a channel in its middle. It formed in a trough between an older, stabilized dune on its east side and an active dune on its west side, making it parallel to the shoreline of the Pacific Ocean. Similar to Cleawox Lake, it is a crytodepression without an outlet, and is fed by only a few surface tributaries and the dunal aquifer. Brush and trees cover most of its drainage basin with the exception of an unvegetated dune on the north end that is actively encroaching. Water quality on Threemile (mesotrophic) differs slightly from Cleawox (oligotrophic) due in part to strong winds on this lake that keep it from stratifying significantly. There are some small wetlands associated with the incoming tributaries to this lake.

Estuaries

Siltcoos River and Tahkenitch Creek estuaries make up the 66 acres of estuary in this watershed. A study of seasonal fish distribution in Siltcoos estuary was conducted in 1986 by the Oregon Department of Fish and Wildlife (Ely, 1987). This study revealed that Siltcoos estuary provides a migratory corridor to and from the lake and its tributaries for coho, cutthroat steelhead starry flounder and sturgeon. Similar to the Tenmile estuary south of this watershed, fish distribution is most diverse in the summer when saltwater is completely flushed with fresh water twice daily. Magnitude of salinity change as well as

rate of change has the greatest effect on fish distribution. In the fall and winter, fresh water dominates these estuaries, causing fish abundance to drop dramatically.

Both the Siltcoos River and Tahkenitch Creek estuaries are subject to becoming bar bound in the Fall. This propensity for bar formation at the mouth is much higher in Siltcoos River than in Tahkenitch Creek given that Tahkenitch Lake elevation above mean sea level is twice that of Siltcoos Lake (15.4 ft. vs 8 ft., respectively). Under natural conditions, bar formation dictated the extent and concentration of brackish water in these estuaries. Larger storms in the late fall and early winter then washed these bars out and allow anadromous fish passage and tidal influence in the estuary.

Historic Fish Distribution and Use

Historically a great amount of fish rearing habitat occurred in the lower unconfined areas of the major tributaries that empty into the coastal lakes (Map 9). This included approximately 8 miles of Maple and Fiddle Creeks, 10 miles of Fivemile Creek and 5 miles of Leitel Creek. However, the lakes probably provided the greatest rearing habitat for the coho salmon. Since the stocking of warmwater fish that prey on the anadromous fish in Siltcoos Lake beginning in the 1920s (ODF&W reports), the rearing conditions in the lower unconfined tributaries have become even more important.

In the late 1800s the low gradient, wide valley bottoms with highly sinuous streams moving back and forth were some of the first areas settled. With settlement came stream modification to accommodate agriculture and primarily livestock grazing. Diking, draining of wetlands, straightening of creeks and removal of large wood all contributed to the loss of rearing habitat in these homesteaded areas. Long time residents of the area interviewed for this watershed analysis described willows extensively lining the stream channels in the past on Maple and Fiddle Creeks, some 40 years after initial homesteading.

The lake systems supported commercial fisheries of about 5,000 adult coho salmon each in Siltcoos and Tahkenitch Lakes around the turn of the century. The adult coho that escaped the commercial and recreational fisheries spawned in the gravels of the upper reaches of the streams (Map 9). These spawning areas were generally where the stream gradient increased, the valley bottom became more confined and large wood was present in greater quantities to hold and sort the gravels from the finer sediments. Some coho salmon spawning continued in reaches greater than 4% gradient, but these areas were generally steelhead and cutthroat spawning reaches.

The Bulletin of the United States Fish Commission (1897) describes an evaluation of Siltcoos, Tahkenitch, and Woahink Lakes by a Dr. Meek to determine if they should stock the lakes with bass and other warmwater species. Dr. Meek concluded that it was not advisable for the commission to stock these fish in the lakes. He said that stocking the bass would be detrimental to the silver salmon fishery and he had concerns that the bass would

spread to the Siuslaw and Umpqua River systems. Dr. Meeks' advice was not taken and a non-native warmwater fishery was created. By the 1920's a very popular bass fishery was created and stocking of various fish species has continued through the present.

An estimate of coho spawner escapement for the last 4 decades (ODF&W) shows that populations in Siltcoos and Tahkenitch are well below levels that existed in the late 1890's that averaged 5,000 fish just in the commercial catch (Table 3.3).

Table 3.3.- Average estimated spawning coho salmon stock size by decade.

	Decade			
Lake Basin	1960's	1970's	1980's	1990's
Siltcoos	5,055	3,015	3,475	3,387
Tahkenitch	1,845	2,144	3,198	1,607
Tenmile	30,919	16,124 **	4,764	5,917

** Lake treatment and bass re-establishment occurred in this time period. Average stock size after 1971 when the bass reestablished was 6,500.

The effect of warmwater species introduction on the coho salmon population of a coastal lake is exemplified in Tenmile Lake just North of Coos Bay, Oregon. In 1968, this lake was treated with a pesticide to rid the lake of its warmwater species. In the years following the treatment, numbers of coho salmon dramatically increased for two years until the bass, bluegill and brown bullhead became established in the lake again. Subsequently the numbers of coho salmon again began to drop over the last 25 years that are about 19% of the coho stock size estimate of the 60's and 6% of those estimated around the turn of the century (ODF&W Tenmile Basin Fish Management Plan 1991). It is likely that the warmwater fish have similarly limited the coho salmon populations in Siltcoos and Tahkenitch Lakes basins.

CURRENT CONDITIONS

Dams on Siltcoos and Tahkenitch

The earliest documentation regarding dams in this watershed is a 1949 report by the State Game Commission (later Oregon Department of Fish and Wildlife). It states that the Coos Bay Pulp and Paper Company had been using an earthen dam at the Tahkenitch Lake outlet to raise water levels in summer, allowing tug boats to go further up the arms of Tahkenitch to retrieve log rafts. In 1949 they proposed an 8-10' high splash dam structure with concrete footings that would allow them to withdraw water during summer. Game Commission field biologists surveyed in Five-Mile Creek and determined that a 5-foot rise in summer water level would not impact spawning gravels since this lake level would be similar to winter levels. This report also documents that before the dam was put in,

natural lake levels fluctuated between 7 and 19 feet above mean sea level (OFC Memo, 1949).

In 1960, International Paper Company (I.P.) acquired a permit to divert water from Tahkenitch and Siltcoos Lakes to supply water to a pulp mill in Gardiner, Oregon. I. P. was given an authorized to divert 12.46 cubic feet/second (cfs) from Siltcoos Lake and 36.65 cfs from Tahkenitch Lake. Multi-gated dams for both lakes were constructed in 1963 under the guidance of the permit issued by the State Engineer which stipulated minimum flow and fish passage requirements. In 1966, minimum flow requirements were modified from 50 cfs to 20 cfs for Siltcoos dam and from 20 cfs to 15 cfs for Tahkenitch and these flow requirements remain in tact (Tables 3.5 and 3.6). The Water Master (State Water Resources Department) in Roseburg, Oregon, and Oregon Department of Fish and Wildlife have joint responsibility for ensuring I.P.'s compliance with the permit.

Interestingly, I.P. has drawn water from Siltcoos Lake six or fewer times over the last 34 years that the dams have been in operation. Siltcoos water is used only under emergency conditions when drought has impacted Tahkenitch Lake levels such that water can no longer be drawn. Although additional issues drive lake level maintenance, some advocates have questioned the need for a dam on Siltcoos Lake when weighing the ecological effects against the minimal lake withdrawls.

Construction of both dams included a fish ladder with a required flow of 12.5 cubic feet per second. In 1966, the Siltcoos fish ladder was altered to allow better passage for searun cutthroat. Fish passage requirements differ throughout the year for these two lake systems (Table 3.4). *(The table does not show any differences--clarify)*

Table 3.4. Fish migration through Siltcoos and Tahkenitch outlets.

Time of Year	Fish Activity
October 1 - February 1	Adult coho salmon entering
December 1 - April 1	Adult steelhead entering
July 1 - November 1	Adult sea-run cutthroat trout entering
January 1 - June 15	Juveniles of all three anadromous fish species leaving
Spring	Occasional citing of Sturgeon entering lakes

The original permit recommended periodic flushing in the Fall as needed to keep the mouths of Siltcoos and Tahkenitch Creeks open where sand bar formation has the potential to obstruct fish passage from the ocean. Under natural conditions, larger winter storms in December and January would eventually wash out these bars to allow fish passage. ODF&W documents *(need a better ref. citation here)* state that before the dams were

put in, these creek mouths often inhibited fish passage in the Fall and were dug out by heavy equipment or by hand on several occasions.

Several different points emerge about the practice of flushing the creeks. Some contend that artificially flushing the bars encourages the salmon to move upstream earlier then they would if flushing happened naturally, as with a large rain storm. With artificial flushing, the salmon may enter the spawning grounds before the flows are high enough to make many of the best spawning areas available to the fish. In the past this practice also allowed fishermen a longer fishing season for the salmon and increased license sales and revenue from fishing supplies and accommodations *(ODF&W reference?)*.

Some suspect that the flushing later in the year may be more advantageous for the salmon (*than what*?). On the other hand, timing of the salmon runs may have been shifted over the past 35 years to earlier in the Fall due to artificial flushing (*reference?)*. In addition, planted beach grass has changed the function of the dunes and may also be impacting bar formation.

Although letters from the Water Master on three separate occasions in 1992 and 1994 indicated non-compliance with the flushing stipulation of the permit, recent attention to the dams by I.P. has been more thorough. Bar formation is checked daily and strip charts from stage height recorders below both dams are sent to the Water Master in Roseburg to show compliance. The Siltcoos gage must show high tides each day to prove that its mouth is open. With the recent departure of ODF&W personnel from Florence, monitoring of permit compliance is currently limited to this reporting to the Water Master and infrequent visits he makes to the coast.

Based on stage height records taken on both lakes from the late 1950s before the dams were constructed, Tahkenitch and Siltcoos Lake are held at an average 3.0 to 4.5 feet higher than natural lake levels between April and November. The effect of less lake fluctuation on upstream ecology has not been studied, but intermittent wetlands that once dried up in summer are now innundated year round while floodplain areas once used for grazing by private landowners have either been abandoned, diked, and drained to accommodate seasonal grazing as in lower Maple Creek (Map 10). A local lakes group has documented the loss of groups of islands that were once used by waterfowl as well as erosion of saturated toe slopes into Siltcoos Lake, due most likely to the fact that water no longer recedes in this area during summer.

In addition to changes in resource function, lake level management has developed a social dimension. Some private homes and resorts along Siltcoos Lake are increasingly vocal about their desire to maintain lake levels that accommodate boat docks for a large portion of the year but also protect property from flooding. Following high water in the floods of 1996, a Coordinated Resource Management Planning (CRMP) process was facilitated by the Siuslaw Soil & Water Conservation District for the Siltcoos Lake area to address

concerns by residents and resorts on the lake. In October of 1996, this CRMP produced an interim agreement that maintains Siltcoos Lake at 8 feet from March 15 - September 1, drops lake level to 6 feet from September 1 to November 1, and then opens the gates to maintain a 6-foot level throughout winter. Given that these lake levels fall within the requirements of the State permit, no conflict of interest exists.

Table 3.5. Tahkenitch Dam Management by International Paper Company.

Dates	Maximum Lake Level	Flow Management	Minimum Lake Level	Minimum Flows
Nov 1 - Mar 31	15.4 ft. Mean Sea Level	If lake level exceeds 15.4 ft., all gates shall be fully opened until lake level reaches 15.4 ft.	10.0 ft. Mean Sea Level *	Fish Ladder: 12.5 cfs Total: 15 cfs
April 1 - Aug 31		Fully or partially open gates to maintain lake level at 15.4 ft. **	10.0 ft. Mean Sea Level *	
Sept 1 - Oct 31		Increase flows to maintain open channel. Fully or partially open gates to maintain lake level at 15.4 ft. **	8.0 ft. Mean Sea Level	

* As possible while maintaining authorized diversion and minimum flows.
** If lake level exceeds maximum allowable, fully open all gates until level reaches maximum.

Table 3.6. Siltcoos Dam Management by International Paper Company.

Dates	Maximum Lake Level	Flow Management	Minimum Lake Level	Minimum Flows
Nov 1 - Mar 31	8.0 ft. Mean Sea Level	If lake level exceeds 8.0 ft., all gates shall be fully opened until lake level reaches 8.0 ft.	5.0 ft. Mean Sea Level *	Fish ladder: 12.5 cfs Total: 20 cfs
April 1 - Aug 31		Fully or partially open gates to maintain lake level at 8.0 ft.**	5.0 ft. Mean Sea Level *	
Sept 1 - Oct 31		Increase flows to maintain open channel through sand bar at mouth of river. Check strip chart daily for evidence of tidal swing. Open gates if strip chart does not indicate high tide occurred. Fully or partially open gates to maintain lake level at 15.4 ft.**	3.0 ft. Mean Sea Level	

* As possible while maintaining authorized diversion and minimum flows.
** If lake level exceeds maximum allowable, fully open all gates until level reaches maximum.

Stream Modification

As many of these streams were relocated, straightened and confined with dikes, channel morphology and habitat for aquatic resources were greatly altered (Map 10). Appendix E provides estimates of the amount of channelized and diked mainstem in each subwatershed based on aerial photo analysis. Maple, Fiddle and Fivemile Creeks have been modified for a majority of their mainstem lengths (94, 89 and 69 percent, respectively) while Bear Creek has been moderately modified (44 percent) and Leitel none at all. Much of these modified areas are either currently being grazed or were abandoned for grazing some time in the past after lake levels were modified by the dams (Map 10).

Straightened channels are more efficient at transporting sediment than the meandering channels they replaced. Eroding stream banks in diked portions provide a steady source of sediment which can eventually be transported to the lakes below these streams. Evidence of this sedimentation is readily visible in aerial photographs of the mouth of Maple Creek where a delta has been forming and is beginning to cut off a 10-acre arm of Siltcoos Lake Appendix N. Although delta formation such as this is a natural phenomenon, the process is being sped up by several times due to the excess sediment in Maple Creek.

Large Woody Debris

The unique wide alluvial valley bottoms in combination with the coastal lakes makes interpretation of large wood potential and its effects to the streams and aquatic habitat much different than in previous watershed analyses completed on the Mapleton District. We believe that historically there were only scattered large trees present in the valley bottoms with occasional clumps that extended out from the slopes, possibly on old landslide deposits. The lack of standing large wood around these mainstem channels may not be new although areas where the stream is near the slope breaks on the edge of the valley historically had the highest potential for providing large wood to the stream. Currently these areas have been extensively logged and have little or no potential to supply large wood (Map 11).

In the future contributions of large wood will come from landslides, predominantly from federal lands where large standing trees remain. Farther upstream in the moderately confined reaches, the potential for large wood increases (Table 3.7).

The confined portions of the Fiddle and Fivemile subwatershed and the moderately confined portion of the Bear Creek subwatershed had the highest percentages of adequate supply of large wood. The moderately confined reaches of Siltcoos, Fivemile, Fiddle, and Maple subwatershed have the highest proportion of area not adequately supplying large woody debris (Table 3.7). At the reach level of analysis, the North Prong, upper Fiddle and upper Bell Creek areas have the greatest potential to supply large wood to the streams within the watershed (Map 11). *(Define adequate, near term, and not adequate.)*

Table 3.7. Proportion of confined and moderately confined stream reaches, and potential to supply large wood for subwatersheds in the analysis area.

Subwatershed	Confinement	Adequate	Near-Term	Not Adequate
MAPLE	moderate	30.5	4.7	64.8
MAPLE	confined	47.6	6.7	45.7
FIDDLE	moderate	30.7	0.3	69.0
FIDDLE	confined	57.9	2.3	39.9
BEAR	moderate	55.0	3.3	41.6
BEAR	confined	47.4	1.4	51.2
FIVEMILE	moderate	27.6	3.4	69.0
FIVEMILE	confined	57.2	8.1	34.7
LEITEL	moderate	25.1	32.1	42.8
LEITEL	confined	29.6	15.7	54.7
WOAHINK	moderate	20.8	35.1	44.1
WOAHINK	confined	26.3	31.4	42.3
SILTCOOS	moderate	31.9	10.4	70.2
SILTCOOS	confined	19.4	4.7	63.4
TAHKENITCH	moderate	33.0	28.1	38.9
TAHKENITCH	confined	16.5	23.2	60.3
THREEMILE	moderate	46.0	29.5	24.5
THREEMILE	confined	13.2	55.3	31.5
Total -- Appendix E		*Total*	*Total??*	*Total??*

***Unconfined reaches not shown because it would skew the picture of the function of the wide alluvial bottoms.**

Upland Water Quality and Fisheries

Maple Creek

Forest service ownership is limited to the upper two miles of the headwater mainstem of Maple Creek. Tributaries to Maple Creek which are managed by the Forest Service include Carter, Henderson, North Prong, Schultz, Tenmile and over half of Jordan Creek. From the mouth of Maple Creek at Siltcoos Lake, the first mile or so is in a wetland bog condition until near the confluence of Maple Creek and Schrum Creek. From that point up to the Forest Service boundary (about 8 miles *out of how many*?) the Maple Creek valley bottom (including tributary mouths) has been extensively diked, cleared, straightened and drained--and some of these activities continue today. Subsequently the stream has downcut and has many steep nearly vertical banks that are eroding as the stream tries to reestablish meanders and dissipate energy at its new base level. Few pieces of large wood remain in the channel since landowners were told in the past to remove the wood if they wanted to minimize flooding.

Grazing in this watershed continues to impact the fishery habitat of this stream. There are few areas along this stretch of creek where there is enough vegetation on the banks to stabilize them including a few willows that remain from the willows that naturally lined this channel. There may be temperature and algae bloom concerns in this creek due to the lack of riparian vegetation to provide shade and nutrient input from the agricultural activities in the valley bottoms, however, recent information on these problems has not been collected on private land ownership. In 1974, Lane County surveyed several sites in western Lane County and found that lower Maple Creek had the highest coliform counts in the basin due to agricultural uses. Counts were 100 organisms/100 ml while water considered unsafe for recreational use is 750 organisms/100 ml. Dissolved oxygen dipped to 9 mg/L in one sample while the Department of Environmental Quality (DEQ) minimum standard is 6 mg/L. Low dissolved oxygen was attributed to unagitated water and agricultural activities (*reference??)*

The low gradient continues up the mainstem of Maple Creek and tributaries until climbing into the headwater areas (20 percent gradient). North Prong and Upper Maple Creek appear to be the most productive stream reaches managed by the Forest Service. These are the areas where the majority of the spawning for coho, steelhead and cutthroat and probably a substantial amount of rearing occur (Map 9).

Coho spawning surveys have been conducted on Henderson, North Prong and Maple Creek. North Prong and Maple mainstem had the most fish and Henderson Creek had substantial numbers as well within the Maple Creek drainage (Table 3.8). Additional spawning information is available from ODF&W but was not easily retrievable for this analysis.

Table 3.8. Spawning survey information for WA area (*Give units. Surveys? Fish??).*

Spawn Surveys Coho	Henderson Creek	North Prong Creek	Maple Creek	Alder Creek	Fiddle Creek	Fivemile Creek	Leitel Creek
1960						73	168
1961						146	284
1962						230	272
1963	85	81	82	199	157		
1964	60	96	106				
1965-95	No data	No data	No data	No data	No data	No data	No data
1996	45	107	138	65	192	306	410
1997	22	39	53	25	166	210	358

Fiddle Creek

Forest Service ownership is limited to the upper 5 miles (*out of how many total mainstem miles?)* of the headwater mainstem of Fiddle Creek. The Upper Fiddle subwatershed is

listed as a Tier 1 Key Watershed under the Northwest Forest Plan (1994) and is the only Key Watershed in this analysis area. Tributaries to Fiddle Creek where the Forest Service has some management of the upper reaches of the stream include Bear Creek (3 miles mainstem and 1 mile South Fork), Billy Moore Creek (1 mile), and Alder Creek (1.5 mile)

From the mouth of Fiddle Creek at Siltcoos Lake the first mile or so flows through wetland/bog habitat until near the confluence of Fiddle Creek and Young Creek (near the Ada Grange). From that point up to at least the Forest Service boundary (~ 8 miles) the Fiddle Creek valley bottom (including tributary mouths) is used extensively for agriculture, primarily cattle grazing. Similar to Maple Creek, Fiddle Creek has been diked, cleared, straightening and the stream channels and valley bottom have been drained.. Similar raw banks with little or no woody vegetation are common and a lack of large woody debris limits pool habitat.

There has been some recent fencing to remove livestock from the streambanks in the upper areas of private and along Fiddle Creek and some areas where livestock grazing has been removed altogether and stream channel work and riparian plantings have begun in an effort to improve salmonid habitat. These areas are supporting more vegetation *(than what?)*. Woody plants such as willows will begin colonizing these areas as soils become exposed from the stream meanders and point bars that will form. Again like Maple Creek, fish habitat in mainstem Fiddle Creek may be temperature limited and high nutrient loads from agricultural practices may increase algae activity and decrease water quality. We have not collected any information on these problems because this area is privately owned, but since the county road runs along side the creek, windshield surveys are revealing.

Similar to Maple Creek, the low gradient continues well up the mainstem and tributaries before climbing into the headwaters (Map 7). Bear and Upper Fiddle Creek appear to have the most productive stream reaches managed by the Forest Service. These are the areas where the majority of the spawning for coho, steelhead and cutthroat, and probably a substantial amount of rearing occur. We suspect that some of the best rearing is located in the wetland/marshes in the first mile above Siltcoos Lake. Spawning counts have been taken in Alder and Upper Fiddle Creek, and the high numbers of returning coho to Fiddle Creek indicate why this area was selected as a key watershed (Table 3.8).

A stream survey completed on Forest Service managed lands on Fiddle Creek in 1997 divided the stream into three reaches:

- Reach 1 has a stream gradient less than 1% through a 150 foot wide valley bottom. The stream is deeply entrenched but highly sinuous. There are abundant gravels with a fair amount of sand especially in the lower part of Reach 1 where streambank erosion is high due to cutting of the steep banks. Woody riparian vegetation is lacking and the early seral vegetation present is not able to stabilize the streambanks. Low amounts of large wood were present in this reach but where they were, excellent fish habitat was

also present. Five beaver dams were counted and made up about 8% of the pool area. Many juvenile salmonids were observed in this reach.

- Reach 2 has a about 4% stream gradient through a 100 foot valley bottom bordered by terraces and steep hill slopes. The stream is predominantly bedrock substrate with some accumulations of sediment behind occasional logjams. Debris flow activity was more evident than in Reach 1. Mature conifer forest lies on both hillsides above this reach with alder and bigleaf maple directly along the stream.

- Reach 3 has about a 4% stream gradient through a narrow (less than 100 ft) valley directly bordered by steep hill slopes. Channel geometry is greatly affected by deposition behind debris jams, some of which are large. Gravel, cobble, boulders, and bedrock were present in roughly equal proportions through this reach with the largest substrate size present in greater proportion at the upper section of this reach. Mature conifers dominate the riparian area with substantial amounts of alder and bigleaf maple shading the stream.

In the 1970's parts of Reach 1 and Reach 2 were stream cleaned. That is, log jams were removed that were considered detrimental to fish migration at the time. This has had drastic effects, especially in Reach 2 where the substrate material that was present behind these debris jams was released downstream and consequently Reach 2 is predominantly bedrock with little fish habitat value and has little or no wood to accumulate substrate material in the future. Restoration efforts in this reach could greatly increase the numbers of coho in Fiddle Creek due to the currently limited creek sections that possess good spawning gravels.

Fivemile Creek

This stream contains one of the strongest runs of coho on the Oregon Coast. In 1996 and 1997 peak escapement counts were approximately 200 and 300 fish per mile, respectively. Fivemile Creek flows into the northeast corner of Tahkenitch Lake, meandering through about two miles of marsh/wetland habitat. The first 8 miles of the creek are in private ownership with the upper mile managed by the Forest Service. A 1997 fish habitat survey in this upper mile reach showed a riparian area dominated by alders and bigleaf maple. Stream bank stability is good and gravels are abundant. Rearing for salmonids is limited due to low flows during the summer, the overall lack of large wood present in the system and subsequent lack of deep pools developed with the large wood.

For about 1 mile below Forest Service managed land, Fivemile Creek continues through an alder dominated riparian zone with low gradient and probably abundant gravels for spawning. This section has more flow present during the summer, providing rearing more habitat for salmonids.

On the next 5 miles of Fivemile Creek vegetation has been cleared and the riparian area is currently used for grazing. It is likely that this area is similar to Maple and Fiddle Creek segments that have or are being grazed after being cleared of most woody vegetation. Stream banks are likely to be unstable in many places with a high amount of fine sediment present in the gravels of stream riffles. This area has not been diked as much as portions of Maple and Fiddle Creek but some diking and draining were observed in 1997 aerial photographs. Where the diking and draining have occurred, expect to find a more downcut channel with unstable banks where the stream is attempting to reestablish its meander pattern. There is probably a large reduction in fish habitat through this stream section and we would expect to see fewer juvenile coho rearing here than there would have been historically.

The main feature that is different about Fivemile Creek compared to Fiddle and Maple is the extent of marsh habitat in the lower 2 miles of the creek that has not been diked and drained, at least not lately. We suspect this area contains the majority of the summer rearing habitat for the coho in this stream. The stream meanders through this marshy area with overhanging banks and vegetation, acting almost like a slow backwater behind a beaver dam, where coho often thrive. Side channels look like they exist from the aerial photographs as well. There may be temperature and algae bloom concerns in this creek due to the lack of riparian vegetation, however, we have not collected temperature information because the area is privately owned.

Fivemile was the only creek we know to have had a hatchery within the analysis area. Located near the mouth of Harry Creek, written reports could not be found in ODF&W files detailing the years of operation or species handled at this hatchery. It is believed to have operated in the 1920s and '30s and may have been connected with the Knowles Creek hatchery in the Lower Siuslaw Watershed area (personal communication, George Westfall).

Bell Creek is a major tributary to Fivemile Creek. The lower mile of Bell Creek is privately owned and currently grazed. Much of the riparian vegetation has been removed, and streambank stability and the subsequent fine sediment accumulating on the gravel substrate are of concern. It appears from the aerial photographs that portions of Bell Creek have been pushed to the side of the valley to increase the amount of available pasture, probably sometime in the distant past.

The next mile of Bell Creek is under Forest Service management and about ¾ mile is being grazed under a special use permit. In this area most of the riparian vegetation is gone and streambanks are eroding. Valley floor width is about 300 feet. Deep pools are lacking due to the lack of large wood, although coho salmon juveniles are abundant in the pools that are present. Spawning gravels are abundant and rearing habitat could be greatly increased if streambank and riparian conditions were improved. There may be

temperature and algae bloom concerns in this reach due to the lack of riparian vegetation to provide shade. Temperature information is being collected in this reach for 1998.

After this 1 mile of Forest Service land the creek runs through about 1/3 mile of private lands that have been logged, leaving only a narrow band of bigleaf maple and alder along the stream. This reach of stream contains a fair amount of woody debris, primarily logging slash, and most is not stable enough to form long term fish habitat. In this reach the 1997 fish habitat survey indicated about 1000 feet of stream was dry due to the accumulation of sediment and gravels behind a log jam. Eventually this substrate will set up enough to support a perennial stream if large torrents of unconsolidated material do not come down in the next few years.

The next 1/3 mile of Bell Creek is managed by the Bureau of Land Management. The creek passes through natural stands where riparian areas are dominated by alder with some conifer near the creek, and dense stands of conifer are on the north side of the creek. Fish habitat is good in this stream reach with moderate amounts of large woody debris, associated deep complex pools, and abundant gravels. There is a large logjam present in this reach that is not a fish barrier but has accumulated large amounts of substrate material above the jam and has caused the stream to run subsurface in the summer for about 200 feet. Again, we believe this is a temporary condition that will set up and run perennial in the next few years if no other debris torrents come down. Coho salmon juveniles were abundant in this stream reach with lesser numbers of steelhead and cutthroat.

The next ½ mile of Bell Creek that was surveyed also runs through natural stands. The gradient increases to 5% and the canyon narrows up to about 50 feet.. This reach of stream was subject to a debris torrent, probably in February, 1996, that scoured a substantial amount of this reach. Occasional debris jams have caught substrate and formed pools that may support fish throughout the summer. The 1997 habitat survey showed that fish were present in this reach, probably cutthroat and steelhead juveniles. The substrate in this reach is composed of bedrock, boulders and primarily cobble with small accumulations of gravel behind debris jams. There is high potential for recruitment of large conifers from the upslope areas so the habitat conditions will probably improve in this reach in the future if left alone *(left alone? you mean no logging? no land slides??)*.

Much of the higher production seen in Fivemile Creek is thought to be due to the greater complexity and extent of the wetlands in the lower part of Fivemile Creek compared to Maple and Fiddle. The lower amounts of diking, draining, and straightening of Fivemile Creek could also explain some of the differences in run strength.

Leitel Creek

Leitel Creek currently has the highest spawning escapement counts per mile of any stream in Oregon. In 1996 and 1997 peak spawning coho counts were 410 and 358 fish per mile

respectively. Leitel Creek is approximately 6 miles long and two miles of lower Leitel are in wetlands. These marshy areas have multiple channels and low growing shrubs with a few Sitka spruce and Douglas-fir lining the channel along the road. The next two miles of stream are low gradient, but with a more defined channel, narrower valley, and alder in the riparian area. The substrate is mixed gravel and fines for the first half of this reach and prime spawning gravels for this system in the second half of this reach. The last two miles of the creek are in a more confined valley that limits channel migration and the gradient steepens. Substrate size tends to be larger except where woody debris has collected and trapped gravels behind. This portion of Leitel is most important to the steelhead and cutthroat trout.

Leitel Creek is the stream system in the watershed that has been the least manipulated and most resembles a functioning stream. The major limits to Leitel Creek are the road that runs through the riparian area for most of the stream length and logging close to Leitel and its tributaries. Currently, the drainage ditch on the upper, steep portion of this road is not functioning due to debris and vegetation, causing water to drain on the road during winter. A stream crossing culvert at the bottom of the steep portion of this road also shows potential for clogging and failing into these same gravels and should be maintained or upsized to prevent this. This would help reduce the amount of sediment entering the stream and keep the gravels cleaner where the fish are spawning.

We talked to some loggers that worked on Leitel Creek in the 1970s pulling large timber out of the creek, yet Leitel has maintained high fish production. Since the wetlands in the lower end of the stream have remained fairly intact, this is probably the area that is responsible for the high production in this creek. This area would be used as rearing habitat for the coho salmon.

Riparian Vegetation and Water Temperature

Stream temperature is a function of several factors including solar intensity, vegetative and topographic shading, climate, channel shape and substrate type, the amount of channel directly exposed to sunlight and the presence of cool water inputs to channels. Many of these factors are either directly or indirectly related to the amount and type of riparian vegetation along stream banks of an area being considered.

Riparian vegetation was not mapped to a degree that would allow a thorough analysis of shade adequacy for the riparian zones of this watershed. A cursory analysis of riparian vegetation was conducted using aerial photography to obtain general percentages of the mainstems in full, partial or no shade in summer when stream temperature is of most importance to anadromous salmonids. (Map 12) (Appendix E). (*Possibly include bar chart with numbers; explain that Maple and Fiddle are most impacted, Bear and Fivemile - moderately, Leitel - not much).*

Fiddle Creek is the only stream in the watershed for which we have summer water temperature data (Map 12). Summer 1997 water temperature monitoring in upper Fiddle, about 2/3 of the way up the mainstem in a deposition reach indicates the seven-day average maximum temperature exceeded the State standard of 64° F by about 2 1/2 degrees. Peak daily temperatures exceeded the standard for just less than 50% of the days surveyed (Table 3.9). Reasons for high temperatures this high in the watershed are unlcear and, to some degree, unexpected. Riparian vegetation is dense above this monitoring site (Map 12). Some large wood removal upstream in the past caused one reach to scour to bedrock, but this confined reach is fully shaded, even after the scour. Verification with 1998 monitoring will determine if standard-exceeding temperatures truly exist in upper Fiddle Creek. If so, it suggests a need to pursue restoration efforts higher in this stream to create deep pools that can serve as thermal refugia for salmonids in this key watershed.

Table 3.9. Temperature monitoring for upper Fiddle Creek, Summer 1997

Sampling Period	Seasonal Max (& Date)	7-Day Avg. Max	Week of Max Temp.	Days > 58° F	Days > 64° F
6/24/97 => 9/17/97	68.4° F (8/14/97)	66.4° F	8/10/97 => 8/16/97	84 out of 86	41 out of 86

Summer temperature monitoring is presently occurring in seven locations throughout the watershed. Data will be available early in 1999 and added to this document.

Landslide Susceptibility and Roads

A model based on slope form and gradient indicate that midslope roads in high and extreme landslide susceptibility areas, especially roads built before 1975 with sidecast, and midslope roads in unstable areas such as headwalls are of greatest concern (Map 13) (Appendix C). Sidecast, midslope roads have the highest potential for failure during large storm events and require the most road maintenance. Two roads that are of concern for the reasons are the Sunset Road (2480) and the Popo Road (4830). These roads have the most ravel and cutbank failure of any two roads on the Mapleton District (personal communication Eli Adkisson, former Mapleton road manager). *(Describe ATM status and slope position status).* The stability analysis is based on a 1989 ortho photo and is missing roads built or reopened in the last nine years--primarily roads most recently reopened around Tahkenitch Lake as part of recent harvest.

Include table of Slides after 1996 storm by subwatershed.

Road densities is one indicator of whether or not watersheds are functioning for salmonid spawning and rearing used by The National Marine Fisheries Service (NMFS) (Appendix E). Road densities less than or equal to 2 mi./mi^2 are considered "functioning" while

densities greater than or equal to 3 mi./mi^2 are considered "not functioning", and densities between 2 and 3 is considered at risk. *Using this definition, explain the numbers.*

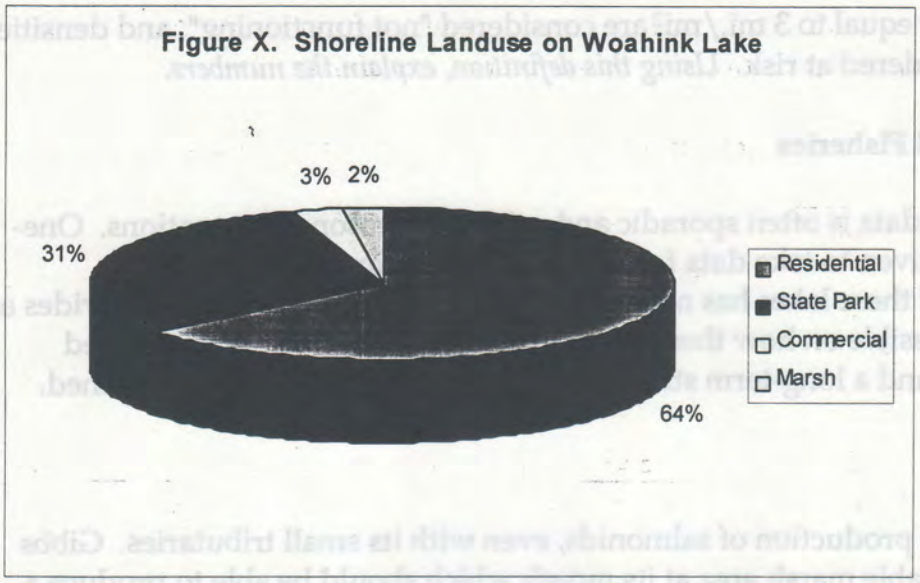
Lake Water Quality and Fisheries

Historical water quality data is often sporadic and subject to seasonal fluctuations. One-time grants were often given to take data for short periods of time, but long term, consistent monitoring of these lakes has not been undertaken. This discussion provides as much information as possible on how these lakes are being impacted so that the "red flags" can be identified and a long-term strategy for consistent monitoring established.

Woahink Lake

Woahink Lake has some production of salmonids, even with its small tributaries. Gibbs Creek has a very respectable marsh area at its mouth which should be able to produce a fair number of salmonids. Little Woahink is a small reservoir formed by a privately owned dam which does not allow fish passage without intervention of the STEP group. There may be a lack of gravels for spawning to produce high numbers of fish in these systems, especially streams on the Northwest and West sides of Woahink which flow in from the dunal formations. Warmwater species are present in Woahink Lake but their extent is limited by the deep water areas and lack of production relative to Siltcoos and Tahkenitch. This lake may have the potential for rearing salmonids over the summer especially in the deeper water areas.

Woahink Lake is probably the most susceptible to changes in water quality than any other lake in the watershed. Historically the most oligotrophic lake on the Oregon Coast, the most pressing threat to water quality is the amount of development occurring around Woahink Lake. Current and future conditions of water quality in Woahink Lake are directly tied to how this development has occurred and continues to occur (Figure 3.1).



There are signs that nutrient levels and therefore productivity are increasing in Woahink Lake to the detriment of water quality. Primary productivity changes over time in lakes that are increasing in nutrients. Mean primary productivity in 1991 was three times that measured in the late 1960s (Table 3.10). Given these numbers, it is believed that Woahink has shifted from oligotrophic to mesotrophic during the last two and a half decades (personal communication, Larson). While the eutrophication of lakes is a natural part of their succession, the changes in Woahink Lake are taking place far sooner than would naturally occur in this deep lake.

Table 3.10. Primary productivity in Woahink Lake for three years (mg C/m^2/hr).*

Year Measured	Number of Profiles	Max	Mean
1968	8	37.05	19.91
1969	9	45.96	21.01
1991	2	81.97	65.39

* Data taken from Larson, 1972 and an MS Thesis by Dagget, 1994

Another sign that productivity in Woahink Lake may be increasing is revealed in secchi disk measurements used to monitor water clarity. Depth of visibility decreased from 1989 to 1991 and from 1993 to 1997. Increases from 1991 to 1993 may be a result of changes in inputs from the watershed and the climatically driven cycle (Oliver et. al, 1998). The depth of sight, 1993 to 1997 decreased at a rate of 1.8 feet per year, which is a significant trend (Figure 3.2).

Figure 3.2. Mean secchi disk depth for Woahink Lake, 1989-1997.

Eutrophication of Woahink and Siltcoos Lakes is particularly alarming since development continues with neither area wide sewage nor water treatment facilities in this area. Currently, several housing developments around Woahink and Siltcoos lakes rely on small private water treatment facilities of varying size and effectiveness that draw their water from the lakes. Simultaneously the condition of septic tanks around the lake are in varies based on age and type. Thorough site evaluations take place by Lane County officials for the installation of new septic systems which must account for soil type and proximity to the lake, but a 1972 survey of septic tanks found that 26% of all tanks within 100 feet of the lake were performing unsatisfactorily (Lane County, 1978). Where systems had failed, sewage was coming to the ground surface very near the lake and in winter almost certainly drained there.

An additional source of nutrients to Woahink Lake is the runoff from lawns and driveways that lead directly into Woahink Lake. Sediment and fertilizer laden runoff from these areas are high in phosphorus and nitrogen and are key components of the eutophication now observed. Education and increased awareness of private shore owners is very important to limiting this nutrient source.

If nutrient levels continue to increase relatively unchecked by State or County officials, problems such as those in Tenmile Lake south of this watershed will begin to take place. In Tenmile Lake, toxic algal blooms (Microcystis) have made water unsafe for drinking or recreation during certain times of year with uncertainty of its long-term effects on public safety and the viability of local tourism. A rigorous monitoring program is currently being financed by DEQ.

Dune City has jurisdiction over some land use practices along portions of Woahink Lake within city limits. Its city plan includes rules that seek to protect vegetation and soil within 50 feet of the water and fines are levied for destructive practices done without a permit. Although the city is not financed to patrol the lakeshore for these activities,

concerned neighbors usually call to report these activities when they occur. One red flag is the practice of using riprap and fill along the shoreline. For any filling or riprapping with quantities greater than 50 cubic yards, permits are deferred from Dune City to the Army Corp of Engineers, who are much less stringent than Dune City. Although these cases seldom occur, they compromise much needed restrictions on shoreline development and lead to short and long-term erosion of sediments into the lake.

Another way in which development affects Woahink Lake is the physical changes that occur in the shoreline. Douglas W. Larson, lakes researcher and former DEQ employee, has monitored change in the lakes since 196o using aerial and ground photography and water sampling. This documentation indicates that with residential and recreational development, lake banks have been denuded and trampled, causing erosion into the lake. Subsequently, shallow shoals have been created that function differently than when banks descended steeply into the lake. Warmer water now supports aquatic vegetation where there was none before. An example of this is the north side of the lake where the East Woahink public boat launch and parking area continues to change with heavy use.

Site Specific Water Quality Concerns in the Woahink basin

A 1992 memo from the Oregon Department of Fish and Wildlife documented muddy water conditions in the northwest arm of Woahink Lake. It described the Foglio Trucking Company parking lot and shop area (approx. 4 acres) off Highway 101 as a "chronic sediment producer". Next to the trucking company is Siuslaw Automotive and Wrecking, a 3.5-acre lot of wrecked cars which is a potential source of petroleum pollutants, although no point sources have been reported.

In the same area from 1994-1996, Big Bear, Inc. (Nordahl) cleared approximately 18 acres of coastal forest for a proposed RV park next to the truck and wrecking yards and caused considerable sedimentation into the northwest arm of Woahink. A local lakes group documented that flow diverted toward Highway 101 flooded a private parcel with turbid water, flowed through the trucking company parking lot and drained into the northwest arm. Secchi disk (clarity) readings were only 1.5 feet where they had been up to 21 feet in the past.

Honeyman State Park is reviewing its septic systems throughout the park, some of which have an impact on lake water quality. Built in the 1930s, there are 7 separate drain fields that handle effluent, five on Woahink Lake and two large fields on the dunes near (personal communication, Eric Scott-- Mater Engineering).

The leach field at the East Woahink boat launch is about 50 feet from the water rather than the required setback under DEQ standards is 100 feet, and a group camping area may be expanded. Because soil types, this leach field would have to be relocated onto the other

side of Canary Road. The needed repairs will probably take place within the next two years, financed by lottery backed bonds.

Siltcoos Lake

Siltcoos Lake had a commercial fishery for coho salmon of about 5000 fish per year in the late 1800's. Run strength has declined as it has throughout the rest of the west coast since these times although the runs in this lake system are currently some of the most healthy in the state of Oregon. It is believed that these runs of coho would be more healthy if the Lake did not contain non-native warmwater fish such as large mouth bass and yellow perch that prey on young salmonids.

Summer temperature profiles of Siltcoos indicate that temperature is fairly constant from surface to bottom (68 degrees F in 1981 and 69 degrees F in 1961) and is near the upper threshold for salmonid survival. The recordings were taken at the end of July 1981 (Atlas of Oregon Lakes and Oregon State Game Commission 1966) so lake temperatures may have increased further into August. Temperatures in excess of 72 degrees F are considered to be entering the lethal range for salmonids.

During the extreme temperatures of July, August, and possibly September juvenile coho may seek out the cooler waters of the tributaries if they exist. We postulate that current juvenile coho use is primarily limited to winter rearing habitat since the fish that enter the lake when it is cooler and the bass are less active were at a selective advantage over those fish that evolved to go into the lake during the summer and were heavily predated.

Creel census in the 1968, 1970, 1971, 1982, and 1983 have all documented coho juveniles in the lake throughout the summer in the lake (Oregon State Game Commission reports 1968, Oregon Department of Fish and Wildlife Creel Survey report 1983). There is some indication in the older reports that a percentage of the juvenile coho remaining in the lakes are 2 year old fish, meaning they spend 2 years in fresh water instead of 1 which would allow them to attain a larger size prior to going to the ocean. Little is known about these fish which would be a useful research topic.

A recent study by Petersen (1997) compared trophic conditions in five Coastal Oregon lakes including Eel and Garrison Lakes south of this watershed, Siltcoos and Tahkenitch within this watershed, and Munsel Lake just north of this watershed. This study revealed that Siltcoos Lake is the most productive of these five lakes. Chlorophyl-a concentrations for Siltcoos Lake, representative of phytoplankton population densities are a good indication of lake productivity (Table 3.11). Generally, chlorophyll-a concentrations above 10 mg/m^3 are characteristic of
eutrophic lakes (Wetzel, 1983), and Siltcoos shows concentrations greater than 20 mg/m^3 in September. Petersen (1997) also reports that although Tahkenitch and Siltcoos have

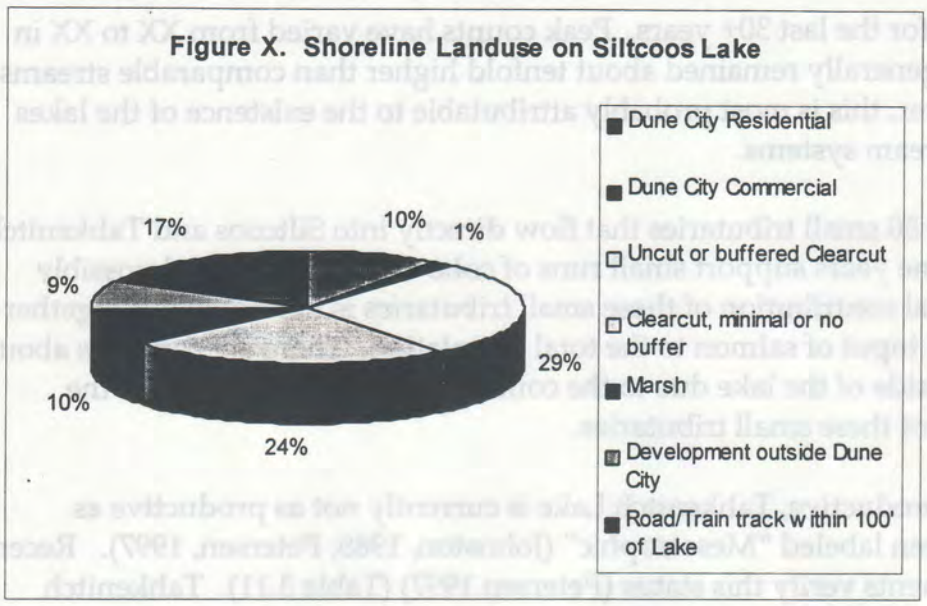
very similar morphometry, Siltcoos Lake is much more fertile, very likely having to do with the difference in land use patterns and development found on Siltcoos Lake.

Table 3.11. Levels of chlorophyll-a in five coastal lakes in Oregon*

Lake	Date	Chlorophyll-a average, mg/M³ (n)	Chlorophyll-a range (mg/M³)
Siltcoos Lake	August 2	8.7 (4)	7.0-11.2
	September 7	22.1 (5)	18.9-23.8
	October 5	12.5 (5)	11.2-13.3
Tahkenitch Lake	August 3	6.0 (4)	5.6-6.3
	September 5	6.4 (4)	5.3-8.8
	October 8	8.5 (6)	7.4-10.2
Eel Lake	August 4	5.5 (6)	4.2-7.4
	September 6	1.9 (6)	1.6-2.1
	October 7	4.2 (6)	2.3-5.6
Garrison Lake	August 5	3.8 (4)	2.7-5.3
	September 10	2.8 (4)	0.9-4.1
	October 9	3.8 (4)	3.2-4.9
Munsel Lake	August 3	6.5 (2)	6.3-6.7
	September 8	3.2 (4)	2.5-3.5
	October 6	6.7 (4)	3.9-8.4

* Data taken from Petersen, 1997

The extremely productive nature of Siltcoos Lake makes it attractive for sport fishing, and Westlake and North Beach on the northwest side of the lake have a number of resorts, fishing lodges, a marina and several private docks. The east side of the lake contains less dense development and includes a fishing lodge at Ada Station and the small community of Siltcoos. There is also a county park with a picnic area near Ada. Train tracks and trestles that cross arms of Siltcoos lake, and county roads closely follow most of the western shore. Harmony Bay is a small, isolated development of summer cabins on the South end of the lake, accessed by the County Line Road. There are also two islands that have limited development on them, Jernigan Island, which is privately owned, and Booth Island, which contains 21 very small lots zoned as residential on about 1/5 of the island. Lots are currently being sold on Booth Island.



About 1/3 of the lands around Siltcoos Lake have been logged recently on private land (Figure 3.3) most of which has a lake buffer of one tree width. The State of Oregon has not given adequate thought to the an appropriate width for lake buffer and simply applies stream rules. These do not seem adequate given the fact that the lakes provide drinking water for a number of residents (*Appendix?*).

Tahkenitch Lake

Tahkenitch Lake is very similar to Siltcoos Lake in respect to stocking history and salmonid use. Warmwater fish have been stocked and provide a productive recreational fishery. National bass fishing tournaments have been held at this lake, however, the coho salmon fishery has dwindled and is currently closed.

A July 1981 temperature profile showed characteristics similar to Siltcoos. Temperature was fairly constant through the profile and was measured at 69 degrees F, which again is approaching the lethal limit for salmonids. Therefore the use of the lake by coho salmon in the summer may be limited to tributary mouths or isolated cool deepwater areas. The warmwater species again have probably affected the salmonid use over the years

Public access is concentrated on two boat ramps off Highway 101 on the northwest side of the lake, one private and one Forest Service. Part of the Tahkenitch Campground is located near the Forest Service boat ramp. There are also some undeveloped access points off of County Road 49 on the south side of the lake (Mallard Arm). Aquatic weeds are currently a hindrance to recreational fishing in this lake.

Estimates of current run size have been made for Siltcoos and Tahkenitch (Table F.1.) and show that estimated spawning stock size has remained relatively constant for these 2 lake systems for the last 40 years. Spawning counts in various stream segments have been

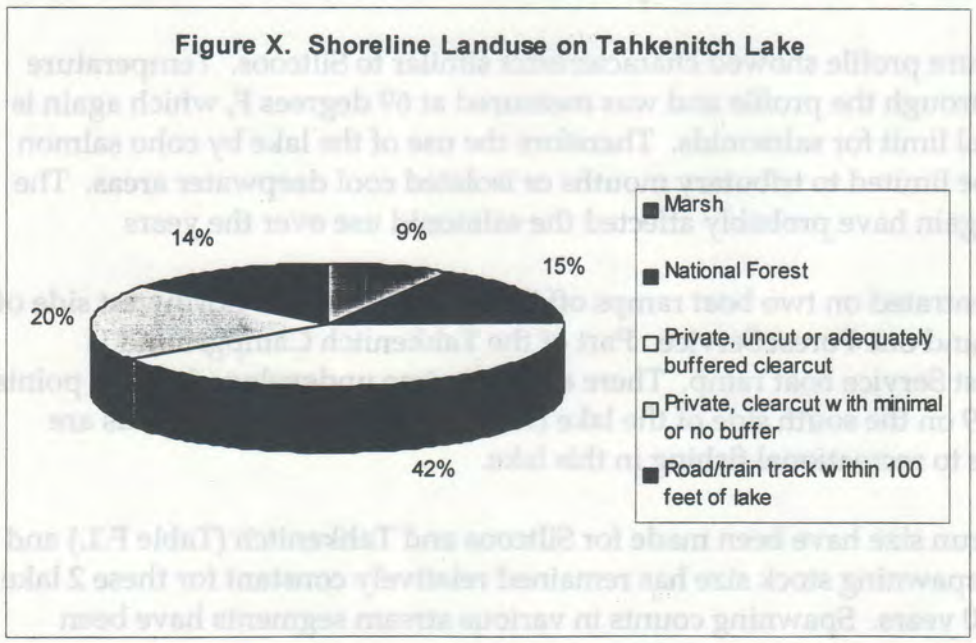
conducted sporadically for the last 30+ years. Peak counts have varied from XX to XX in various years but have generally remained about tenfold higher than comparable streams on the main Siuslaw River, this is most probably attributable to the existence of the lakes associated with these stream systems.

There are probably over 50 small tributaries that flow directly into Siltcoos and Tahkenitch Lakes that in at least some years support small runs of coho and cutthroat and possibly some steelhead. The total contribution of these small tributaries is unknown but together do provide a substantial input of salmon to the total population. There are concerns about fish passage on the east side of the lake due to the condition of the culverts under the railroad tracks on some of these small tributaries.

Although shallow and productive, Tahkenitch Lake is currently not as productive as Siltcoos Lake and has been labeled "Mesotrophic" (Johnston, 1985; Petersen, 1997). Recent chlorophyll-a measurements verify this status (Petersen 1997) (Table 3.11). Tahkenitch Lake appears to be phosphorus limited as Algal Growth Potential was greatly increased when phosphorus was added to samples in lab experiments (Curtiss, et. al 1984).

Tahkenitch is one of the few large coastal lakes near a populated area that does not have private housing development on the shoreline, however, about 50 houseboats on the lake range from currently occupied to abandoned and dilapidated. No additional houseboats will be allowed on Tahkenitch Lake. Septic systems are required to be self contained but the status of each is currently unknown to DEQ. Given the potential for inputs of Phosphorus and Nitrogen from raw sewage, the condition of these septic systems is important to monitor for the future.

Figure 3.4. Shoreline Landuse on Tahkenitch Lake



Past and current resource conditions around Tahkenitch Lake are closely tied to logging practices. Much of the land surrounding the lake was once owned singly by Crown Zellerbach, but has since been sold and resold by a number of small industrial timber companies. Intense logging of lake adjacent forest land without buffers began in the 1930s and continued through the late 1960s. Old growth spruce logs were downhill logged into the lake and were brought to lake-side mills by tug boats. Saltzman (1963) reported designated log boom areas on 30% of the shoreline in 1960. Downhill logging caused high sedimentation and skid trails created deep troughs leading to the lake, some of which can still be seen today.

Current logging of young second growth is once again occurring through this area, this time via a dense network of roads on this moderately steep landscape. There are locations where road densities are very high, especially where ground-based logging is on moderate slopes. Buffer widths between clearcuts and the lake are minimal in places.

Cleawox Lake

Direct influences that currently have potential to affect water quality on Cleawox Lake include Honeyman State Park on the south end, private development on the northeast side of the lake and Camp Cleawox, a girlscout camp on the east side. This lake would benefit from renovation of the outdated septic system at Honeyman State Park. In addition, there is concern over RV effluent from the dump site that contains formaldehyde which is a biocide, killing organisms that are crucial to leach field function. Filtration for this chemical will be a required as part of the improvements (personal communication, Daryl Johnston--ODEQ).

On the other side of Cleawox Lake, the concession area has an associated leach field that needs relocation due to its presence in soils with perched ground water. A terrace nearby would serve as a much better drainfield.

Lake-side homes on the northwest side are a combination of vacation and permanent residences that have, for the most part, left native trees and brush undisturbed. As most of the soils in the lake basin are well drained, sandy soils, properly functioning septic systems are especially critical where development has and will continue to occur. New systems are systematically field checked, but older systems in the area that may be failing.

In the mid-1980s, Honeyman State Park dredged a portion of Cleawox Lake to keep open the passage between the northern long, narrow arm of the lake and the wider, oval section to the south. The objective was to keep advancing dunes from cutting off boat passage between the two areas. Park officials no longer pay for this and it is assumed that Cleawox Lake will become two lakes in time.

Although Cleawox Lake has historically been known as an oligotrophic lake with low productivity, this may be changing. Due to the heavy recreation and increasing development around this lake, it is likely that Cleawox Lake will become more eutrophic over time. Septic improvements planned by State park officials will help to slow this process, but other septic conditions need to be surveyed in developed areas. *(Will there be any effect to fish? water quality?)*

Threemile Lake

During the 1930s, land near the south end of this lake was homesteaded and extensively logged in the 1930s and '40s. Currently, much of the basin has grown back to thick second growth coniferous forest. Access to the lake was gained by vehicle from the beach side during the 1960s but today vehicles are restricted and access can only be gained by hiking on the Tahkenitch Trail or by a one-mile trail from Sparrow Park Road to the south. Limited dispersed camping occurs around the lake at the north and south ends as well as a small penninsula on the west shore.

A 1993 report on Threemile Lake included a gillnet fish survey which did not mention bass in the fish totals. Based on a recent fisherman's catch, it appears bass have been introduced and are doing well in emergent vegetation on the north end of the lake. This report also mentions introduction of yellow perch and Cutthroat trout by former residents (Whereat and Merritt, 1993).

Ocean Tributaries and the Dunal Aquifer

Siltcoos River, Tahkenitch Creek and Threemile Creek are the three ocean tributaries in the watershed and all three drain through the dunal sheet. As such, their substrates are dominated by sand. Migration through these creeks is the main function for salmonids. Adults migrate through when the bar is flushed out by fall rains or dam releases. This usually occurs in October but sometimes not until December if left to open naturally, and is highly dependent on the amount and timing of the fall rains. Some cutthroat may move up these streams earlier in the fall or even late summer.

The main needs for adult fish in these streams during migration are deep pools with cover where they can rest and hide from predators (and poachers), and escape from the high velocity flows. From February to June, salmonids are smolting and moving down the river toward the ocean, and additional habitat elements are required such as slow velocity backwater to escape potential flood flows. Accumulations of wood for cover, velocity breaks, and food production are also crucial for the salmonids to be in the best shape possible before entering the ocean.

There is potential for impacts to recreational developments built within the floodplain of these creeks, and often mitigation of these impacts turn into detrimental impacts to fishery resource. An alternative is to find measures that would benefit both resources. For

Table 3.12

~~Appendix E:~~ Subwatershed Summaries for Coastal Lakes Watershed.

E.1 - Subwatershed summaries for the upland stream valleys

Subwatershed	Maple	Fiddle	Bear	Fivemile	Leitel
Acres	13,534	9,006	4,420	6,714	3,275
Ownership	Federal - 59% Indust. Pvt - 27% Small Pvt - 14%	Federal - 53% Indust Pvt - 40% Small Pvt - 7%	Federal - 76% Indust Pvt - 24%	Federal - 47% Indust Pvt - 43% Small Pvt - 10%	Indust Pvt - 100%
Tributaries	**Private:** Mills, Johns, Schrum, Carle, Roache, Grant, lower Carter, lower Jordan, Starkes, Stokes, Ryder, most of Maple mainstem **Federal:** Carter, upper Jordan, Henderson, N. Prong, Coleman, Schultz, Ten Mile, upper Maple Mainstem	**Private:** Young, King, Alder, lower Billy Moore, lower Fiddle mainstem **Federal:** upper Billy Moore, upper Fiddle mainstem	**Private:** lower Bear mainstem **Federal:** upper Bear mainstem, south fork Bear	**Private:** Perkins, lower Harry, lower Bell **Federal:** upper Harry, upper Bell	**Private:** all of eitel mainstem
Acres by LTA					
Source, Transport & Deposition in miles & (%)	So - 217 (86%) Tran - 10 (4%) Dep - 26 (10%)	So - 170 (89%) Tran - 8 (3%) Dep - 15 (8%)	So - 87 (89%) Tran - 3 (3%) Dep - 8 (8%)	So - 97 (84%) Tran - 6 (5%) Dep - 13 (11%)	So - 52 (85%) Tran - 4 (7%) Dep - 5 (8%)
Percent deposition by ownership	Small Prvt - 52% Roseburg - 23% Davidson - 17% USFS - 8%	Davidson - 37% Small Prvt - 30% USFS - 13% WilIndust - 12% Roseburg - 6% Rosebor. - 2%	Davidson - 86% USFS - 14%	Davidson - 38% Rosebor. - 31% USFS - 17% Small Prvt - 12% Hancock - 2%	Hancock - 68% Rosebor. - 17% Menasha - 9% PortBlakely - 6%
% mainstem re-channelized and diked	94%	89%	44%	69%	none
% mainstem with abandoned or current grazing	87% currently grazed 7% abandoned	65% currently grazed 24% abandoned	74.5% currently grazed	56% currently grazed 21% abandoned	none
% full, partial and no shading on mainstem	full - 10% partial - 34% no - 56%	full - 29% partial - 26% no - 45%	full - 26% partial - 34% no - 40%	full - 21% partial - 47% no - 32%	full - 29% partial - 66% no - 5%
Large wood potential (% by subwatershed and confinement)					
Landslide Susceptibility	High - 4% Mod - 10% Low - 86%	High - 7% Mod - 13% Low - 80%	High - 4% Mod - 14% Low - 82%	High - 7% Mod - 12% Low - 81%	High - 6% Mod - 11% Low - 83%
Road densities /1	3.7 mi/mi^2	2.7 mi/mi^2	2.8 mi/mi^2	2.2 mi/mi^2	3.6 mi/mi^2
System Road	Ridgetop - 25.3	Ridgetop - 17.6	Ridgetop - 11.2	Ridgetop - 13.7	Ridgetop - 7.5

miles by slope position	Midslope - 34.9 V. Bottom - 17.1	Midslope - 8.6 V. Bottom - 11.7	Midslope - 3.3 V. Bottom - 4.4	Midslope - 3.3 V. Bottom - 6.0	Midslope - 4.3 V. Bottom - 6.4
Culvert problems	Culvert with fish passage problem, Carter Cr., 2400 RD	2 partially plugged culverts, 4811 and 4811 957	none known	Partially plugged and damaged culvert on 4811 near 044 spur	Continued maint. needed just above spawning gravels. Storm-proof road crossing culverts
Stream Survey Info Available	1998 FS Lands	1997 FS Lands	1998 FS Lands	1997 FS & BLM Lands	None
Coho peak spawning counts #/mile	1996- 138 1997- 53	1996- 192 1997- 166	no counts made	1996- 306 1997- 210	1996- 410 1997- 358
Miles stream by fish species	coho - 18.3 steelhead - 20.8 cutthroat - 21.1	coho - 13.0 steelhead - 14.6 cutthroat - 14.6	coho - 6.4 steelhead - 7.7 cutthroat - 7.7	coho - 10.6 steelhead - 13.5 cutthroat - 13.5	coho - 5.4 steelhead - 5.6 cutthroat - 5.6
Potential veg (acres)	WILL HAVE FOR FINAL				
Current seral veg acres	WILL HAVE FOR FINAL WA				

1/ These numbers are likely underestimated due to the age of ortho photographs (1989) used for mapping.

E.2: Lake Basin and Dunes Subwatershed Summaries.

Subwatershed	Siltcoos	Tahkenitch	Woahink	Threemile	Dunes
Acres	12,728	11,397	4,934	2,490	14,076
Percent land ownership	Lake - 25% Residential - 21% Rosebor. - 19% Roseburg - 14% Davidson - 11% USFS - 10% County - 1%	Roseboro - 29% PortBlakely - 27% Lake - 18% USFS - 15% Menasha - 7% Small Prvt. - 3% Hancock - 1%	Residential - 46% Roseburg - 23% Lake - 15% State Park - 8% Davidson - 5% USFS - 3%	USFS - 50% PortBlakely - 45% Small Prvt. - 5%	USFS - 8 SmallPrvt. - 7% Rosboro - 4% County - 1% State Park 1%
Road densities	4.5 mi/mi²	2.9 mi/mi²*	4.6 mi/mi²	1.1 mi/mi²	2.4 mi/mi²
Most serious water quality problems	Aquatic weeds	Aquatic weeds	Increased nutrients Reduced clarity	Recreation impacts	Recreation impacts
Landslide Susceptibility	Low - 98% Mod. - 2%	Low - 96% Mod - 3% High - 1%	Low - 99% Mod. - 1%	Low - 100%	Low - 100%
Potential veg (acres)	SEE FINAL WA				
Current seral veg acres.	SEE FINAL WA				

* Based on 1989 ortho quads. Recent logging in this subwatershed has probably pushed this over 3 mi/mi².

example rather than riprapping meander bends to stabilize a sand bank, use bioengineering techniques that create some fish habitat as well.

Impacts to the dunal aquifer have not been well studied in this area. It has been theorized that with the vegetating of the dunes for stabilization, litter buildup and decomposition has caused increased iron levels in percolating water. Present withdrawls are mostly north and south of the watershed, but future development in the area may cause expansion of aquifer withdrawal to this area. At present, water systems for communities in the Dune City and Glenada areas are poorly developed and are composed of systems that withdraw and treat water from the lakes for local housing developments. Future plans to pump from the aquifer in this area should utilize research recently done in the Coos Bay/North Bend area for information on saltwater intrusion and possible effects of over pumping.

Aquatic Weeds

Both Siltcoos and Tahkenitch Lakes are listed on DEQ's 303(d) List for "aquatic weeds or algae" and this designation is fitting for both lakes in terms of aquatic weeds. The aquatic weed known as Brazilian elodea (*Egeria densa, formerly elodea densa and anacharis densa*) is currently the most oppressive exotic in these lakes. Originating in South America, it is believed to have been first introduced to both these lakes in the early 1930s. Elodea found perfect conditions in Siltcoos and Tahkenitch with their shallow depths, higher nutrient levels and temperate coastal climate. Although levels have fluctuated in these lakes from year to year, growth in dense patches has been a problem for recreational and commercial users from the mid-1940s to the present.

A decrease in 1954 in Tahkenitch Lake was attributed to an increase in water level due to a temporary dam put in at the outlet that year (Bond, 1955). Another reference to lake level effect on weed growth appears in 1966 when field observers noted extreme growth after a 4-foot drop in summer lake level, most likely associated with draw down for inspection of wooden train tressels. It must be remembered, however, that control of elodea using lake level has not been successful to any significant degree in the past (Table 3.12).

Table 3.12. Estimated occurrence of Brazilain elodea (*Egeria densa*) in Siltcoos and Tahkenitch Lakes for selected years between 1945 and 1955. *(What are these units? Percent of lake?)*

	Estimated Infestation in Percent			
Lake	**1946**	**1948**	**1951**	**1954**
Siltcoos Lake	58%	74%	90%	43%
Tahkenitch Lake	43%	86%	-	68%

Pitney (1949) described Brazilian elodea as the most serious aquatic nuisance in Oregon due to a rate of development that is "almost beyond conception". It can grow at the

water's edge to as deep as 18 feet. Shading can limit elodea growth, but in experiments pieces shaded for three months resprouted after being re-exposed to light. In these coastal lakes, the period of most aggressive growth usually occurs from mid-May through April. An old, well established plant may consist of five or six stems up to 18 feet in length growing from a root crown which is often six or more inches below the surface of the soft mud. Up to twenty fibrous roots 8-24" anchor the plant. Root crowns over winter in shallow areas and some stems remain in tact in somewhat deeper areas to resume growth the following year. Fragments can be carried by boats, waterfowl, or floatplanes and pieces from a previous year can resprout and grow the following year (Bond, 1955).

By the mid to late 1940s, several experiments were being undertaken by the Oregon Agricultural Research Station to eradicate this nuisance weed, and both Tahkenitch and Siltcoos served as test lakes for these experiments. In 1947 and 1948, hundreds of chemicals were experimented with in laboratories, tanks and within Siltcoos and Tahkenitch Lakes themselves (Aldrich, 1953). Although copper sulfate was found to be most successful in experiments conducted during this time, use of a heavy metal compound that accumulates over time was assumed to be more deleterious to the health of the lakes than the Brazilian elodea itself (Pitney, 1949). However, this notion is debated by some who point out that copper is quickly bound up in clay particles that settle at the bottom of lakes with little to no toxic effect.

Testing of chemical methods for the eradication of Brazilian elodea continued through the mid 1960s, but successful chemicals showed harsh effects on resident salmonids and bluegill (Bond et al, 1966). Currently, there are at least six herbicides registered for safe use in Oregon for the control of noxious aquatic weeds. Under the correct conditions, these herbicides can be used to reduce infestations. However, private use that does not follow manufacturers guidelines can be a threat to aquatic resources and other lake users (personal communication, Sytsma).

Physical means of removing elodea from lakes can be effective but if done incorrectly, fragmentation of the weed spreads it further in the lake. Correct disposal of harvested weeds can also be troublesome. Large scale physical eradication has been attempted in Siltcoos Lake with little success. Removal in local areas still occurs, especially around resort boat docks where elodea becomes extremely thick.

Recent research has shown that Brazilian elodea throughout Oregon is genetically uniform which makes it susceptible to biological control. Portland State University is currently undertaking a study to identify South American fungi or insects that are a natural enemy to Brazilian elodea. Caution must be exercised with biological controls, however, due to other effects they may produce. One such experiment with a biological control introduced weed-eating carp (*Ctenopharyngodon idella*) into Devil's Lake on the Northern Oregon Coast to eradicate Eurasian watermilfoil (*Myriophyllum spicatum*). Six years into the project, weeds had not been significantly reduced, but liquefied fecal waste from the carp

had fueled new crops of weeds and algal blooms never before seen in the lake (Larson, 1996).

Another aquatic weed that was mentioned in a 1965 fieldtrip to Siltcoos Lake was *Brasenia schreberi* (water shield). It was described as "extremely heavy in several areas of the lake" (Bond et al, 1966). *Egeria densa* has also spread from Tahkenitch to Elbow Lake, most likely moving through Elbow Lake Creek which connects the two lakes.

Parrot feather *(Myriophyllum aquaticum)* was introduced to Siltcoos Lagoon before 1950 and control attempted in the 1950s was unsuccessful, due mainly to the fact that it does not respond to chemical controls. This weed is also present in Woahink and Siltcoos Lake and unless it is physically removed, will begin to cause problems in these areas in the future. It grows in shallow, backwater areas where it can create acidic conditions if ammonium is present. These acidic conditions can be harmful to coho salmonids using these same backwater areas.

Mercury levels in fish of the coastal lakes

In May 1997 fish samples from Siltcoos, Tahkenitch, Eel, North Tenmile, and South Tenmile Lakes were taken and analyzed to determine the amount of mercury present in the tissue. Mercury in minute concentrations can cause health problems for humans, especially for pregnant women or women who plan to have children in the near future. Mercury is a bioaccumulator and through the food chain, the levels of mercury increase from prey to predator. That is why the large fish that feed primarily on smaller fish are the ones that have the health advisory for consumption. The 1997 Coastal Lake lab samples were taken from largemouth bass, black crappie, bluegill, brown bullhead, rainbow trout, and yellow perch.

The federal standard set by EPA for mercury levels in fish tissue is 0.60 mg/kg wet weight while the State of Oregon's standard is 0.35 mg/kg wet weight. The largemouth bass, which are the top predator within the lake, had the highest concentrations of mercury in all 5 lakes sampled. The levels ranged from 0.27 - 0.63 mg/kg-wet weight of bass tissue, and were highest in Eel and South Tenmile Lakes and lowest in Tahkenitch and Siltcoos Lakes (Table F.3). Other fish species were appreciably lower (Table 3.13).

Table 3.13. Mercury levels in fish of the Central Oregon Coastal Lakes (1997). Mercury levels are reported in mg/kg-wet weight of fillet tissue.

	Tahkenitch	**Siltcoos**	**Eel**	**North Tenmile**	**South Tenmile**
Largemouth Bass	0.27	0.35	0.56	0.41	0.63
Black Crappie	0.1		0.18	0.18	0.15
Bluegill	0.07				0.12
Brown Bullhead		0.07	0.07		
Rainbow Trout	0.04				
Yellow Perch	0.13				

Current 303(d) Waterbody Listings

The Oregon Department of Environmental Quality is required by the federal Clean Water Act to maintain a list of stream segments that do not meet water quality standards (Table 3.14). The 303(d) List cites the section of the Clean Water Act requiring this information. Furthermore, the State of Oregon is required to set priorities and target resources for use

in developing Total Maximum Daily Loads (TMDLs) for addressing point and nonpoint sources of pollutants. This list along with priorities for TMDL development within two years are submitted to the U.S. Environmental Protection Agency every two years. TMDL development for listed streams and lakes in Oregon is expected to be accomplished within ten years.

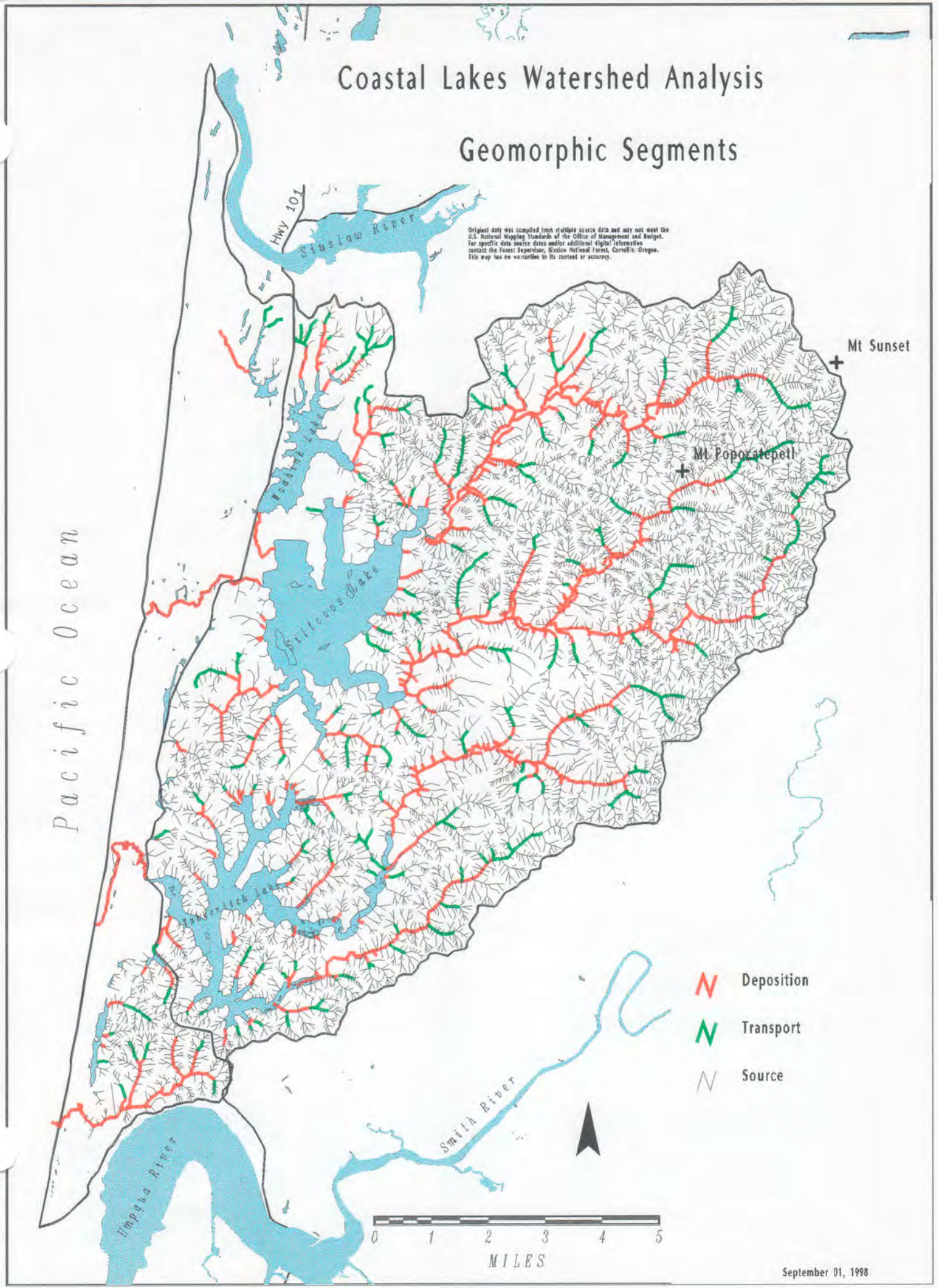
Priorities for TMDL development for sub-basins in Oregon are primarily driven by presence of threatened and endangered fish species within each sub-basin. This watershed analysis area represents the Siltcoos sub-basin which is part of the Mid Coast basin, and is included in the Priority 1 category as are all the coastal sub-basins in Oregon due to the presence of coho salmon in these waters. Table X gives a listing of the streams and lakes included on the Proposed 1998, 303(d) List. Extent of water quality problems on streams is often listed as "Mouth to Headwaters" where suspected water quality problems exist but little data has been collected to confirm this diagnosis. This begins the discussion over water quality showing that many gaps exist in the water quality data for this watershed area.

Table 3.14. - Waterbodies listed in 1996 and 1998 as water quality limited for the Siltcoos sub-basin, Mid Coast basin of Oregon.

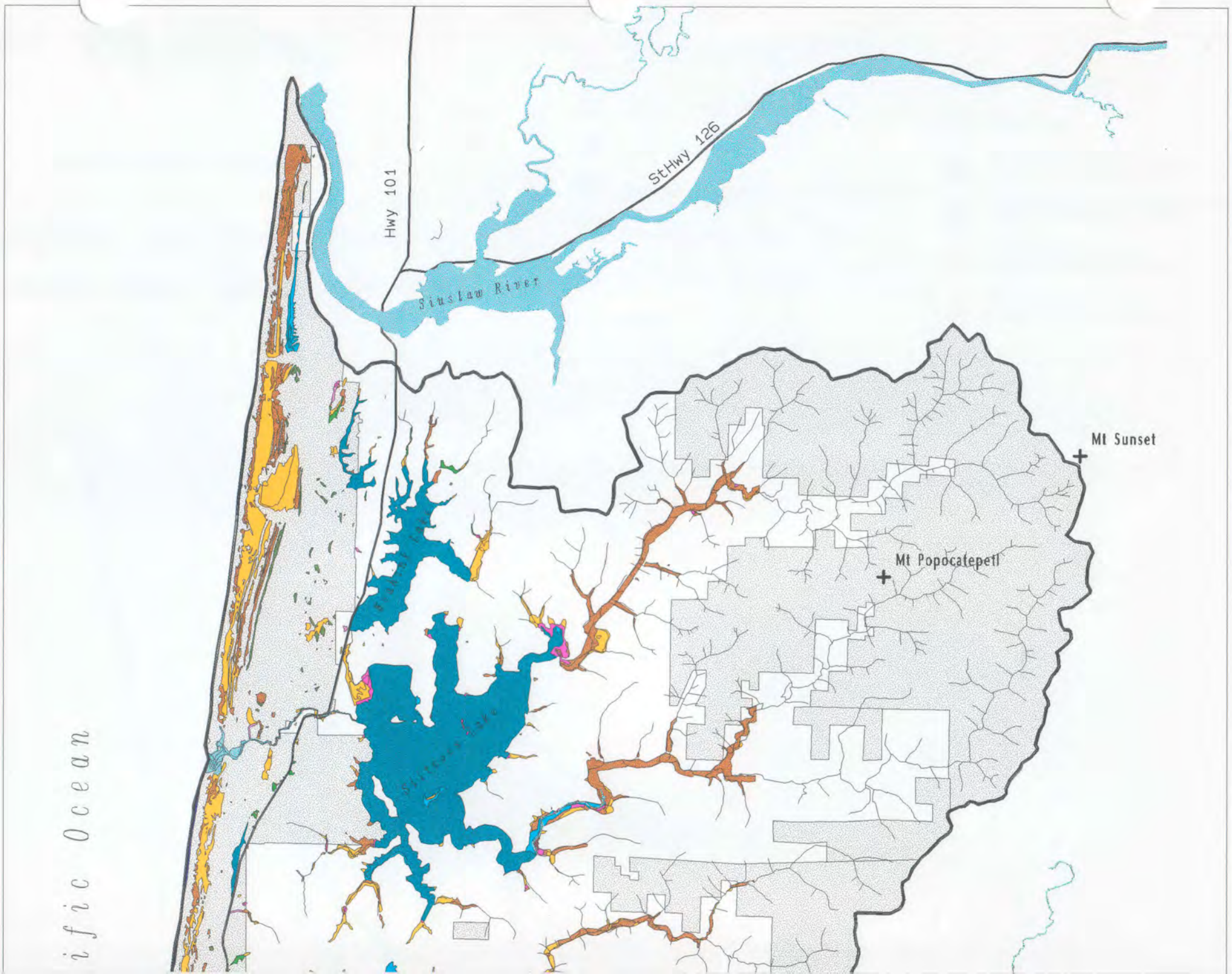
Waterbody Name	Boundaries	Parameter
Maple Creek	Mouth to Headwaters	Habitat Modification Sedimentation Water Temperature
Fiddle Creek	Mouth to Headwaters	Habitat Modification Sedimentation Water Temperature
Siltcoos Lake	Lake	Aquatic Weeds or Algae
Tahkenitch Lake	Lake	Aquatic Weeds or Algae
Siltcoos River	Mouth to Siltcoos Lake	Aquatic Weeds or Algae Flow Modification

Coastal Lakes Watershed Analysis

Geomorphic Segments



September 01, 1998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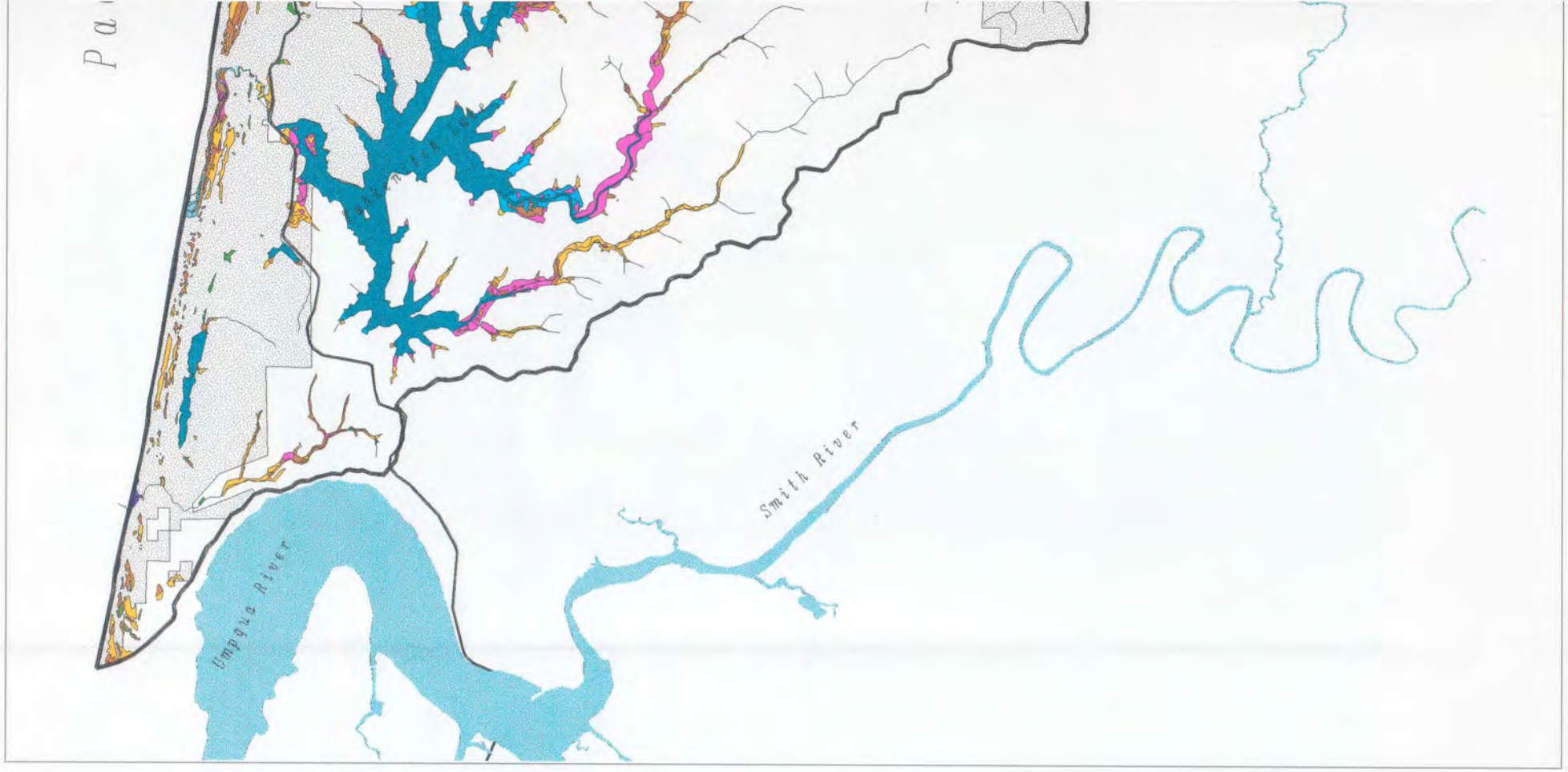
StHwy 126
Siuslaw River
Mt Sunset
Mt Popocatepetl
ific Ocean



Coastal Lakes Watershed Analysis
Wetlands and Deep Water Habitats

0 1 2 3 4

MILES

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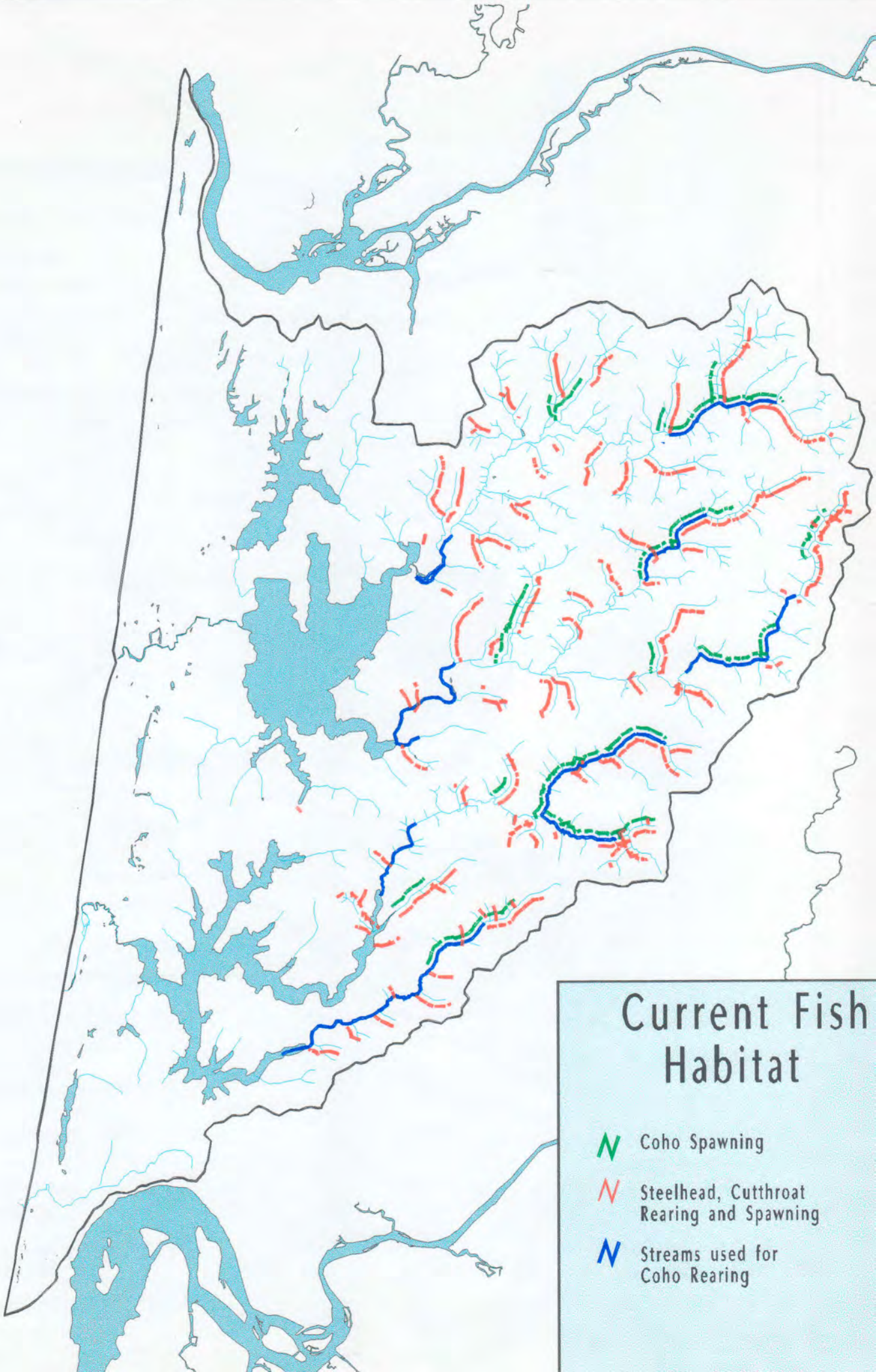
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has no warranties to its content or accuracy.

- Siuslaw NF
- Estuary, Subtidal and Intertidal
- Lacustrine, Limnetic (DeepWater Lake, >2m)
- Lacustrine, Littoral (Lake Association Wetland, <2m)
- Marine, Intertidal
- Palustrine, Aquatic Bed
- Palustrine, Emergent Vegetation, Permanently and Semipermanently Flooded
- Palustrine, Emergent Vegetation Flooded Part of the Year
- Palustrine, Forest, Scrub, Shrub, Flooded Part of the Year
- Palustrine, Unconsolidated Bottom Permanently and Semipermanently Flooded
- Palustrine, Unconsolidated Bottom Flooded Part of the Year
- Riverine, Tidal
- Riverine, Low Gradient

August 31, 1998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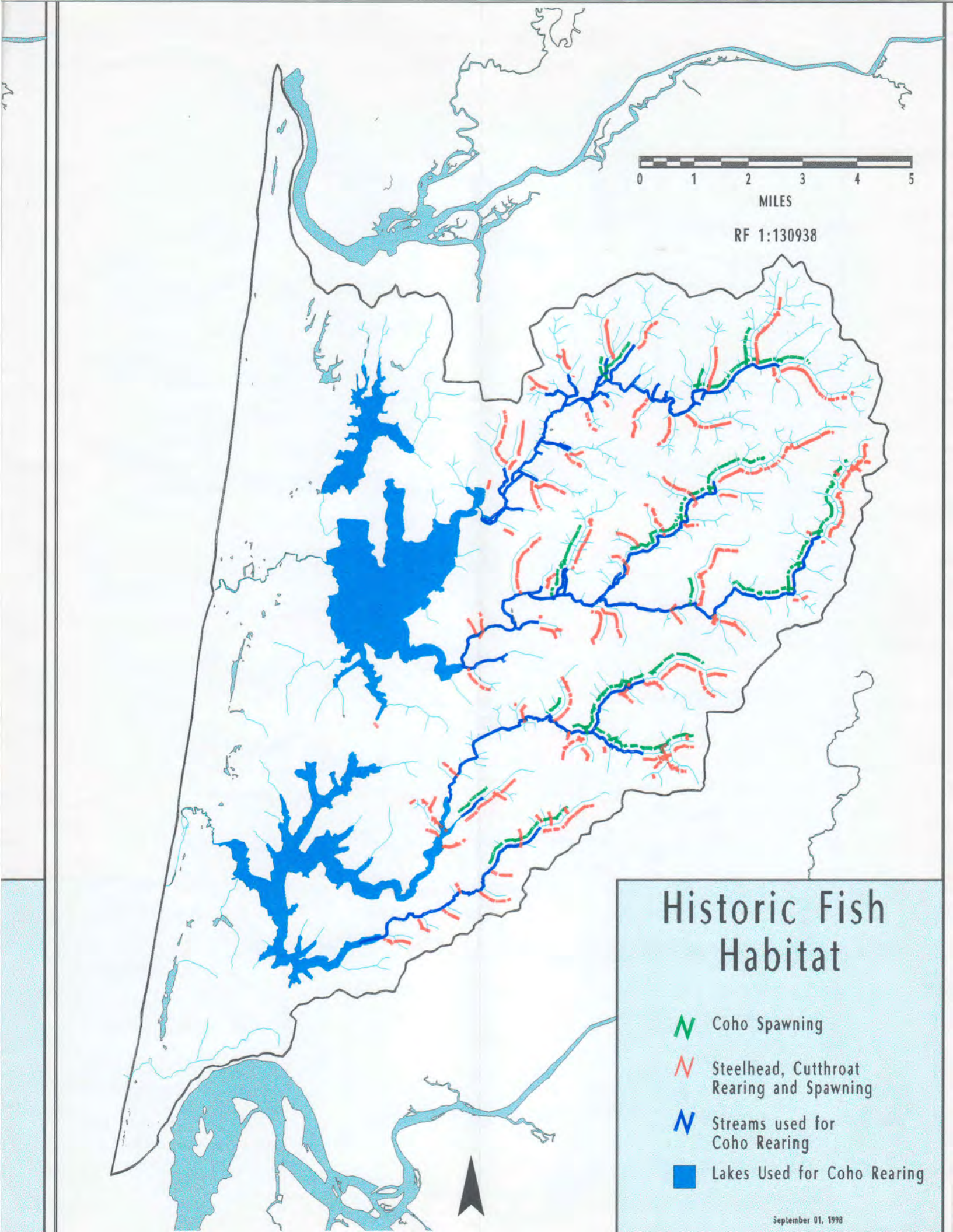
Coho Spawning
Steelhead, Cutthroat Rearing and Spawning
Streams used for Coho Rearing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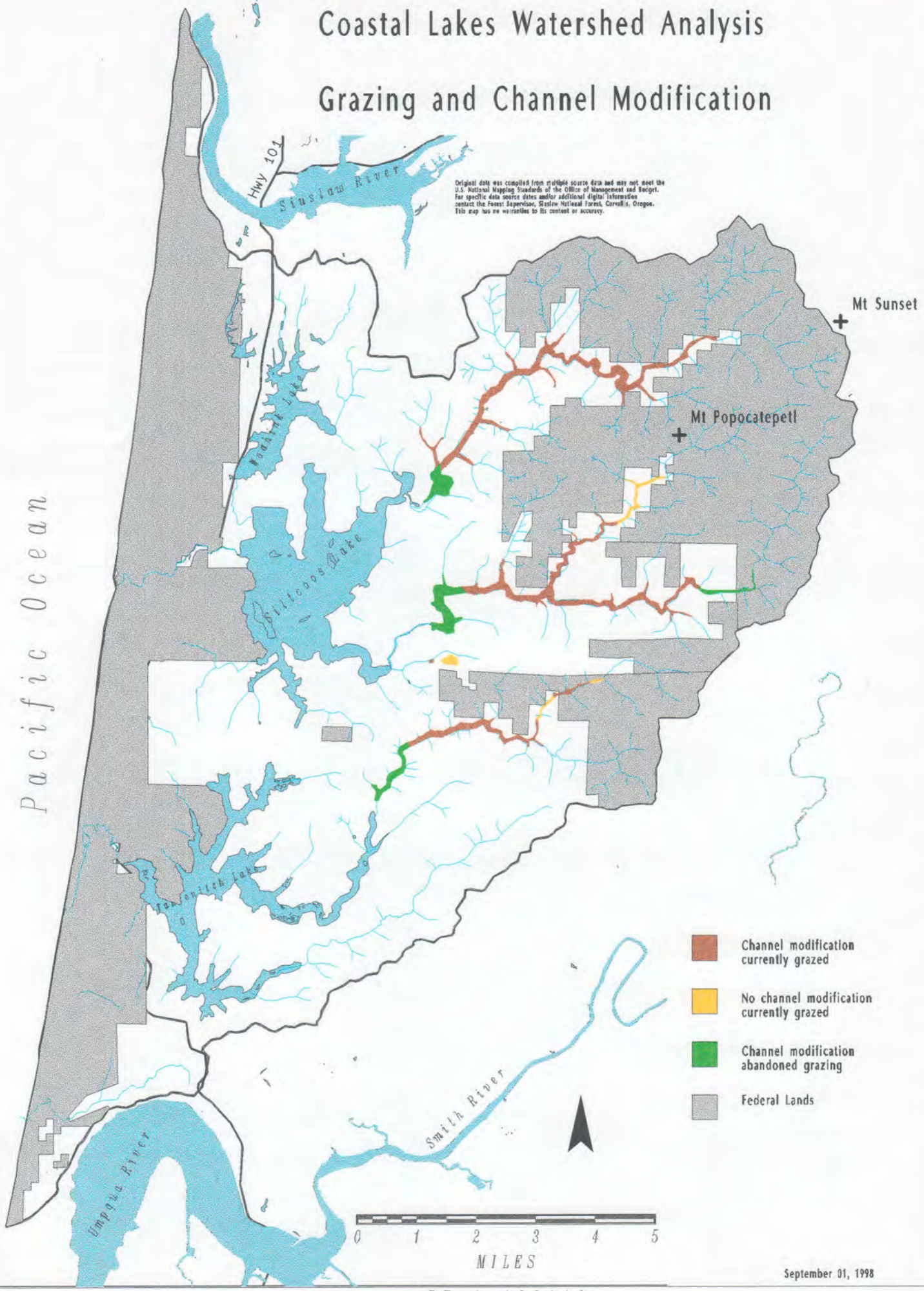
Historic Fish Habitat
Coho Spawning
Steelhead, Cutthroat Rearing and Spawning
Streams used for Coho Rearing
Lakes Used for Coho Rearing
September 01, 1998

Coastal Lakes Watershed Analysis

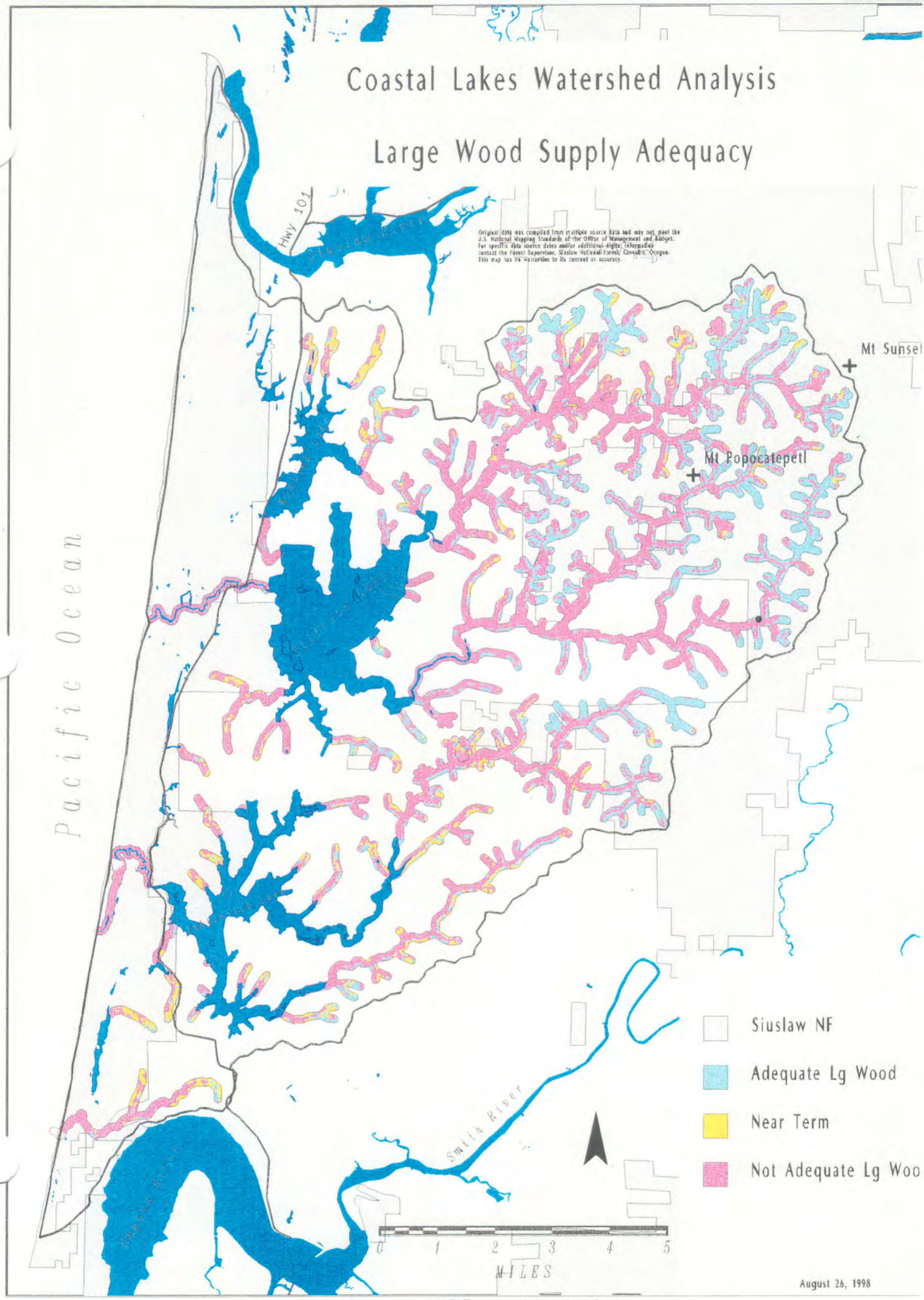
Grazing and Channel Modification



September 01, 1998

Coastal Lakes Watershed Analysis

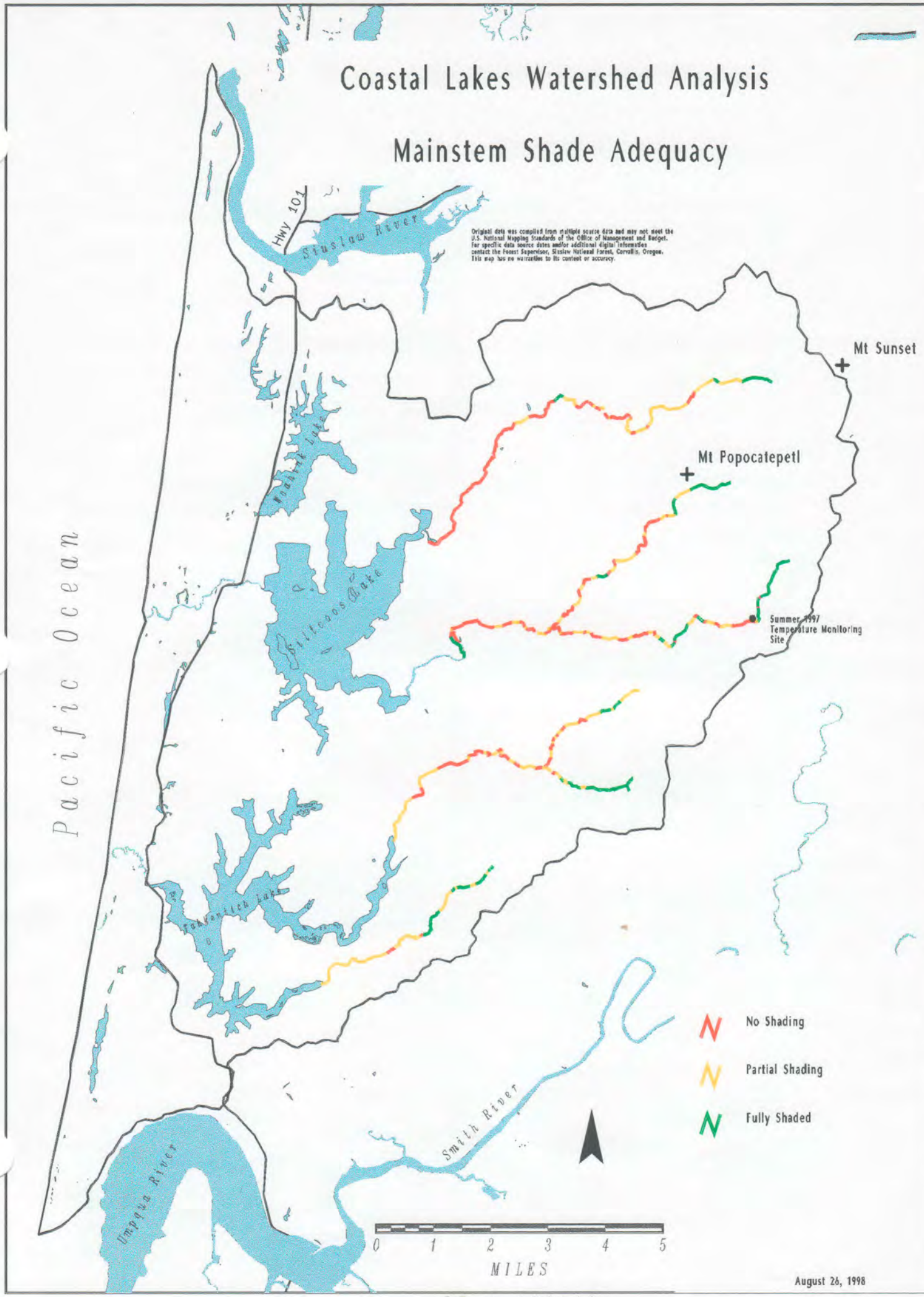
Large Wood Supply Adequacy



August 26, 1998

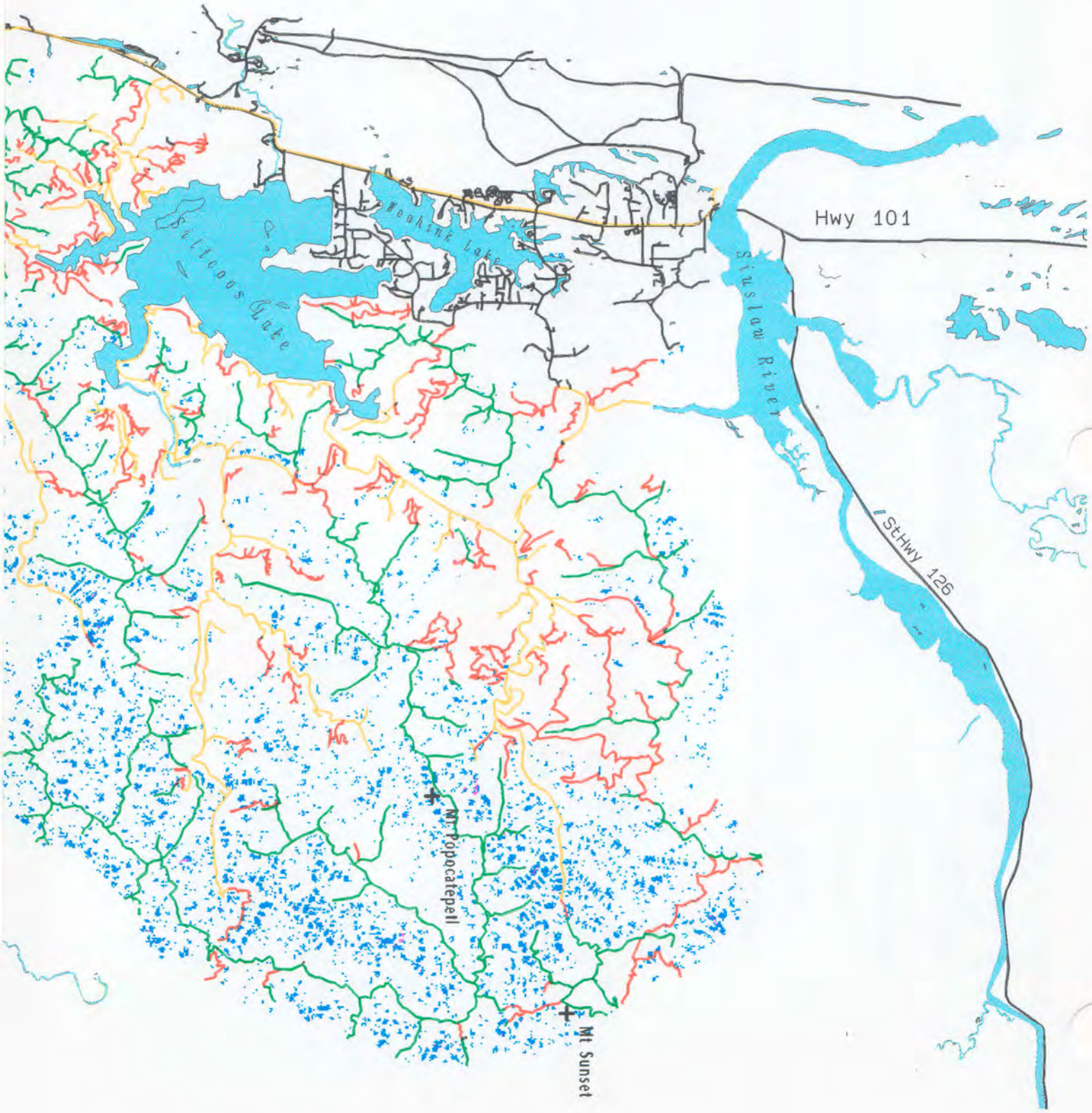
Coastal Lakes Watershed Analysis

Mainstem Shade Adequacy



August 26, 1998

ific Ocean


Hwy 101
Siuslaw River
Siltcoos Lake
Woahink Lake
StHwy 126
Mt Popocatepell
Mt Sunset

Coastal Lakes Watershed Analysis
Landslide Susceptibility

- Valley Bottom
- Midslope
- Ridgetop
- Dunes/Residential
- Low to Moderate Susceptibility
- High Susceptibility
- Extreme Susceptibility

0 1 2 3 4
MILES

RF 1:105552

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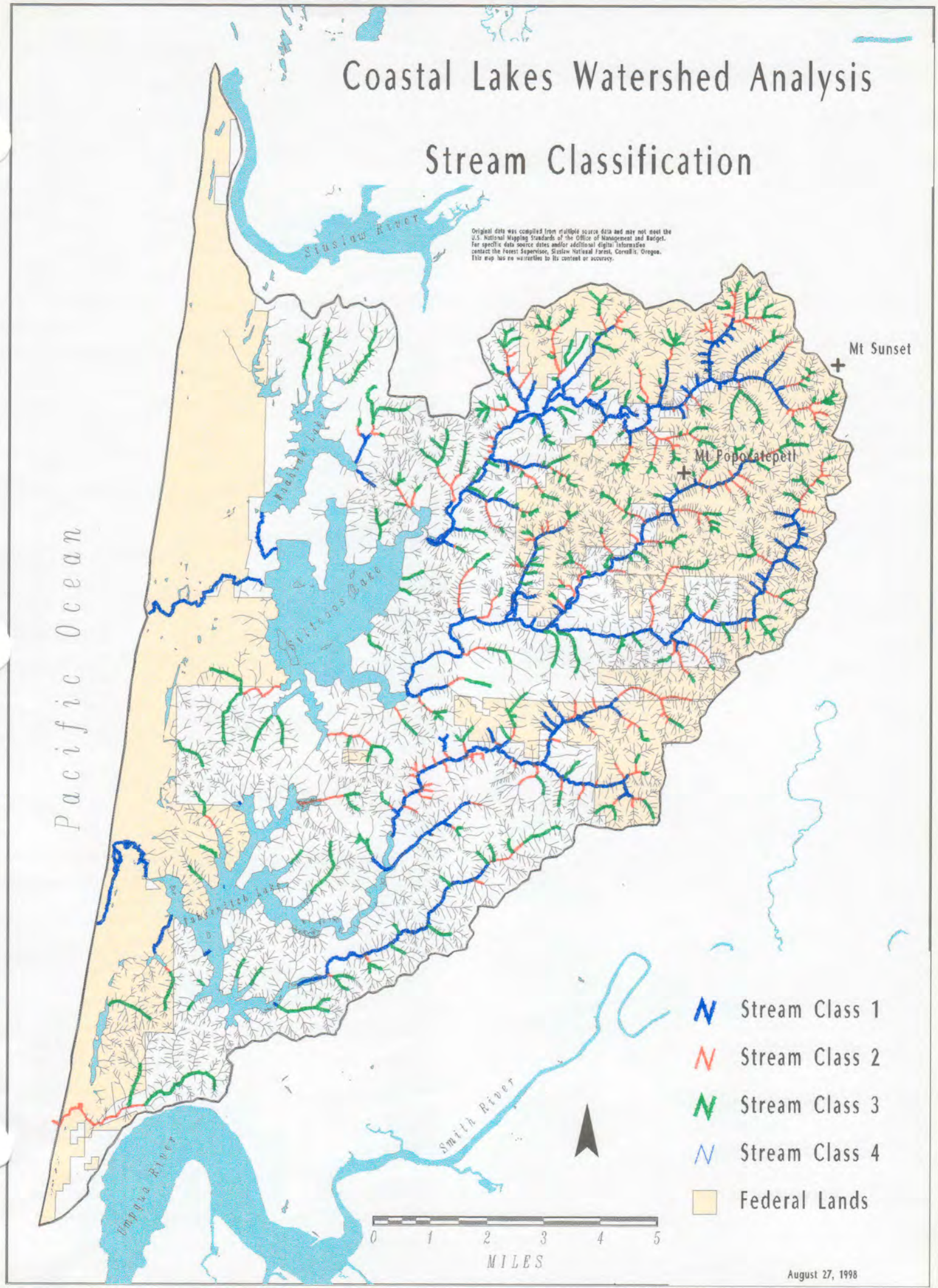
August 26, 1998

Coastal Lakes Watershed Analysis

Stream Classification



August 27, 1998

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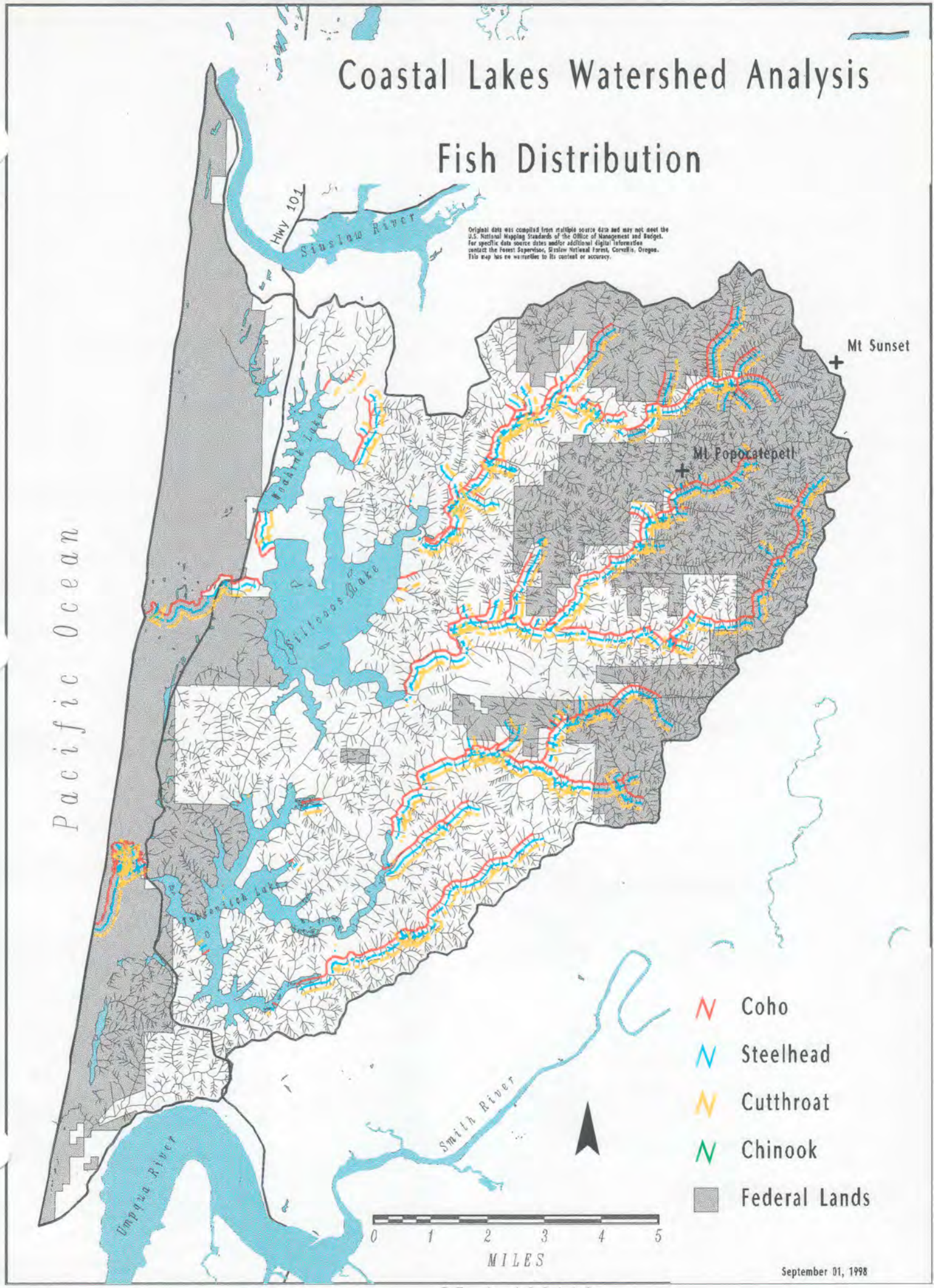
Fish Distribution