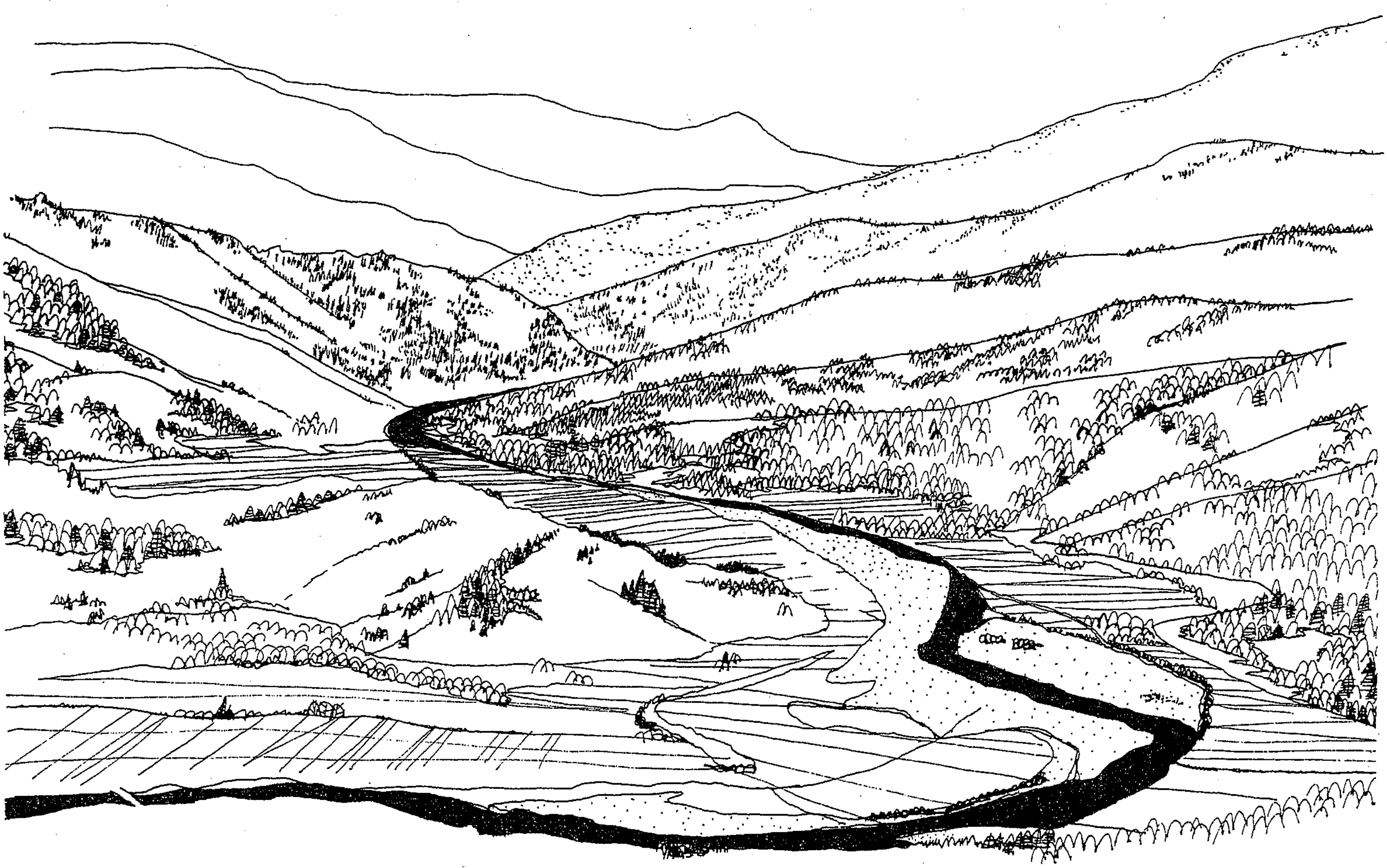
FRESHWATER RESOURCES OF THE OREGON COASTAL ZONE



ın Coastal Conservation & Development Commission

Freshwater Resources
Oregon Coastal Zone

A natural resource inventory report to the

OREGON COASTAL CONSERVATION & DEVELOPMENT COMMISSION

December 1974

Prepared by

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January 30, 1975

To the 58th Legislative Assembly of the State of Oregon:

This report is one of ten resource inventories prepared for the OCC&DC for use in developing a resource management plan for the Oregon Coastal Zone. Prepared by the staff of the State Water Resources Board, this document provides a coastwide identification of the characteristics, uses, needs and management considerations associated with the freshwater resources.

Thus, compiled within the inventory are descriptions of the current water resource use situation and assessments of water availability and future potentials. We believe this document is the best possible evaluation and data base that could be gathered within the limited time frame and available budget. Accordingly, we wish to commend the State Water Resources Board for a task well done and to extend our appreciation to those who participated in this work effort.

As the inventory indicates growth in demand for water use among conflicting uses will pose problems for management in the years ahead. This fact supports a point the Commission would like to emphasize. That is, the need to look upon this inventory as a working document that is subject to change and in need of periodic updating. This is necessary because for the inventory to be useful to local units of government and state agencies in carrying out resource conservation and development activities it must reflect a current assessment of the resource situation. And this is an essential ingrediant for the continued effective management of the Oregon Coastal Zone.

Sincerely,

Wilbur E. Ternyik
Chairman

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Introduction

The Oregon Coastal Zone contains a variety of climatic and topographic features that both influence and control the freshwater resources of the zone. Between the Columbia River in the north, the California border in the south, the crest of the Coast Range in the east, and the Pacific Ocean in the west exists a water resource that can probably best be described as spasmodic. Serene, meandering, yet confined streams can become torrents of sediment and debris-laden water almost instantly resulting in destruction of life and property; and in an equally short period the streams can recede and return to their serene character. The uses, both existing and future, the availability, and the management of this "ill-mannered", yet vital, water resource are the subjects of this Coastal Zone Freshwater Report. Figure 1 illustrates the extent of the Coastal Zone and Table 1 indicates the area of the Coastal Zone by basin and county.

To facilitate discussion of the Coastal Zone freshwater resources, three general regions will be addressed: the North Coast Basin area, extending from the Columbia River south through the Neskowin Creek watershed; the Mid-Coast Basin area, which includes the Salmon River watershed through the Tahkenitch Creek watershed; and the South Coast Basin area, which extends from the Tenmile Creek watershed through the Winchuck River drainage at the Oregon-California border. For this report, the South Coast will also include the lower reaches of both the Umpqua and Rogue River systems, because of the small areas involved. To further aid in analyzing the water resources of the Coastal Zone, the general regions have been divided into 49 study areas as shown in Figure 2 and listed in Table 2.

North Coast Basin Area

The North Coast Basin area includes streams draining into both the Pacific Ocean and the Columbia River. The Pacific Ocean drainages constitute the majority of the area and include the following major streams: the Little Nestucca and the Nestucca Rivers flowing into Nestucca Bay; the Tillamook, Trask, Wilson, Kilchis, and Miami Rivers flowing

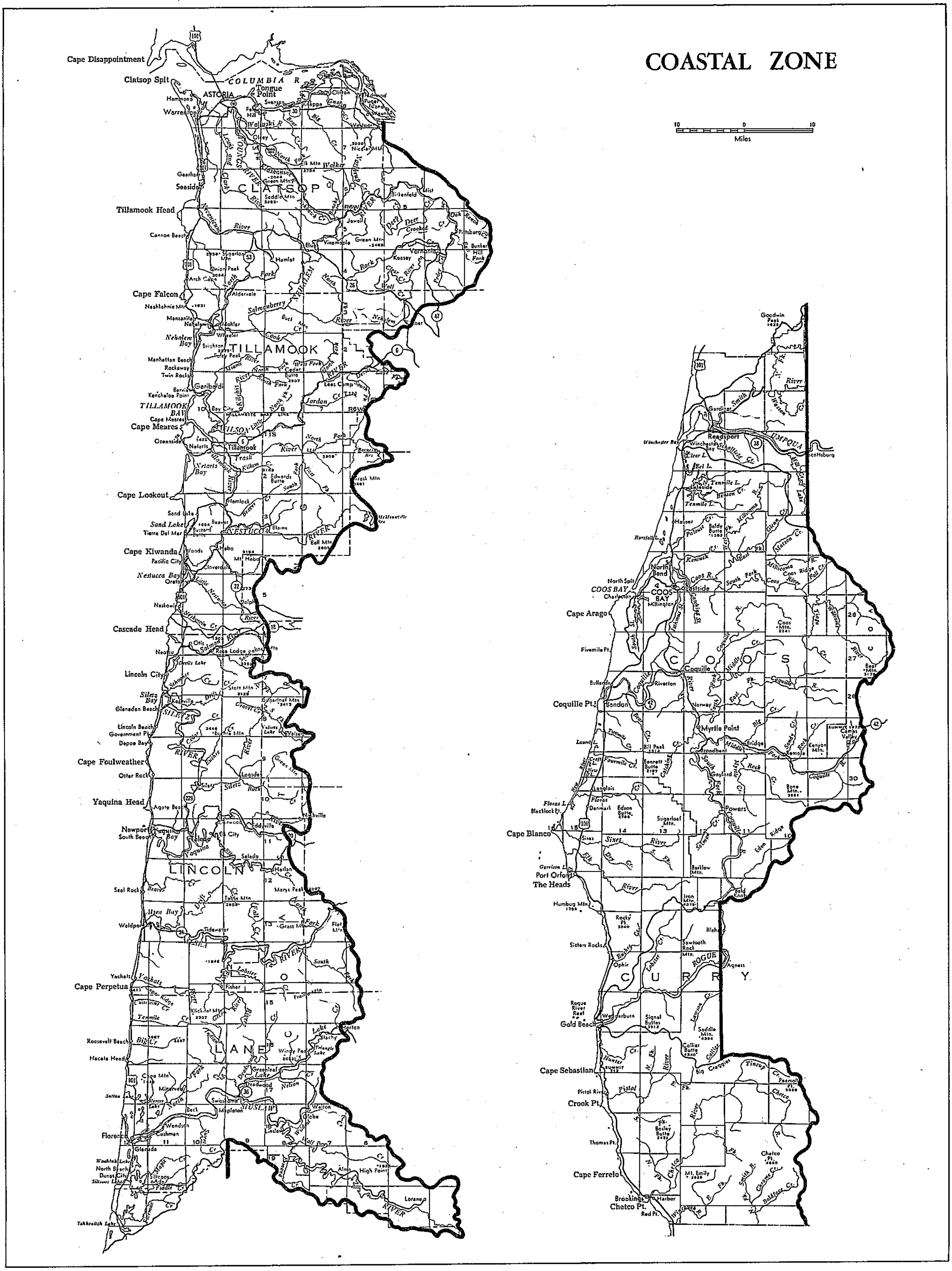

FIGURE 1. The Coastal Zone.

TABLE 1

COASTAL ZONE AREA
BY BASIN AND COUNTY

COUNTY	TOTAL AREA	AREA WITHIN COASTAL ZONE		
	Sq. Mi.	Sq. Mi.	Acres	Percent of County
NORTH COAST BASIN				
Clatsop	843	843	539,500	100
Columbia	646	270	172,800	41
Polk	708	3	1,900	0
Tillamook	1,115	1,091	698,200	97
Washington	716	85	54,400	12
Yamhill	714	62	39,700	9
BASIN TOTAL	-	2,354	1,506,500	-
MID-COAST BASIN				
Tillamook	1,115	14	9,000	1
Polk	708	100	64,000	14
Lincoln	998	983	629,100	98
Benton	668	184	117,800	28
Lane	4,610	991	634,200	21
Douglas	5,089	89	57,000	2
BASIN TOTAL	-	2,361	1,511,100	-
SOUTH COAST BASIN				
Coos	1,627	1,598	1,022,700	98
Curry	1,629	1,126	720,600	69
Douglas	5,089	260	166,400	5
BASIN TOTAL	-	2,984	1,909,700	-
ROGUE BASIN				
Curry	1,629	298	190,700	18
Coos	1,627	2	1,300	0
BASIN TOTAL	-	300	192,000	-
UMPQUA BASIN				
Douglas	5,089	270	172,800	5
Coos	1,627	7	4,500	0
Lane	4,610	3	1,900	0
BASIN TOTAL	-	280	179,200	-
COASTAL ZONE TOTAL	-	8,279	5,298,500	-

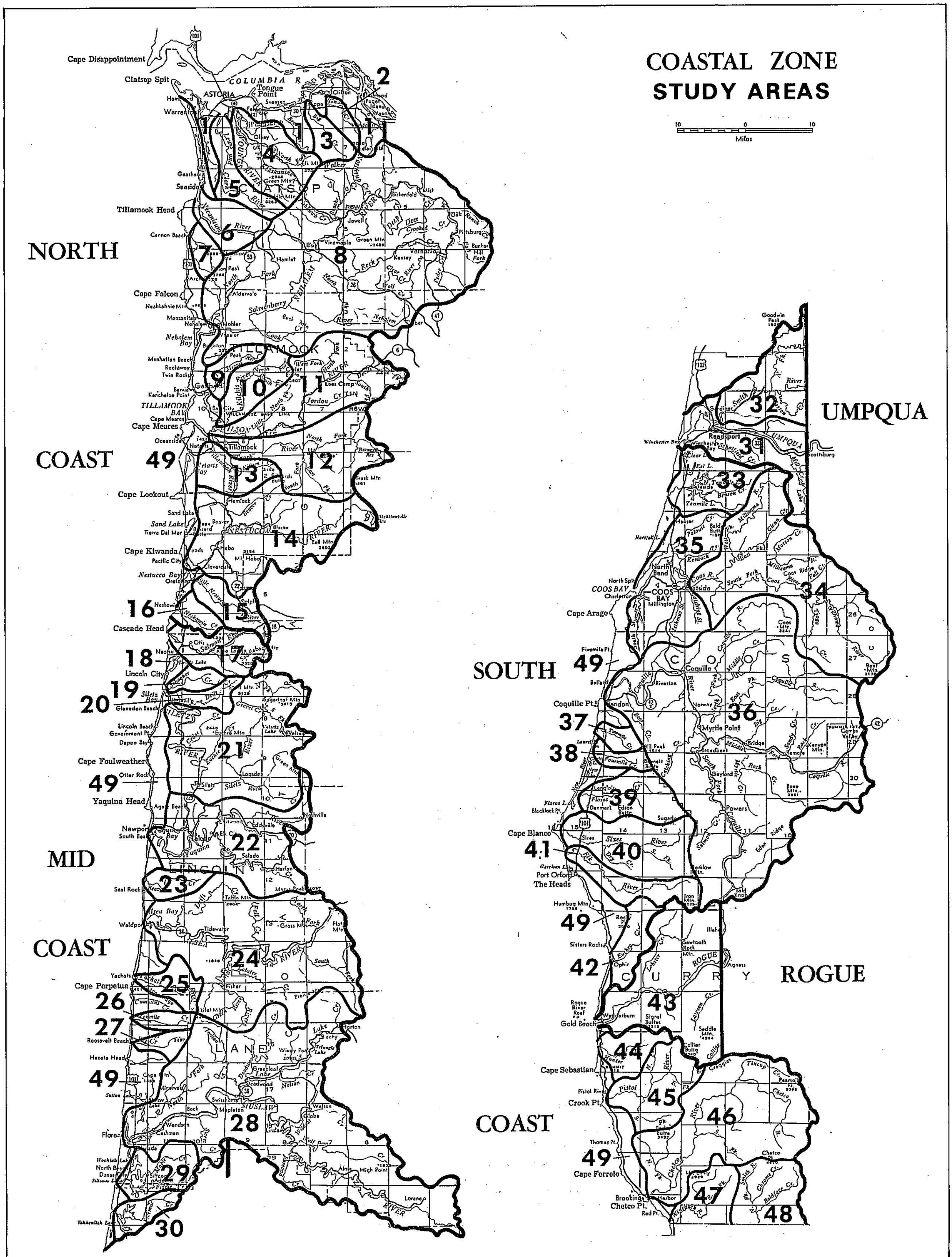

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FIGURE 2. Study Areas.

TABLE 2

COASTAL ZONE STUDY AREAS

1.	Columbia River Misc.	18.	D River	34.	Coos River
2.	Gnat Creek	19.	Schooner Creek	35.	Coos Bay
3.	Big Creek	20.	Drift Creek	36.	Coquille River
4.	Youngs River	21.	Siletz River	37.	Tenmile Creek
5.	Lewis and Clark River	22.	Yaquina River	38.	Fourmile Creek
6.	Necanicum River	23.	Beaver Creek	39.	Floras Creek
7.	Elk Creek	24.	Alsea River	40.	Sixes River
8.	Nehalem River	25.	Yachats River	41.	Elk River
9.	Miami River	26.	Tenmile Creek	42.	Euchre Creek
10.	Kilchis River	27.	Big Creek	43.	Rogue River
11.	Wilson River	28.	Siuslaw River	44.	Hunter Creek
12.	Trask River	29.	Siltcoos River	45.	Pistol River
13.	Tillamook River	30.	Tahkenitch Creek	46.	Chetco River
14.	Nestucca River	31.	Umpqua River	47.	Winchuck River
15.	Little Nestucca River	32.	Smith River	48.	Smith River
16.	Neskowin Creek	33.	Tenmile Creek	49.	Pacific Ocean Misc.
17.	Salmon River				

Note: Numbers correspond to the study areas shown on the Coastal Zone Study Areas Map - Figure 2

into Tillamook Bay; the Nehalem River flowing into Nehalem Bay; and the Necanicum River flowing into the Ocean at Seaside.

The two major streams draining the Columbia River portion of the area are the Youngs River and the Lewis and Clark River.

The Nehalem River has the largest watershed in the basin with over 800 square miles. All other streams have watersheds of less than 200 square miles.

Only a few rivers in the North Coast Basin are more than 30 miles in length. The Nehalem with a main stem length of 118 miles is the longest. Other rivers are the Nestucca, 52 miles; the Wilson, 43 miles; the Trask, 39 miles; the Lewis and Clark, 27 miles; the Youngs, 22 miles; and the Klaskanine, 12 miles.

The North Coast Basin has a humid climate resulting from the temperature moderating influence of the Pacific Ocean and from intensification of rainfall induced by the Coast Range.

Some variation in this general pattern is brought about by effects of the Columbia Gorge. Figure 3 illustrates the annual rainfall pattern over the Coastal Zone.

The average annual precipitation varies from 70 inches along the coast to over 150 inches near the headwaters of the Kilchis and the Wilson Rivers. Most of the Tillamook River watershed has an average annual precipitation above 80 inches, with the lowest precipitation occurring along the eastern boundary. In the Nehalem watershed, the precipitation increases in an easterly direction from about 90 inches over the coastal strip to a high of more than 140 inches over the headwaters of Cook Creek, and then decreases to 50 inches in the Vernonia area.

The precipitation in the North Coast Basin is extremely seasonal. Most of the precipitation occurs during the fall and winter, with 75 to 80 percent of the annual precipitation occurring during the months of October through March. The lowest precipitation, usually well below 2 inches, generally occurs during both July and August. Although rainfall varies considerably in amount throughout the basin, the seasonal distribution pattern is similar throughout the area. These characteristics, combined with similar vegetative and soil conditions, result in a fairly uniform streamflow distribution pattern throughout the area. The average monthly discharge patterns for the rivers in the North Coast area follow very closely to the precipitation patterns. Once the late fall rains have saturated the soil, runoff varies directly with the precipitation because snowfall is not a significant factor in the Coast Range. Peak flows occur during the months of December, January, and February, which reflect the heavy rainfall of those months. After February, streamflows begin to recede, reaching their lowest point in August and September.

The North Coast has both natural and man-made lakes located throughout the region. They vary in size from small log ponds to the larger man-made reservoirs such as Fishhawk Lake reservoir and lakes of dune origin such as Cullaby Lake. Most of the natural lakes are located along the coastal strip and were formed by sand moving inland and blocking streams. Many of the lakes in the foothills and coastal valleys are man-made; however, natural lakes exist also. Most of these reservoirs are used to store water for municipalities and are located in the remote areas of the watersheds. Lowland natural lakes are used for a variety of purposes. Many of these lakes offer fine fishing and recreational opportunities, but in some instances these lakes are beginning to show signs of

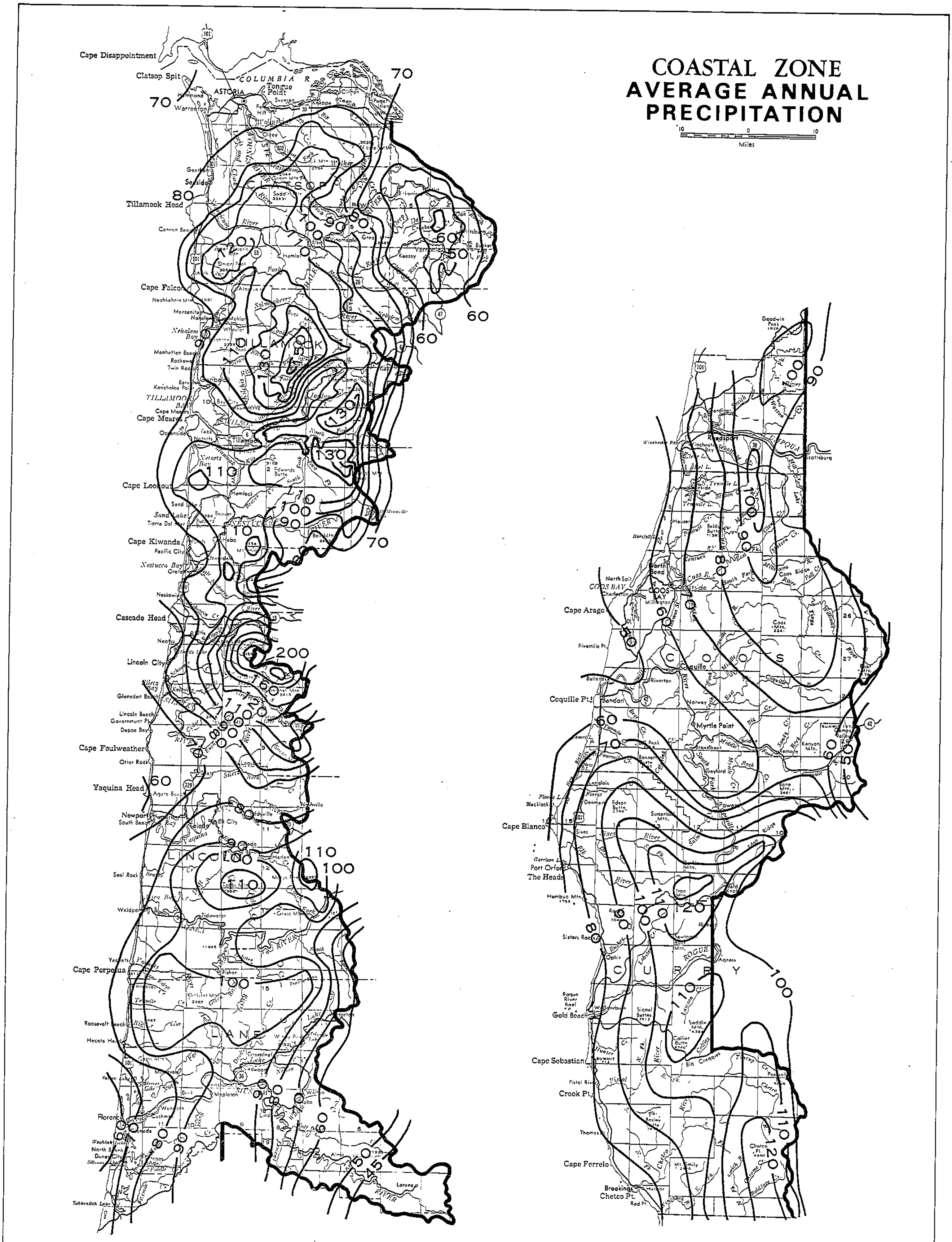

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FIGURE 3. Annual Precipitation Patterns.

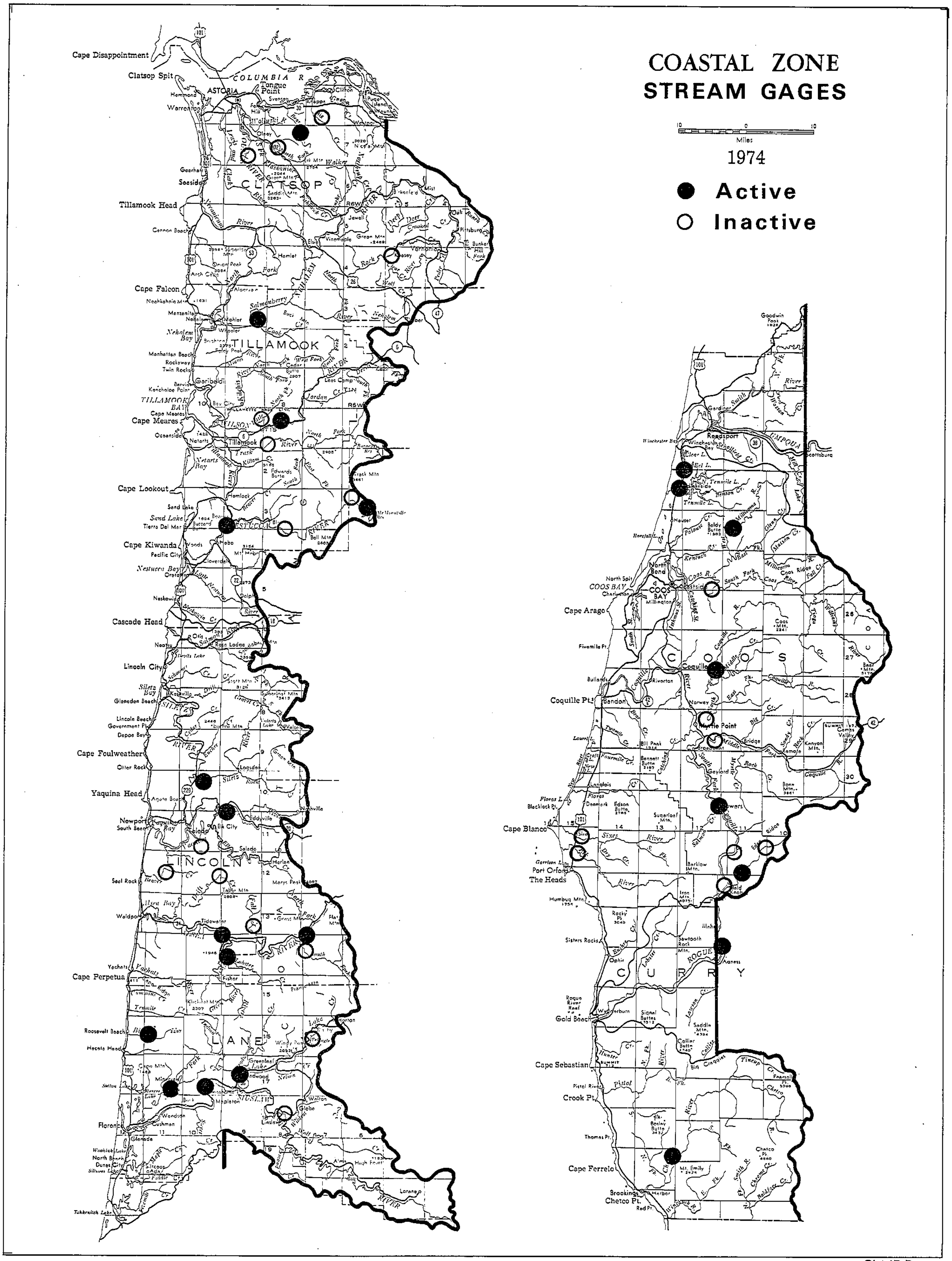

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FIGURE 4. Stream Gaging Stations.

TABLE 3

SELECTED USGS GAGING STATIONS

COASTAL ZONE

Average Monthly Flows in CFS

STREAM	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	RECORDED		AVERAGE
													Monthly High	Monthly Low	Ac.-Ft./Yr.
Big Creek #142485 SM 2.9 1949-55	66	166	307	396	381	288	205	97	62	43	30	27	538	21	124,250
Youngs River #142515 SM 9.7 1919-58	96	276	409	383	363	277	178	78	45	20	10	17	1,159	5	129,181
N. Fk. Klaskanine River #142520 SM 4.7 1949-55	31	82	133	175	139	105	66	26	17	12	6	6	245	3	47,996
*Nehalem River #143010 SM 13.6 1940-68	841	3,722	5,995	6,223	6,359	4,324	2,652	1,301	574	251	205	205	12,492	63	1,845,224
*Wilson River #143015 SM 9.6 1931-68	659	1,957	2,722	2,530	2,308	1,842	1,177	638	324	164	112	162	7,988	40	871,391
Trask River #143025 SM 10.3 1931-55 1962-68	450	1,405	2,153	2,070	1,827	1,489	941	535	306	164	108	123	5,490	50	695,970
*Nestucca River #143036 SM 13.5 1965-68	304	990	2,686	2,950	2,005	1,631	759	402	338	128	109	115	4,307	49	748,205
*Siletz River #143055 SM 42.7 1924-68	833	2,405	3,290	3,195	3,024	2,347	1,538	829	442	205	135	237	7,827	48	1,140,000
*N. Fk. Alsea River #143061 SM 0.7 1958-68	82	299	537	679	639	501	281	167	71	36	36	37	1,648	15	199,254
S. Fk. Alsea River #143062 SM 1 1958-63	31	149	212	281	471	344	222	132	52	24	14	15	730	10	116,371
*Alsea River #143065 SM 17.5 1940-68	466	1,785	3,176	3,677	3,548	2,659	1,502	840	383	186	120	132	7,875	60	1,111,000
Siuslaw River #143070 SM 44.9 1931-41	78	526	1,227	1,689	1,841	1,376	745	370	236	92	48	41	3,303	26	498,166

TABLE 3

SELECTED USGS GAGING STATIONS

COASTAL ZONE

Average Monthly Flows in CFS

(Continued)

STREAM	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	RECORDED		AVERAGE
													Monthly High	Monthly Low	Ac.-Ft./Yr.
Lake Creek #143075 SM 18.6 1931-55	52	226	426	508	500	362	224	117	58	27	15	16	939	6	146,788
*Tenmile Creek #143232 SM 2 1957-68	30	258	600	759	789	576	397	228	96	37	28	17	1,446	4	228,245
*W. Fk. Millicoma River #143245 SM 7.1 1954-68	92	369	597	584	542	460	242	120	38	14	10	17	1,357	3	185,070
*N. Fk. Coquille River #143268 SM 21.5 1964-68	31	375	617	905	474	454	212	104	41	16	11	12	1,530	4	201,780
N. Fk. Coquille River #143270 SM 4.3 1964-68	135	1,124	2,046	2,454	2,016	1,639	944	465	261	93	45	49	4,752	22	680,833
M. Fk. Coquille River #143265 SM 2.2 1931-46	67	825	1,606	1,800	1,837	1,452	755	371	158	55	24	25	4,217	9	538,325
*S. Fk. Coquille River #143250 SM 28 1917-26, 1929-68	232	980	1,631	1,773	1,688	1,318	922	471	171	62	34	37	5,360	16	564,193
*Chetco River #144000 SM 10.7 1970-73	386	3,184	5,746	8,265	3,207	4,503	2,095	822	341	174	101	175	13,450	65	1,755,500
Umpqua River #143210 SM 56.8 1906-68	1,962	6,834	12,723	15,778	15,702	12,270	9,648	6,623	3,892	1,770	1,177	1,174	51,231	702	5,377,539
*Rogue River #143723 SM 30 1961-68	2,013	4,762	12,070	12,862	11,504	9,229	7,400	5,813	3,078	1,546	1,222	1,220	43,980	935	4,376,000
*Illinois River #143782 SM 3.2 1961-68	964	4,655	9,013	9,726	8,613	7,494	5,057	3,280	930	380	248	206	26,830	164	3,040,500

*Gages active 1974

Note: Years shown are those used to compute averages.

overuse. This is especially the case when development occurs on the lakes without proper facilities to handle the influx of recreationists.

Streamflow records in the area are limited. Figure 4 and Table 3 illustrate the extent of these records. Only the Trask, Wilson, Nehalem, and Youngs Rivers have stations with more than 6 years of record. From these gaging records, the annual yield of a given drainage area is determined. The annual yield is a net value representing the precipitation on the area less surface infiltration, evaporation losses, and consumptive water uses. Since watershed characteristics are constantly undergoing change, the average annual yield reflects yearly differences in both watershed characteristics and consumptive use.

TABLE 4

AVERAGE ANNUAL YIELD OF THE
COASTAL ZONE STUDY AREAS

NORTH COAST

WATERSHED	DRAINAGE AREA Sq. Mi.	AVERAGE ANNUAL YIELD Acre-Feet
1. Columbia River Misc.		
2. Gnat Creek	26	78,000
3. Big Creek	39	112,000
4. Youngs River	122	323,000
5. Lewis and Clark River	62	181,000
6. Necanicum River	87	243,000
7. Elk Creek	21	87,000
8. Nehalem River	847	2,148,000
9. Miami River	36	174,000
10. Kilchis River	67	377,000
11. Wilson River	195	986,000
12. Trask River	176	805,000
13. Tillamook River	61	280,000
14. Nestucca River	259	1,010,000
15. Little Nestucca River	59	232,000
16. Neskowin Creek	21	87,000

Basin yields vary throughout the watersheds (Table 4). These differences can be attributed to how man uses the water in a given area and to the vegetative and geologic characteristics of the watersheds. Nature consumes about 20 to 25 percent of the precipitation before man can use it, either through evaporation or vegetative transpiration. In addition to these losses, there is the ground water recharge from the surface system. Some of these losses are regained elsewhere through wells.

The North Coast has an average annual yield of 7.5 million acre-feet. However, it should be emphasized again that a large part of this water occurs when man gains little benefit from it - the winter months.

Ground water resources vary from moderate amounts in the alluvial deposits along the Columbia River and the foothills of the Coast Range to very limited quantities in the Coast Range proper. Rock structure determines to a large degree the source, occurrence, quality, and the movement of the ground water available for use. Rocks in the basin consist principally of sedimentary and volcanic units which are relatively impervious. It is unlikely that these two rock types could produce high capacity wells.

Ground water is generally concentrated in the course deposits of the low-land alluvials along the Columbia River and the fringes of the Coast Range, particularly in the Tillamook area. The sand forming much of the narrow coastal belt is generally too fine-grained and too highly compacted to yield much ground water. The ground water potential for the area can be characterized as poor, with the exception of the Tillamook area and the sand dunes just south of the city of Warrenton.

Mid-Coast Basin Area

The Mid-Coast Basin area is drained by six major river systems: the Salmon River, the Siletz River, the Yaquina River, the Alsea River, the Yachats River, and the Siuslaw River; see Figure 2. All have their headwaters near the crest of the Coast Range and flow westward into the Pacific Ocean. In addition to these major rivers, there are about 70 streams with smaller watersheds which flow directly into the Pacific Ocean. Springs in the basin are generally small and contribute only minimally to the annual yield.

The Siuslaw River is the longest stream in the basin, with a length of 118 miles. The lengths of the other major rivers are: Siletz, 77 miles; Alsea, 60 miles; Yaquina, 52 miles; Salmon, 25 miles; and Yachats, 17 miles.

INTRODUCTION

As in the North Coast area, the Mid-Coast Basin area has a temperate, humid climate. This results from the moderating influence of the Pacific Ocean and from the rainfall induced by the Coast Range barrier. Rainfall is strongly influenced by elevation, increasing from 60 to 90 inches along the seacoast to as high as 180 to 200 inches on the Coast Range divide. The lowest rainfall occurs in the upper Siuslaw drainage.

Approximately 80 percent of the precipitation occurs between October and March. Average precipitation during this period is 8 to 12 inches per month in the coastal valleys and over 20 inches in the mountainous areas. Winter precipitation often occurs in moderate to heavy storms that may continue without interruption for prolonged periods. Summer rainfall is only 1 to 2 inches per month; and it consists of occasional light rainstorms, drizzle, and heavy coastal fog.

In addition to the freshwater streams, the Mid-Coast Basin area has approximately 8,000 acres of freshwater lakes located along the coastline from Devils Lake in the north to Tahkenitch Lake in the south. Approximately 80 percent of the total surface area of freshwater lakes of the Mid-Coast is located in western Lane County near Florence where the sand-dune lakes of Sutton, Mercer, Clear, Munsel, Cleawox, Woahink, Siltcoos, Tahkenitch, and several other smaller lakes are located. Three other lakes of importance are: Triangle Lake, in the upper watershed of Lake Creek; Valsetz Lake, in the upper Siletz River drainage; and Devils Lake, near Lincoln City. All of these lakes are important for recreation and fish life and some for municipal water supplies.

The average annual runoff for the Mid-Coast area is estimated to be 8,100,000 acre-feet. The largest contribution to this total, 2 million acre-feet, is made by the Siuslaw River drainage. The other contributors and their yields are shown in Table 5. The annual yields vary considerably from year to year depending upon the local precipitation patterns.

As in the North Coast area watersheds, the Mid-Coast area has little infiltration to ground water from rainfall as the soil mantle is relatively thin and overlies impervious rock. Most of the water moves directly into the stream channels. Corresponding almost directly to rainfall, streamflows begin to rise with the beginning of the rainy season in October, reaching maximum flow about midwinter, January and February, and then taper off as rainfall decreases to a low flow in August and September. About 80 percent of the average annual yield occurs during

TABLE 5

AVERAGE ANNUAL YIELD OF THE
COASTAL ZONE STUDY AREAS

MID-COAST

WATERSHED	DRAINAGE AREA Sq. Mi.	AVERAGE ANNUAL YIELD Acre-Feet
17. Salmon River	75	447,000
18. D River		50,000
19. Schooner Creek	18	93,000
20. Drift Creek (Siletz Bay)	41	236,000
21. Siletz River	300	1,375,000
22. Yaquina River	253	749,000
23. Beaver Creek	34	107,000
24. Alsea River	474	1,522,000
25. Yachats River	44	147,000
26. Tenmile Creek	22	82,000
27. Big Creek	15	54,000
28. Siuslaw River	773	2,002,000
29. Siltcoos River	72	202,000
30. Tahkenitch Creek	35	97,000

the November through April period with only 3 percent occurring during the July through September period.

Marine sedimentary rocks and to a lesser extent volcanic and intrusive igneous rocks exist throughout most of the basin. These rocks are fine-grained and relatively impermeable to water, resulting in only meager quantities of available ground water, except in a few alluvial and sand-dune areas. Ground water quality is generally poor due to dissolved minerals and decomposed vegetation and in some cases contamination from inadequate sewerage treatment.

The sand dunes of western Lane County are by far the most productive ground water aquifers in the Mid-Coast Basin area. A study by the U.S. Geological Survey of an area in the sand dunes extending from Florence to Lily Lake indicates that the sand dunes absorb about 55 of the 65-inch annual precipitation in this region. An estimated 7 inches of this is lost to evapotranspiration resulting in an annual recharge of approximately 48 inches. The study also shows that the 48 inches of annual recharge total approximately 46,000 acre-feet per year or 41 million gallons per day. The water is generally soft and of good chemical quality, although there are places that contain objectionable amounts of iron.

South Coast Basin Area (Including those portions of the Umpqua and Rogue River Systems in the Coastal Zone)

The South Coast Basin area of the Coastal Zone consists of four major stream systems: the Coos, Coquille, Umpqua, and Rogue River watersheds, and several small watersheds including Sixes, Chetco, Winchuck, Pistol, and Elk Rivers.

The South Coast Basin area, exclusive of the Umpqua and Rogue Rivers, drains 2,984 square miles (Figure 2). All streams have their headwaters in the Coast Range. There are about 750 named streams and over 1,000 unnamed streams. Together, these streams total approximately 4,500 miles in length; however, only a few streams are more than 50 miles in length. The longest is the Coquille River, extending 99 miles from its mouth to the headwaters of the South Fork.

Climate in the South Coast Basin area is similar to the Mid and North portions of the Coastal Zone, because of the influence of the Pacific Ocean. Average annual precipitation is lowest along the coast, ranging from 50 to 70 inches and increasing with elevation to over 120 inches in parts of the Coast Range. Nearly 80 percent of the average annual precipitation occurs during the six months of October through March, with about 50 percent during November, December, and January. Precipitation during the three lowest months of the year, June, July, and August, is only about 4 percent of the total annual precipitation and amounts to less than 4 inches a month in most areas of the basin.

Since the South Coast Basin's stream gaging records are fragmentary, runoff data is estimated by various methods for areas without gaging stations. At present, the only active stream gages are on the South Fork Coquille River, the West Fork Millicoma River, Tenmile Creek, the North Fork Coquille River, and the Chetco River (Figure 4, Table 3).

The only active station currently in use which has a long-term period of record is on the South Fork Coquille River at Powers. It has been in operation since 1926.

Records of the gaging stations were extended by correlation to the base period of 1930 to 1972 to facilitate the comparison of different stream systems within the basin. Yields of ungaged streams have been estimated from runoff records of other streams and from precipitation records.

TABLE 6

AVERAGE ANNUAL YIELD OF THE
COASTAL ZONE STUDY AREAS

SOUTH COAST

WATERSHED	DRAINAGE AREA Sq. Mi.	AVERAGE ANNUAL YIELD Acre-Feet
31. Umpqua River		400,000
32. Smith River		30,000
33. Tenmile Creek	96	268,000
34. Coos River	418	1,276,000
35. Coos Bay		
36. Coquille River	1,079	2,185,000
37. Twomile Creek	14	34,000
38. Fourmile Creek	20	49,000
39. Floras Creek	88	229,000
40. Sixes River	129	372,000
41. Elk River	91	267,000
42. Euchre Creek	37	97,000
43. Rogue River		500,000
44. Hunter Creek	45	122,000
45. Pistol River	102	299,000
46. Chetco River	350	1,037,000
47. Winchuck River	157	419,000
48. Smith River	93	267,000
49. Pacific Ocean Misc.		

The average annual yield of the South Coast Basin area is estimated at approximately 7 million acre-feet (Table 6). This represents an average unit runoff of about 57 inches compared to the average annual precipitation of about 80 inches.

The seasonal pattern of runoff of the South Coast streams is typical of most of the Coastal Zone in that it closely follows the pattern of precipitation. The highest runoff months are November through April, which are also the highest precipitation months. With decreasing precipitation in the summer, flows become extremely low in the months of June through October, reaching their minimums in August and September. Generally, about 90 percent of the annual yield occurs in the six-month period of November through April and from one-third to one-half of this occurs in the months of January and February. Less than 1 percent of the annual yield occurs in the months of August and September. As an example, average monthly flows for the South Fork Coquille

River at Powers vary from 32 cubic feet per second in September to 1,880 cubic feet in January.

The major geologic features of the South Coast Basin consist of the southern part of the Coast Range and the northwestern corner of the Klamath Mountains. These mountains contain the oldest rocks in the Coastal Zone. Marine sedimentary rocks predominate throughout most of the basin with lesser units of igneous and metamorphic rocks occurring in the south. The rocks of the basin are generally fine-grained, compact, and impermeable so that they yield little ground water. Ground water supplies are generally inadequate both in quantity and quality throughout most of the area. The exception, however, is the 13,000-acre sand-dune area adjacent to the ocean north of Coos Bay. Large quantities of high quality ground water have been discovered and are being used to some extent today.

Additional potential sources of ground water are the sand and gravel aquifers lying along the alluvials of the main rivers, particularly the Coos and Coquille Rivers. Most other river systems flow through narrow valleys and therefore have deposited relatively little alluvium. The use of ground water is restricted in many areas because of the quality problem. The principal problems are bacterial contamination, excessive iron content, and, to a lesser degree, high acidity and oily odorous water caused by serpentine deposits.

The South Coast Basin area has a number of freshwater lakes with a total surface area of approximately 4,000 acres. In addition, log ponds and reservoir sites occupy approximately 700 additional acres of water-surface area. The largest of the natural lakes is Tenmile Lake with approximately 1,187 acres, followed by North Tenmile Lake with about 858 acres. Other lakes of importance include Clear Lake, Eel Lake, Saunders Lake, Horsfall Lake, Spirit Lake, Sand Point Lake, Floras Lake, Garrison Lake, New Lake, Laurel Lake, and Croft Lake. In addition, there are numerous other small lakes ranging from 10 acres up to 50 acres in size. These fresh-water lakes are important for recreation, for fish and wild-life habitat, for municipal water supplies, and, in some cases, industrial uses such as log ponds.

The Umpqua and the Rogue Rivers are major river systems in themselves; however, a small part of their drainages are included within the Coastal Zone.

The Umpqua River enters the Pacific Ocean near Reedsport and the Rogue River enters the Pacific Ocean further south —

at Gold Beach. Together, these rivers drain more than 9,700 square miles; but this report will only consider about 600 square miles of these two basins.

Average annual precipitation is lowest near the mouth of each of the rivers with 70 inches and increases to 100 to 110 inches as elevation increases. Nearly 80 percent of this average annual precipitation occurs during the six-month period of October through March, with about 50 percent occurring during November, December, and January. Precipitation during the three lowest months of June, July, and August is only about 4 percent of the total annual precipitation.

That portion of the Umpqua River Basin included in the Coastal Zone extends from approximately Scottsburg to the mouth of the Umpqua River. It is estimated that the Coastal Zone portion of this watershed yields about 430,000 acre-feet in an average year.

The Rogue River portion of the south coastal area extends from Agness to the mouth of the Rogue River, a distance of about 27 river miles. Most of this watershed is a part of the Siskiyou National Forest. The terrain is very rugged and is very sparsely populated. Use of this portion of the watershed is primarily for recreation, summer cabins, and logging. That portion of the Rogue River Basin which is considered part of the Coastal Zone is estimated to yield about 500,000 acre-feet on an average year.

Major Water Uses

Throughout the Coastal Zone, the major consumptive uses of water are for municipal, industrial, and irrigation purposes and will remain so in the foreseeable future. Fish life is the major nonconsumptive use of water in the Coastal Zone.

North Coast Basin Area

In the North Coast, municipalities are the primary consumptive users of water. Municipal uses are centered around Astoria, Warrenton, Seaside, Gearhart, Cannon Beach, Nehalem Bay, Tillamook Bay, and inland near the headwaters of the Nehalem River at Vernonia. Industrial consumption of water is significant within the North Coast Basin, but most of the industrial water needs are supplied by the various municipal water systems located throughout the basin. Future industrial development will probably occur in the Astoria-Warrenton area and to the south in the Tillamook Bay area. Any increase in industrial demand will probably be met through an expansion of the existing municipal systems. Irrigation consumption is centered in the Tillamook Bay area and in scattered areas throughout the Nehalem River valley. Domestic consumption is not significant in terms of total amount of water diverted and consumed relative to municipal, industrial, and irrigation consumption.

Mid-Coast Basin Area

In the Mid-Coast Basin, again municipal and industrial water consumption are the greatest uses of the water resources. Municipal use is concentrated in the Lincoln City, Newport, Toledo, Siletz, Waldport, and Florence areas. For the most part, industrial water use in the Mid-Coast is supplied through municipal systems with the major exception of the Georgia Pacific plant at Toledo. This plant draws its water from the Siletz River. In addition, there is an industrial facility located near Gardiner, Oregon, in the Umpqua River Basin, which takes its water from Tahkenitch Lake in the Mid-Coast Basin. Other industrial areas are located in the Siuslaw watershed, notably in the Mapleton and Swisshome area. Irrigation uses are centered in the upper Elk Creek drainage, a tributary to the Yaquina River, and in the upper Alsea watershed around the town of Alsea. A third area of irrigation consumption is on Lake Creek above and below Triangle Lake. Fish life is the major nonconsumptive use of the waters of the Mid-Coast. The recreational use of water is also extremely important throughout the Mid-Coast in terms of fishing, boating, and water contact sports.

South Coast Basin Area

In the South Coast Basin, industrial water use continues to be the prime consumer of water. Industrial development is centered in the Coos Bay area, Coquille, and Myrtle Point, with smaller seafood processing industries located at Bandon, Port Orford, Gold Beach, and Brookings. For the most part, these industries are supplied through municipal systems. The major municipal systems are located in Coos Bay, Coquille, Myrtle Point, Bandon, Port Orford, Gold Beach, and Brookings and account for most of the municipal consumption in the South Coast. Irrigation is significant in the Coquille drainage, especially along the South Fork and the main stem. It is also significant in the Bandon area for the cranberry bogs, and in the Floras Creek-New Lake region south of Bandon. Recreation is the major nonconsumptive use of water on the freshwater lakes and rivers throughout the South Coast. The use of freshwater resources in the South Coast for fish life is also very significant as a nonconsumptive use of water.

In the Umpqua River drainage below Scottsburg, the major uses of the water are for fish life and navigation. There is municipal use of water for the city of Reedsport; however, this water comes from Clear Lake in the South Coast Basin and as such would be considered an interbasin diversion of water. There is some irrigation taking place above stream mile 10 on the Smith River and a small amount of irrigation on Ash Creek above Loon Lake.

In the lower Rogue River from Agness to the mouth, the major use of the water is for recreation and fish life. However, municipal use of water to supply Gold Beach and Nesika Water District is growing. Water for industrial uses in this area is supplied through the municipal systems of Gold Beach and Nesika Water District.

MAJOR WATER USES

Summary

Municipal and industrial water uses are the primary consumers of water throughout the Coastal Zone. In addition, irrigation will continue to be an important water use, especially in the Tillamook, Alsea, Lake Creek, Coquille, and the Floras Creek regions. Domestic water, or that water which is self-supplied in rural areas, is relatively insignificant and probably will remain so in the foreseeable future. The major nonconsumptive uses of water are for fish life and recreation, with navigation being important in the Tillamook Bay, the Columbia estuary, the Yaquina Bay, Coos Bay, and the Umpqua River. There are no significant power developments; however, there is potential for power development throughout the Coastal Zone. Currently, there is very little water used in mining operations in the Coastal Zone; however, the potential for water use for mining operations is significant, especially in the South Coast.

Recently, conflicts over providing adequate domestic and municipal water supplies and maintaining minimum flows for aquatic life have surfaced. Coastal development has outpaced water supply development to a point that either existing systems are already inadequate or are fully utilized resulting in a need for immediate supply expansion. While the domestic-municipal needs are the most apparent out-of-stream needs, industrial and irrigation needs also exist in some areas of the coast, further complicating the water-supply issue. However, to maintain the anadromous fishery and attractive recreational streams, natural flows should not be further depleted. Even now, summer flows are below the minimum streamflows recommended by the Wildlife Commission to maintain the anadromous fishery.

If the Coastal Zone is to maintain its fishery resources, scenic attractiveness, and economic growth, the coastal streams must not be allowed to deteriorate or suffer irrevocable damage before action programs are implemented to develop water supplies and flow augmentation to satisfy the water needs of the people and maintain fishery and other aquatic life.

Water Needs

All water needs and use conflicts are a direct result of water requirements in excess of low-summer flows. Many streams are fully or even overappropriated and cannot readily support additional demands without storage. Additional growth in consumptive water uses will cause use conflicts with recreation and fish life along the entire coast in future years.

Domestic

Domestic water needs along the coast vary considerably from subbasin to subbasin. Rural residents, outside incorporated areas or municipal supply service districts, rely to a large measure on direct appropriation from surface sources. Although municipal systems are supplying water to more rural areas, private development of surface water will continue to be important for domestic growth.

The lack of ground water of adequate quantity or quality and the seasonal variations in surface flows will continue to be the major problem facing both individual and small group domestic water systems. Since the cost of storage is generally beyond the capacity of the individual water user, these conditions may ultimately inhibit development in some areas.

While specific domestic problems have not been identified, new residential or recreational type developments located in areas isolated from municipal water supply facilities may experience difficulties in obtaining water supplies without considering storage. This is particularly evident if minimum streamflows are to be maintained.

Municipal

The needs of municipal supply systems are currently or can be expected to become some of the most critical problems within the Coastal Zone. The majority of the coastal residents are now served either by municipal systems or by water districts.

WATER NEEDS

Pressures on municipal systems are expected to increase over the next few years reflecting both increased population and increased per capita demands. In many cases today systems are experiencing summer shortages. Seasonal peaks in population, coincidental with low seasonal surface flows, compound municipal water supply problems.

Many municipal systems are using small nearby watersheds which, although sufficient in the past, are inadequate to supply the increased water needs. In almost all cases, development of reliable sources of supply will require construction of storage to meet the demands of peak summer periods. Capital costs associated with construction of storage expansion or moderation of treatment facilities, and distribution systems are likely to be beyond the means of most communities.

Several conflicts are developing relating to provision of municipal water supplies and maintenance of instream flows. In the North Coast Basin there is a need for expansion of water supply facilities in the Astoria, Seaside, Tillamook Bay, Nehalem Bay, and the Pacific City-Neskowin areas. Development of these facilities is expected to be substantially more expensive if minimum streamflows are to be maintained. Similarly, in the Mid-Coast and South Coast Basin areas potential conflicts exist. The uses of the Salmon River in north Lincoln County for municipal water supply, a fish hatchery, and protection of instream fishery values are not compatible water uses without flow augmentation. Full exercise of rights on the Siletz River for municipal, industrial, and irrigation needs would reduce streamflows below established minimums. Needs of the city of Bandon, the Wildlife Commission Fish Hatchery, and agricultural demands exceed available supplies in that area. In addition, the city of Powers is seeking a water right to cover historic municipal withdrawals on the Coquille system which could be junior to the established minimum streamflow leading to a possible conflict.

Industrial

Industrial needs of the Coastal Zone are expected to increase, though probably at a lesser rate than municipal demands. Industrial uses, particularly pulpmills and aluminum reduction plants, are large-scale water users. Expansion of wood-products industries appears possible in the Astoria-Warrenton area, the Tillamook Bay region, Newport-Toledo area, and the Coos Bay and North Bend region. Most of the new industry is expected to be served by municipal supply systems. The possibility of an aluminum reduction plant in Warrenton would create additional demands for water and would necessitate the development of a larger municipal system.

While most industries are now on municipal systems, there are some notable exceptions including pulpmills in Toledo and Gardiner and some wood-products industries in and around Coos Bay and Coquille. Development of coal deposits in the South Coast Basin could also require water for thermal generating facilities sometime in the future. These anticipated expansions will make the competition between consumptive and nonconsumptive uses even greater in some areas.

Irrigation

Throughout the Coastal Zone, substantial amounts of potentially irrigable land can be found in all major drainages. However, current water use is small in comparison to its maximum potential.

Areas of irrigation do exist along the Nehalem River system, the Tillamook Bay region, the lower stretches of the Siletz River, the Alsea River, and the Triangle Lake-Lake Creek areas of the Siuslaw River. In the South Coast, irrigation is predominately centered along the Coquille River and its forks, the cranberry bogs in and around the Bandon area, and between Bandon and Port Orford. While the potential for increased irrigation in all of these areas exists, there appears to be little interest in developing additional acreage. Like other consumptive uses, most irrigation is currently maintained from direct diversion of surface flows. Existing rights and established minimum streamflow regimes will preclude a large expansion in irrigated acreage, except as supplied from storage, in most areas.

Recreation

Recreation, an important factor in the Coastal Zone economy, is also expected to increase in the future. Although most attention is centered on the ocean and its beaches, there is considerable activity on the major rivers, estuaries, and lakes. Recreational use of the inland waters, including the coastal lakes, is generally associated with scenic attractions, sport fishing, boating, water skiing, and water contact sports.

Maintenance of the recreational uses will be dependent upon maintaining adequate perennial streamflows in the coastal drainages. In some cases, the recreational opportunities could actually be increased by streamflow augmentation.

Without storage, however, maintenance of these opportunities is at direct odds with expanding consumptive water needs.

Fish and Wildlife

The anadromous fishery of the Coastal Zone is desirable both from the sport and the commercial fishing viewpoint. Collectively, the commercial and sports fishery, along with related processing industry, are major factors in the economy of the entire Coastal Zone. As population of the coastal zone increases, the pressures on the fishery will increase, not only in terms of angler days, but also in terms of additional or competing demands for water on the same stream systems.

Maintenance of adequate streamflows are essential to the preservation of the anadromous fish resource. To a large degree, these runs have been maintained by hatchery operations of the Fish Commission of Oregon and the Oregon State Wildlife Commission. However, adequate water supplies are proving to be a major problem even in the operation of hatcheries in the Coastal Zone. The problem is of particular concern during the late summer months when streamflows are at their lowest points.

The rivers and estuarine areas are used by waterfowl along the Pacific Flyway and do provide notable recreational hunting opportunities. In consumptive terms, however, the needs of wildlife are exceedingly small.

Other Uses

The feasible hydroelectric potential of the Coastal Zone is exceedingly small due to the lack of adequate storage sites. However, there are some sites along the South Fork Coquille, Wilson, Trask, and Nehalem Rivers. Development of this potential could pose serious problems for the anadromous fishery.

The existing and anticipated need for water for mining operations is fairly small in most areas. While there may be some water requirements in conjunction with the Eden

Ridge coal deposits, no other large-scale mining operations are anticipated in the next few years.

Conclusions

In general, use conflicts resulting from the seasonal variations of surface waterflows have and will continue to plague the Coastal Zone. Expanding industrial, municipal, and perhaps irrigation demands could be in direct conflict with the region's recreational potential and the anadromous fishery. Flow augmentation through storage, the only feasible means of augmenting low-summer flows, could also pose serious problems for the anadromous fishery.

Identification of multiple-purpose storage potentials in the Coastal Zone is a current ongoing program. Reservoir sites compatible with both environmental and water supply objectives are being studied. Reservoir studies suggest that Federal financing for anadromous fishery, recreation, and water quality enhancement benefits will probably be a necessity for implementation. The state's role in future financing of these activities to provide reimbursement for cost allocations reflecting regional benefits is an emerging concern of coastal residents.

Recognizing that historic Federal water storage developments, premised upon flood control, irrigation, or watershed restoration may not fit the coastal situation is a key factor when reservoir development is reviewed.

Management Considerations

Existing Coastal Zone Water-Use Policy

General Policy Character

Policies for use of Oregon's surface waters have been set forth by major drainage areas in programs adopted by the State Water Resources Board. These water-use programs, established under legislative standards, classify the unappropriated portions of natural streamflow for the highest and best uses.

In allocating its water resources, Oregon, like many western states, follows the appropriative water rights system. Under this doctrine, characterized as "first in time, first in right", the earliest rightholders have first claim on natural flows. Later or junior rightholders, regardless of the type of use, may be prevented from utilizing water if streamflows fall below the level required to satisfy demands of senior rightholders. As a result, water use programs apply only to rights filed after adoption of the respective policy statements and do not affect prior water rights or use under such rights.

Since water use programs must take into consideration existing rights and present water use, seasonal variations in streamflow, watershed characteristics, and anticipated future needs, both consumptive and nonconsumptive, no single policy is applicable to the entire Coastal Zone. Rather, basin programs, much as in the spirit of land-use plans and zoning, only for water, are a culmination of the policies for smaller areas, subbasins, or stream sections.

Oregon law identifies domestic, municipal, irrigation, power development, industrial, mining, recreation, wildlife, fish life, and pollution abatement as beneficial water uses. In general, main stem sections of most major rivers and streams in the Coastal Zone are open to appropriations for all beneficial uses. Diversions, however, are subject to seasonal flow variations, existing rights, and minimum streamflow requirements.

On the other hand, many minor streams are classified to allow only small-scale appropriations because of limited runoff and the importance of these drainages to the anadromous fishery. Similarly, most natural lakes are also classified for such uses as domestic, livestock, recreation, fish life, and wildlife to protect recognized esthetic values and recreation potentials. Restrictive classifications may limit the types of water uses, whereas withdrawals by the State Water Resources Board, the State Engineer, or the legislature may limit the number of rightholders.

Municipal, industrial, and irrigation uses tend to entail larger quantities of water and are allowed mainly on the larger drainages. There are exceptions, prior claims, and specific reservations; but in the main the larger streams have provided the only reliable source of available water. However, it is doubtful that many of the coastal streams could meet the demands of any new or large expansion in municipal, industrial, or agricultural needs during the summer months.

Power development, although designated as a beneficial use in most areas, has little feasibility due to the limited number of environmentally compatible project sites and today's high construction costs.

Minimum perennial streamflows, an important part of the water use programs, have been established to assure that some flow remains in the waterways to sustain aquatic life or to minimize pollution. Conceptually, a minimum flow is similar to a water right in that it protects a specified flow against future appropriations except for human and livestock consumption.

In the Coastal Zone, all established minimum streamflows reflect the requirements of aquatic life. Although other instream uses such as recreation may have different requirements, specific flows have not been identified and no statutory basis exists for their establishment.

Recent policy revisions have made the minimum streamflow regimes in the Coastal Zone some of the most extensive in the state. Yet many of the streamflows are still below identified minimum levels for aquatic life during the summer months because of prior water claims.

While the minimum streamflow systems do not directly restrict the types of uses, or numbers of users, rightholders junior to the minimum streamflows are subject to curtailment during low-flow periods. Since existing rights and established minimum streamflows in some areas now account for virtually all the available streamflow normally anticipated during the summer months, future water needs will require either development of storage (flow augmentation) in the Coastal Zone or will be met at the expense of instream water values.

Specific Coastal Zone Water Use Policy

In the North Coast Basin area, the majority of the streams are classified for domestic, livestock, municipal, irrigation, power development, industrial, mining, recreation, wildlife, and fish life uses. There are some streams, however, which have been classified for limited uses and this also includes the natural lakes of the Coastal Zone. All of the natural lakes of the North Coast Basin are classified only for the utilization of water for domestic, livestock, small power development, and in-lake uses for recreation, wildlife, and fish life purposes.

The waters of the Klaskanine River and its tributaries, the Lewis and Clark River, and the Tillasqua Creek (Big Creek) have been legislatively withdrawn by ORS 538.251 for the protection of fish life. The legislative withdrawals do not affect any existing rights or future appropriations for domestic, stock, municipal, fish culture, esthetic, recreational, or public park purposes.

In addition, the streams listed in Table 7 are classified only for the utilization of water for human consumption, livestock consumption, small power development, and instream uses for recreation, wildlife, and fish life purposes. Accompanying these classifications for the utilization of water in the North Coast Basin, the State Water Resources Board has established, for the purpose of maintaining a minimum perennial streamflow sufficient to support aquatic life, minimum streamflows for many streams and their tributaries. Figure 5 illustrates the water use limitations and the locations of the established minimum streamflows for the Coastal Zone.

In the Mid-Coast Basin, the waters of all of the natural lakes are classified only for utilization of water for domestic, livestock, and in-lake uses for recreation, wildlife, and fish life purposes. These lakes are Devils, Triangle, Lily, Sutton, Mercer, Collard, Munsel, Cleawox, Carter, Lost, Elbow, Clear, Woahink, Siltcoos, Tahkenitch, and Threemile. Two of these lakes, Woahink Lake and Clear Lake, have specific amounts of water reserved for municipal purposes. In each instance, this amounts to 1.5 cfs.

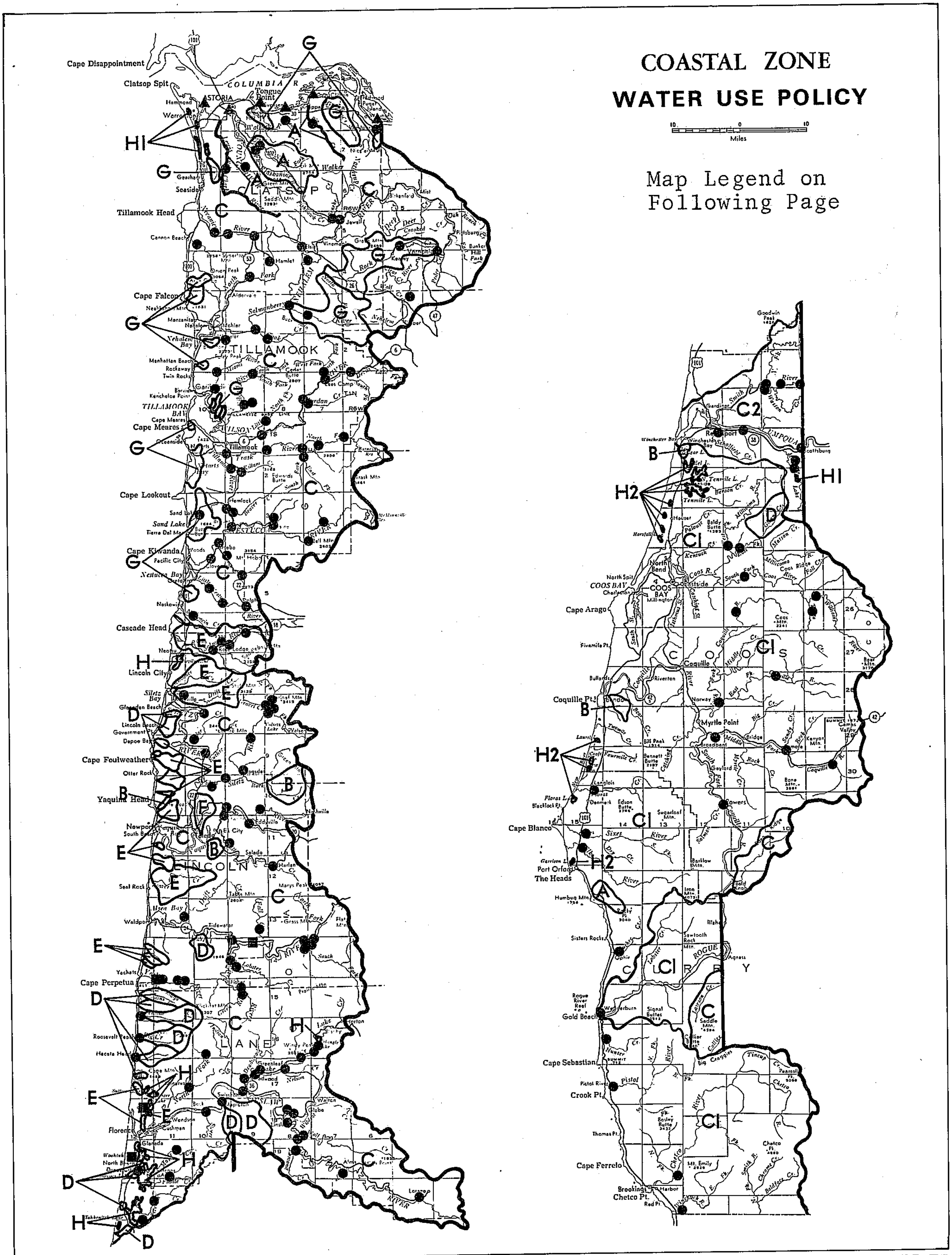

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FIGURE 5. Water Use Policy.

MANAGEMENT CONSIDERATIONS

STATE WATER RESOURCES BOARD
WATER USE POLICY

MAP LEGEND

A....Withdrawn by Legislative Order

B....Withdrawn by Order of State Engineer

C....Domestic, Livestock, Irrigation, Power, Industrial, Mining, Recreation, Wildlife, and Fish Life

C1...Limits Power to 7½ hp.

C2...Includes Temperature Control

D....Domestic, Livestock, Irrigation (½ acre), Power (7½ hp.), Recreation, Wildlife, and Fish Life

E....Domestic, Livestock, Municipal, Irrigation (½ acre), Power (7½ hp.), Recreation, Wildlife, and Fish Life

F....Human Consumption, Livestock Consumption, Industrial, Recreation, Wildlife, and Fish Life

G....Human Consumption, Livestock Consumption, Power (7½ hp.), Recreation, Wildlife, and Fish Life

H....Natural Lakes - Domestic, Livestock, Recreation, Wildlife and Fish Life

H1...Include Power (7½ hp.)

H2...Include Power (7½ hp.) and Irrigation (½ acre)

▲ Tidal Influence Zone - Domestic, Livestock, Municipal, Irrigation, Industrial, Recreation, Wildlife, and Fish Life

■ Municipal Reservation

● Minimum Streamflow Point
Refer to individual basin policy statements for specific locations and streamflow quantities

TABLE 7

WATER USE RESTRICTED STREAMS

NORTH COAST

All streams tributary to Sand Lake (bay)
All streams tributary to Netarts Bay
All streams tributary to Daley Lake
Coleman Creek and tributaries
Vaughn Creek and tributaries
Doughty Creek and tributaries
Patterson Creek and tributaries
Larson Creek and tributaries
All streams tributary to Lake Lytle
Jetty Creek and tributaries
Salmonberry River and tributaries
Rock Creek and tributaries
Short Sand Creek and tributaries
Arch Cape Creek and tributaries
Cullaby Creek and tributaries
John Day River and tributaries
Gnat Creek and tributaries
All tributaries to Westport Slough, except Plympton Creek
Tide Creek and tributaries
Goble Creek and tributaries

The waters of the streams and their tributaries listed in Table 8 are classified only for the utilization of water for domestic, livestock, irrigation of lawn or noncommercial garden not to exceed ½ acre in area, small power development, and instream uses for recreation, wildlife, and fish life purposes. The streams and their tributaries listed in Table 9 are classified similar to those in Table 8; however, municipal uses have been included or added to the uses allowed in these streams. The waters of Olalla Creek and its tributaries are classified for human consumption, livestock consumption, industrial uses, and instream uses for recreation, wildlife, and fish life purposes. In addition, this classification recognizes that the Georgia Pacific Corporation has legal claim for water on Olalla Creek.

The waters of Little Creek and its tributaries, which flow directly into the Pacific Ocean at Agate Beach, have been withdrawn from appropriation by State Engineer's orders dated June, 1960, except for exclusive municipal use by the Agate Beach Water District. The waters of Mill Creek, a tributary to the Yaquina River, have been withdrawn, except for exclusive municipal use by the city of Toledo, by the State Engineer's

TABLE 8

WATER USE RESTRICTED STREAMS

MID-COAST

Schoolhouse Creek and tributaries (Mouth in T 8 S)
Fogarty Creek and tributaries
Deadhorse Creek and tributaries
Canal Creek of Alsea Bay and tributaries
Cummins Creek and tributaries
Bob Creek and tributaries
Tenmile Creek and tributaries
Big Creek at Roosevelt Beach and tributaries
Cape Creek at Heceta Head and tributaries
Quarry Creek and tributaries
Knowles Creek of Siuslaw River and tributaries
Hadsall Creek of Siuslaw River and tributaries
Woahink Creek and tributaries
Siltcoos River and tributaries
Tahkenitch Creek and tributaries
Threemile Creek and tributaries

TABLE 9

WATER USE RESTRICTED STREAMS

MID-COAST

Salmon River and tributaries
Schooner Creek of Siletz Bay and tributaries
Drift Creek of Siletz Bay and tributaries
Tributaries to Depoe Bay
Rocky Creek and tributaries
Spencer Creek and tributaries
Moolack Creek and tributaries
Big Creek near Newport and tributaries
Henderson Creek and tributaries (Mouth in T 11 S)
Thiel Creek and tributaries
Beaver Creek and tributaries (Mouth in T 12 S)
Big Creek at San Marine and tributaries
Vingie Creek and tributaries
Starr Creek and tributaries
Sutton Creek and tributaries
Munsel Creek and tributaries

order dated December, 1959. The waters of Rock Creek, a tributary to the Siletz River, have been withdrawn for appropriation, during the months of July, August, and September of each year, by State Engineer's order dated July 22, 1960.

In addition to the classifications listed for the various lakes and streams in the Mid-Coast, the State Water Resources Board has established minimum streamflows for a variety of streams and their tributaries with specific amounts for each month of the year. All other waters of the Mid-Coast Basin have been classified for all of the beneficial uses as recognized by the State Water Resources Board.

In the Umpqua portion of the Coastal Zone, the waters of the natural lakes have been classified only for the utilization of water for domestic, livestock, small power development, and in-lake uses for recreation, wildlife, and fish life purposes. All streams tributary to the main stem Umpqua from Scottsburg to the mouth can be utilized for all recognized beneficial uses. However, preference shall be given to human and livestock consumption purposes for all the waters in this basin over any other beneficial use. In addition, the State Water Resources Board has established a minimum perennial streamflow for maintaining aquatic life.

MANAGEMENT CONSIDERATIONS

In the South Coast Basin, the State Water Resources Board has classified the waters of the natural lakes of the basin for domestic, livestock, irrigation of lawn or noncommercial garden not to exceed ½ acre in area, small power development, and recreation, wildlife, and fish life purposes only. The waters of Glenn Creek, a tributary to the East Fork of the Millicoma River, have been classified for domestic, livestock, irrigation of lawn and noncommercial garden not to exceed ½ acre in area, small power development, and recreation, wildlife, and fish life purposes only.

The waters of Clear Lake have been withdrawn from appropriation by the State Engineer's order for exclusive use as a municipal water source for the city of Reedsport. The waters of Ferry Creek and Geiger Creek have also been withdrawn from further appropriation by order of the State Engineer for municipal uses by the city of Bandon. Pursuant to ORS 538.120, the waters of Brushes Creek (Brush Creek) have been withdrawn from further appropriation and are to be maintained for exclusive use in state parks. This does not nullify water rights that existed prior to the Legislative withdrawal.

The waters of the South Fork Coquille River have been classified for all beneficial uses including hydroelectric power development. All other waters of the South Coast Basin are recognized for all uses with the exception of hydroelectric power development. Power development is not to exceed 7½ theoretical horsepower on any stream in the South Coast Basin with the exception of a portion of the South Fork Coquille River. In addition, the State Water Resources Board has established minimum perennial streamflows for maintaining aquatic life.

The waters of the lower Rogue River and its tributaries from Agness to the mouth have been classified by the State Water Resources Board for domestic, livestock, municipal, irrigation, small power development, industrial, mining, recreation, wildlife, and fish life purposes. In addition, a minimum perennial streamflow has been established on the main stem Rogue for maintaining aquatic life.

Water Resource Availability

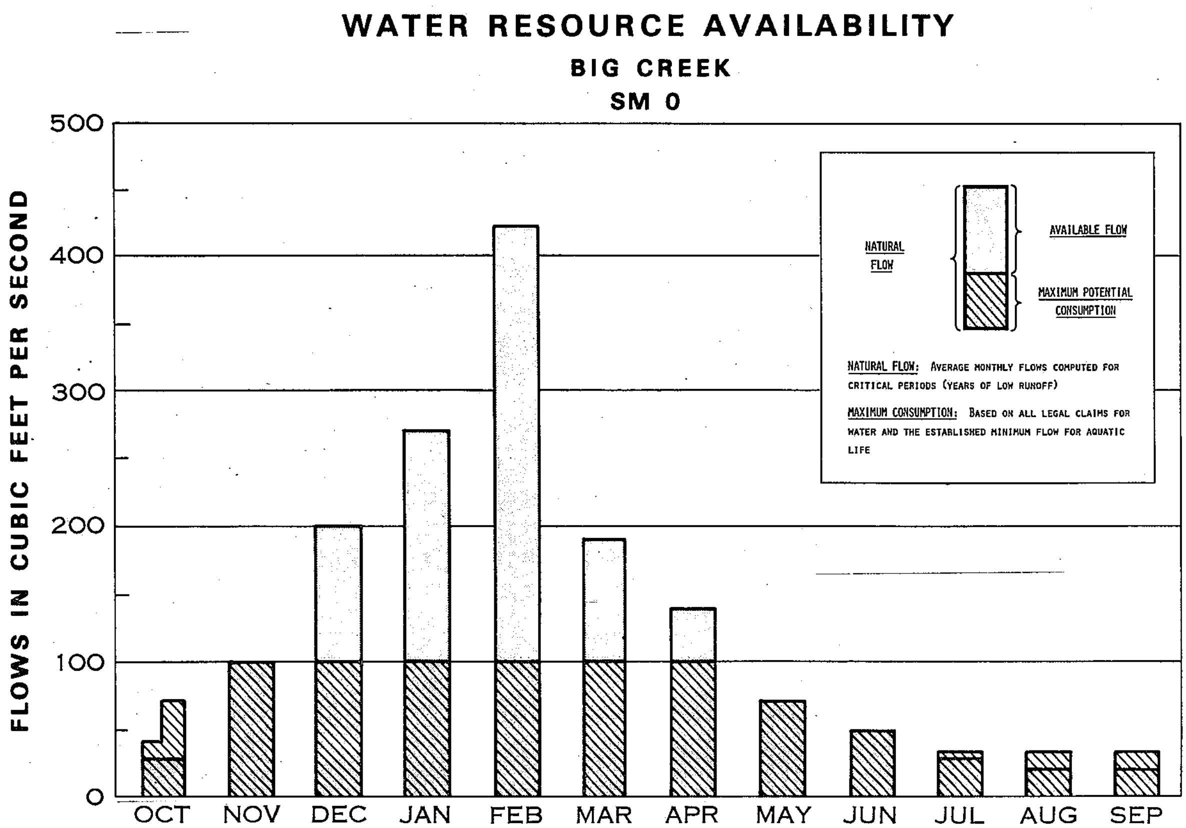
Major Streams

As stated previously, on an annual basis one can conclude that there is sufficient water to satisfy existing and future needs of the Coastal Zone. There is, however, a seasonal distribution problem with insufficient water supply in many of the coastal streams during the low-flow summer months.

Figure 6 through 20 graphically display the water resource availability on the 30 major streams of the Coastal Zone. The figures display, for each stream, the average monthly flow that can be expected to be equalled or exceeded on an average 4 out of 5 years or 80 percent of the time. The monthly natural flow corresponds to an 80 percent flow as determined by the State Water Resources Board's frequency analysis. From these figures, it is evident that there are extremely high winter-time flows, basically November through March, with flows tapering off in April and May, reaching critical low flows in August and September.

For each month, the maximum potential consumptive demand for water has been calculated and is also displayed in each of the figures in relationship to the monthly natural flow. The maximum potential consumptive demand is based on all the legal claims for diversion of water from its natural channel. This includes domestic, municipal, irrigation, and industrial water rights. In addition, the consumptive values include the minimum streamflow requirements for aquatic life established by the State Water Resources Board's programs for each of the rivers in question. The consumptive values reflect what could be consumed if all of the out-of-stream water rights were exercised to their fullest under the law. It should be noted here that only one figure is included for each stream studied. Each figure represents the situation near the mouth of the stream, a theoretical evaluation point since few out-of-stream uses exist in the tidewater reaches of the streams. Similar analyses were completed for various points on the streams including tidewater for most streams; and while they are not included in this report, to conserve space, the data are available in the State Water Resources Board office in Salem. Depending on the water-use levels upstream, the availability situation may or may not be adequately reflected at the downstream point.

On examination of the figures, beginning with those streams of the North Coast Basin area, it is apparent that in each case the streams are deficient in flow to meet the maximum potential consumptive demand, including the established minimum streamflows for at least one month out of the year and, in many cases, up to four months out of the year.



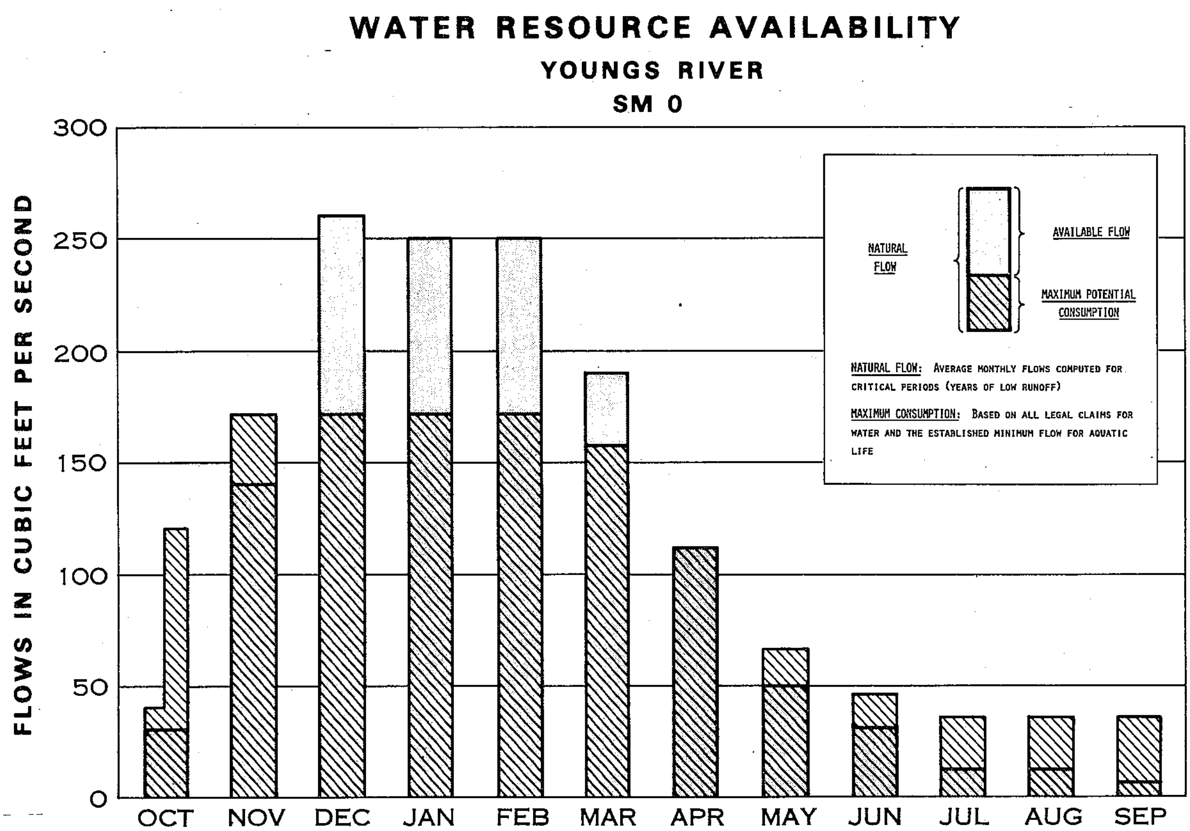
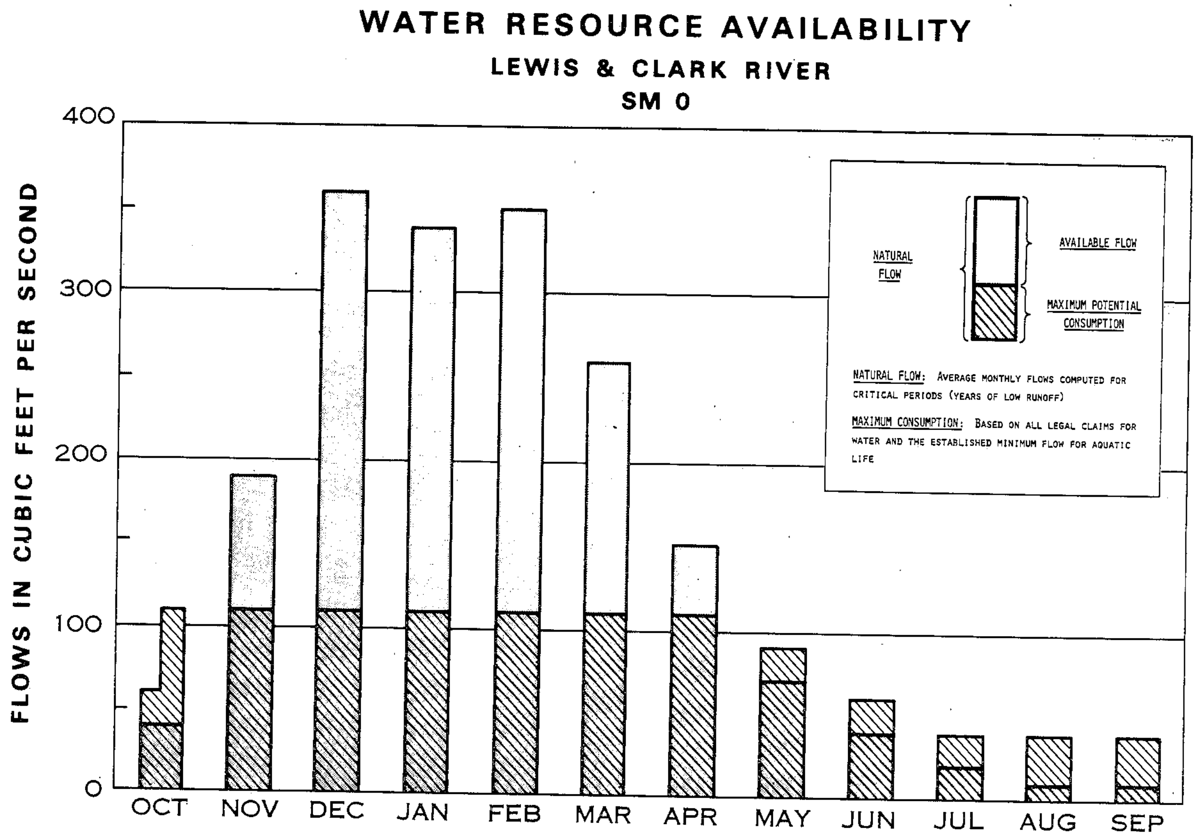


FIGURE 6. Water Resource Availability.



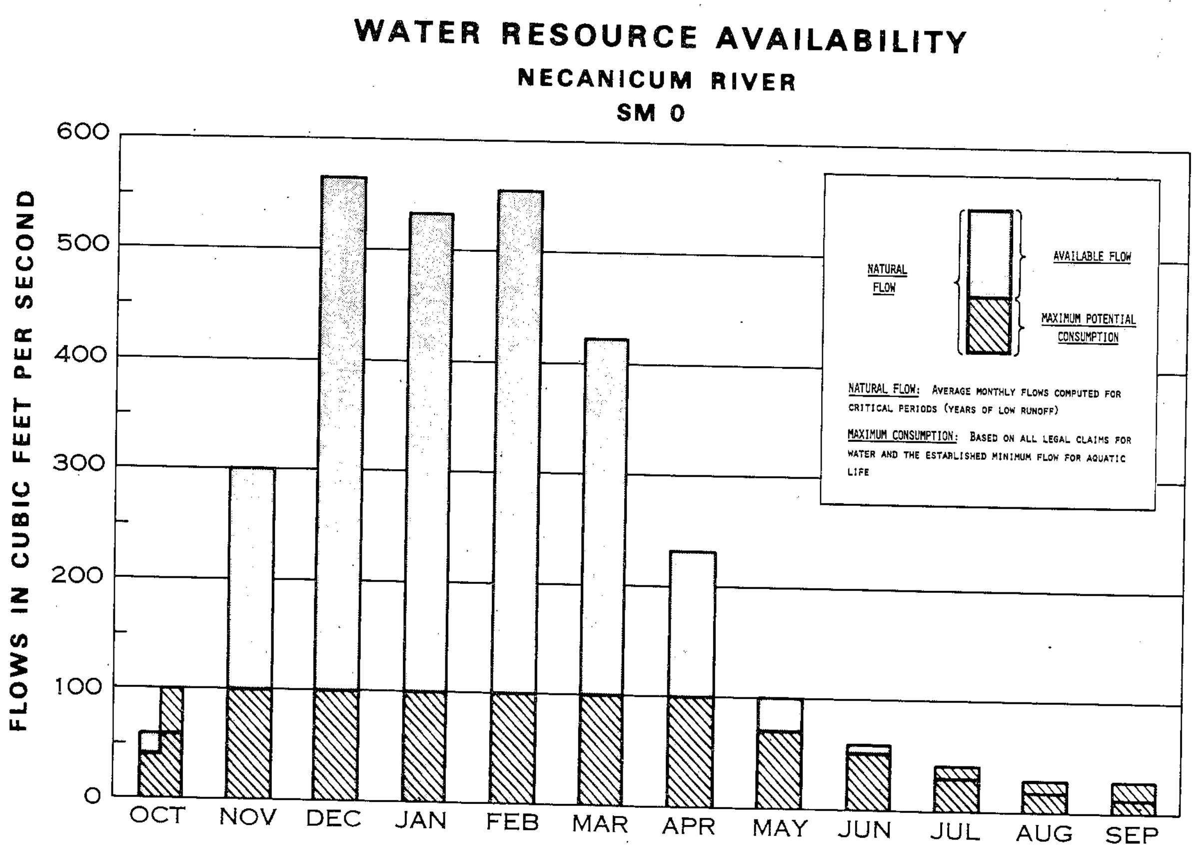
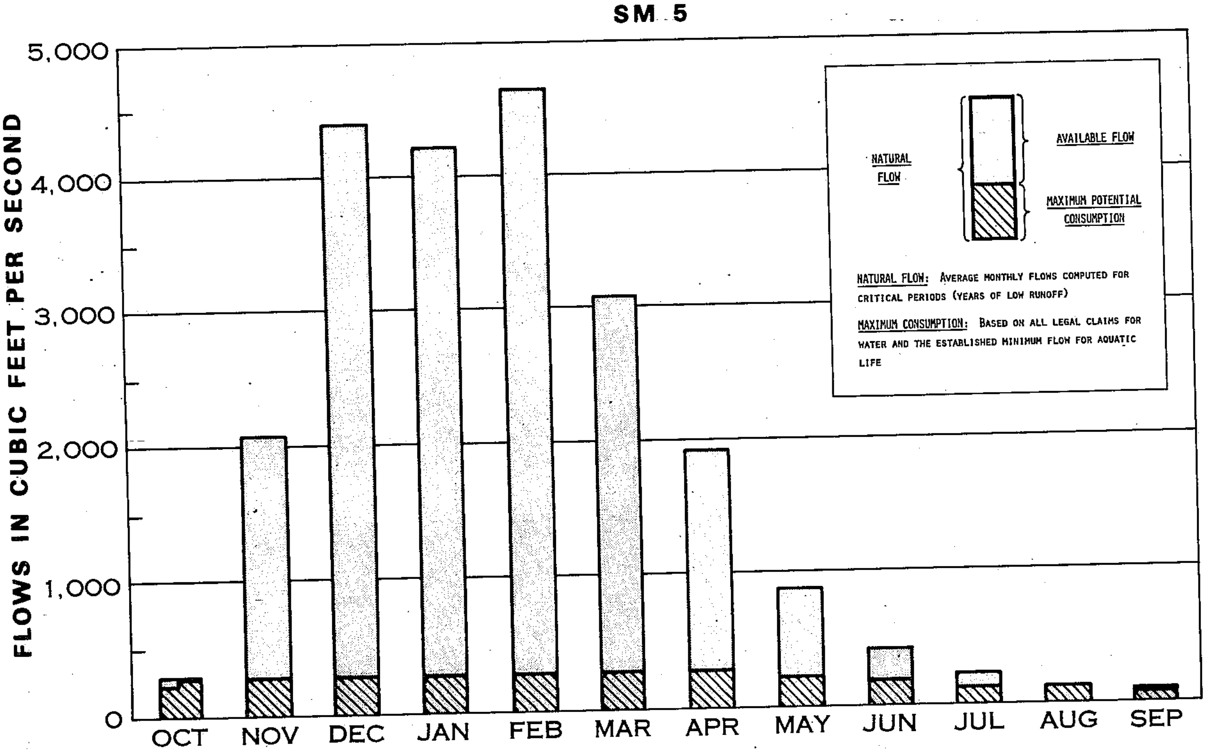


FIGURE 7. Water Resource Availability.

WATER RESOURCE AVAILABILITY
NEHALEM RIVER
SM 5



WATER RESOURCE AVAILABILITY
MIAMI RIVER
SM 0

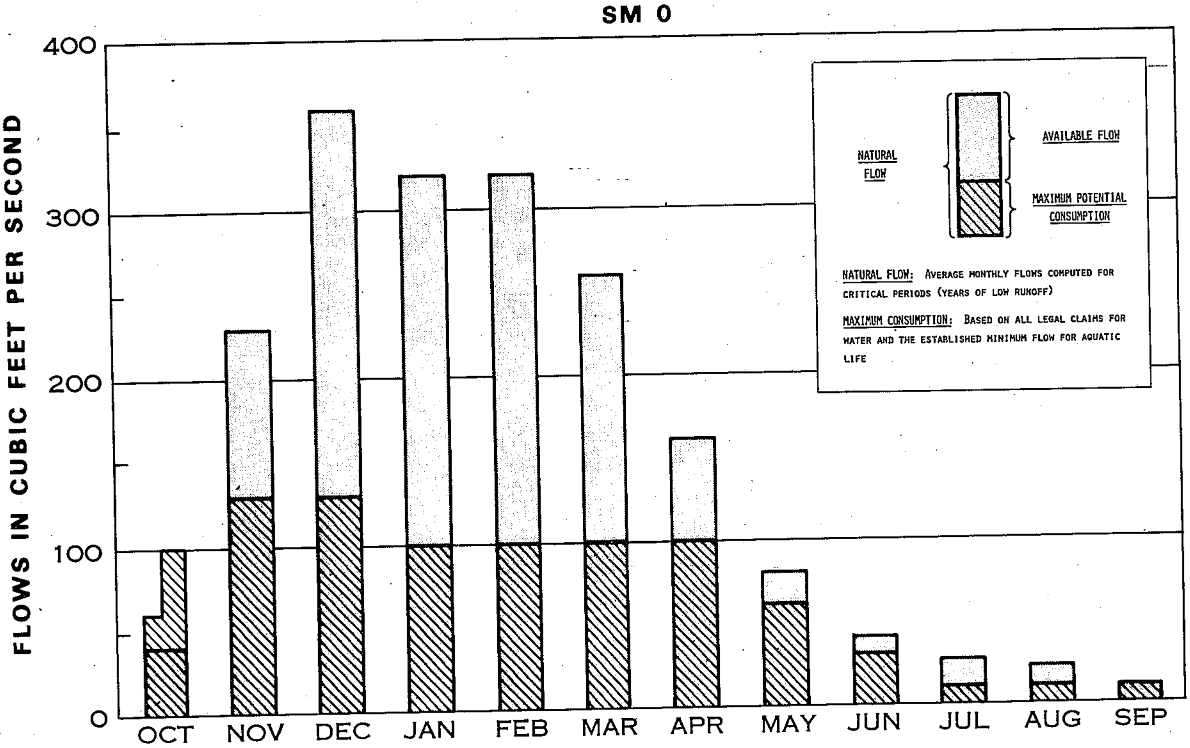
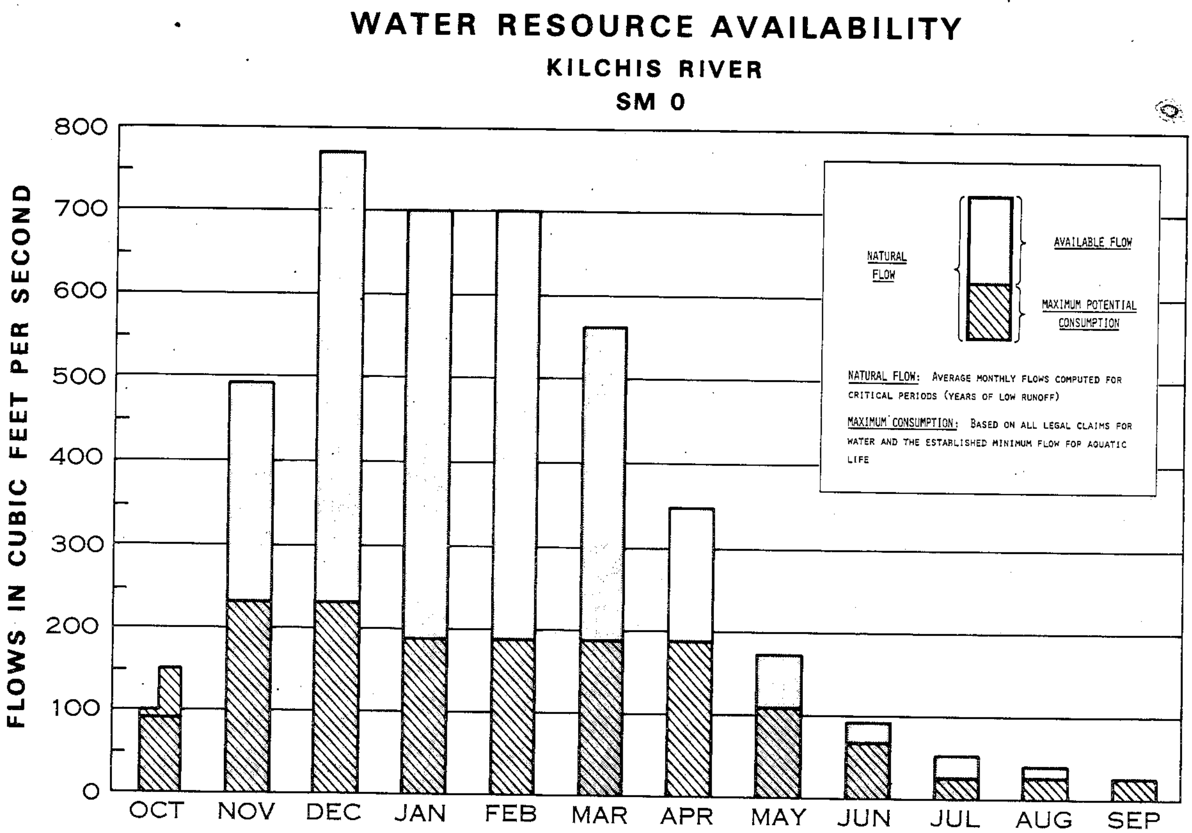


FIGURE 8. Water Resource Availability.



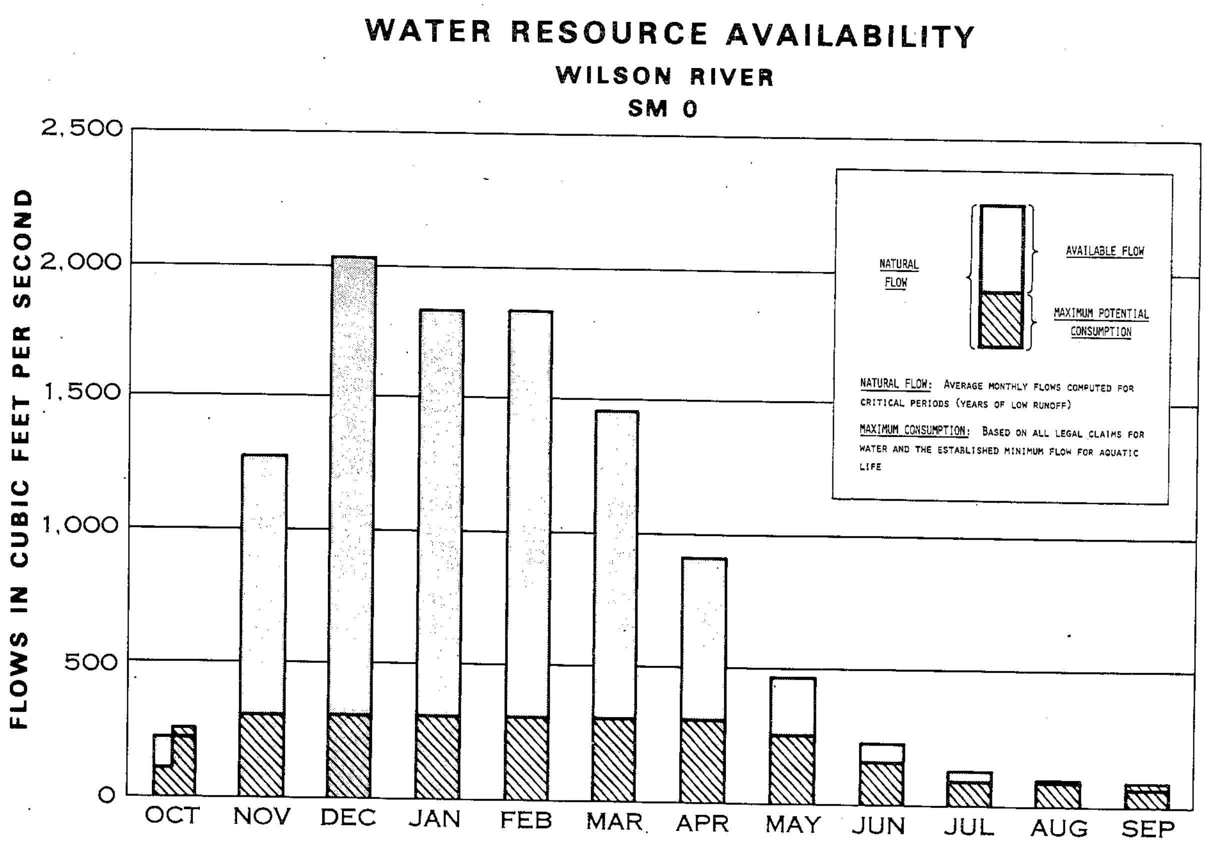
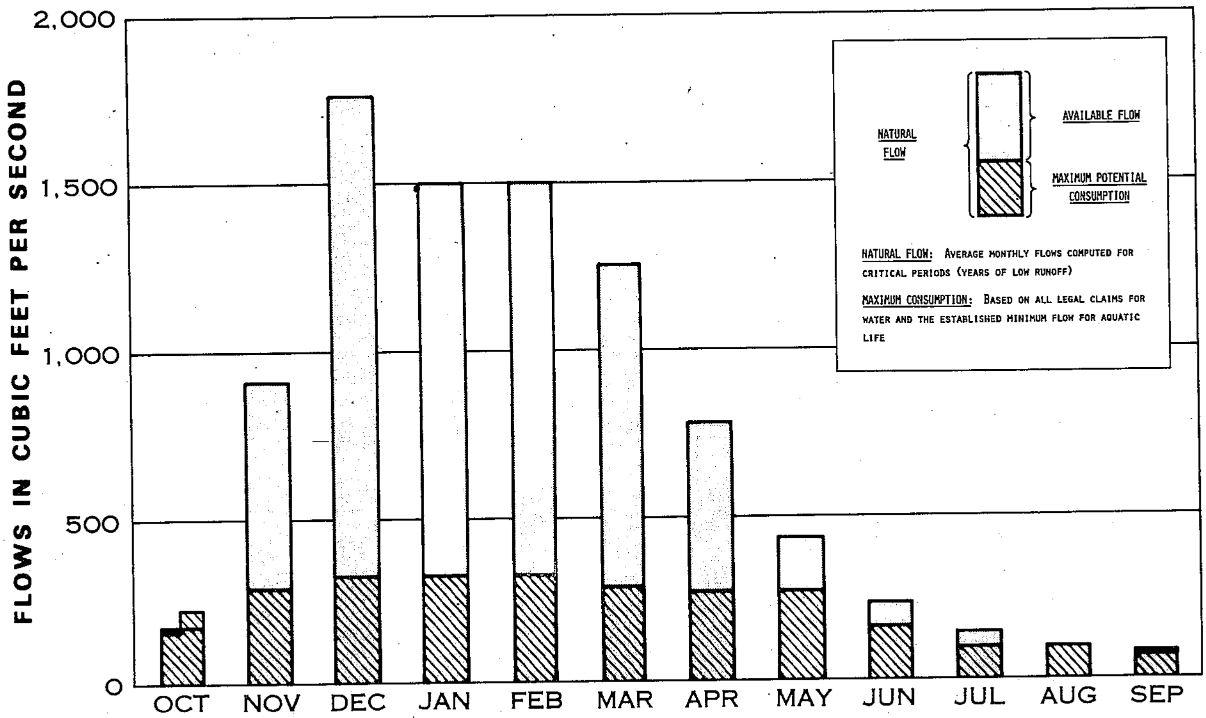


FIGURE 9. Water Resource Availability.

WATER RESOURCE AVAILABILITY
TRASK RIVER
SM 0



WATER RESOURCE AVAILABILITY
TILLAMOOK RIVER
SM 4

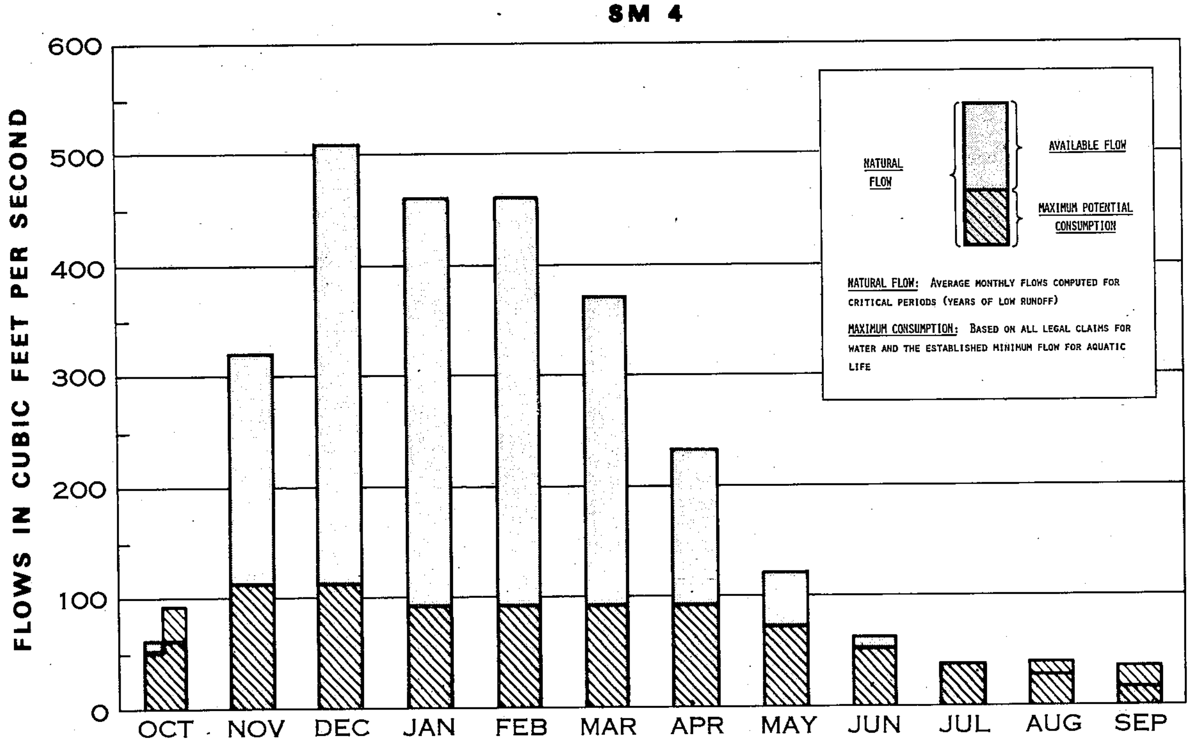


FIGURE 10. Water Resource Availability.

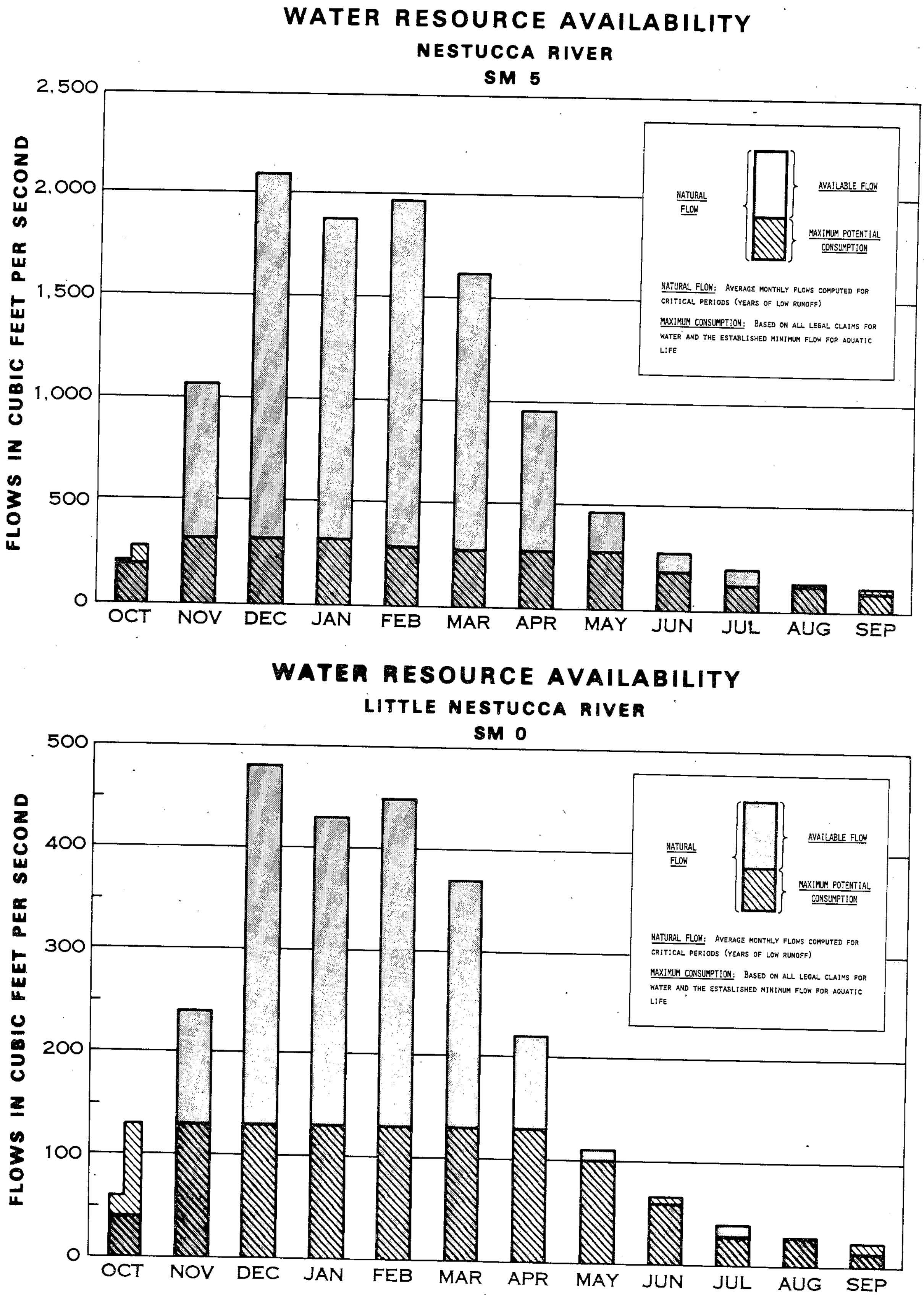
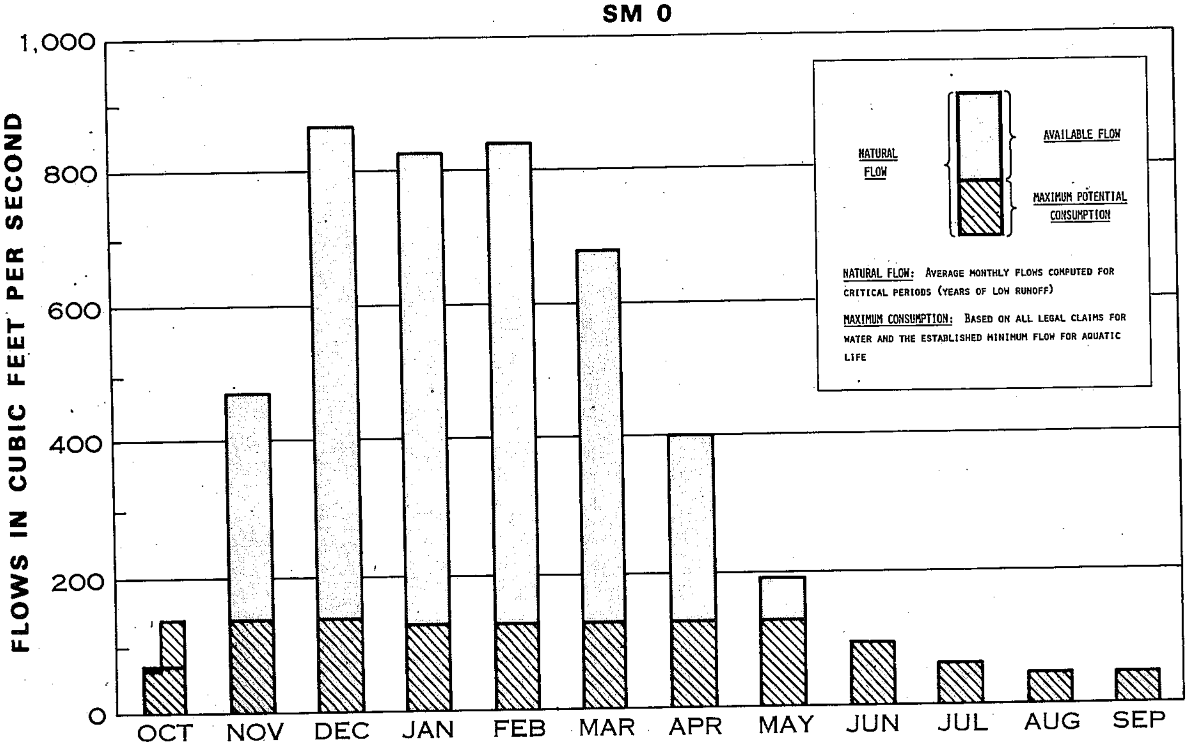


FIGURE 11. Water Resource Availability.

WATER RESOURCE AVAILABILITY

SALMON RIVER

SM 0



WATER RESOURCE AVAILABILITY

SILETZ RIVER

SM 0

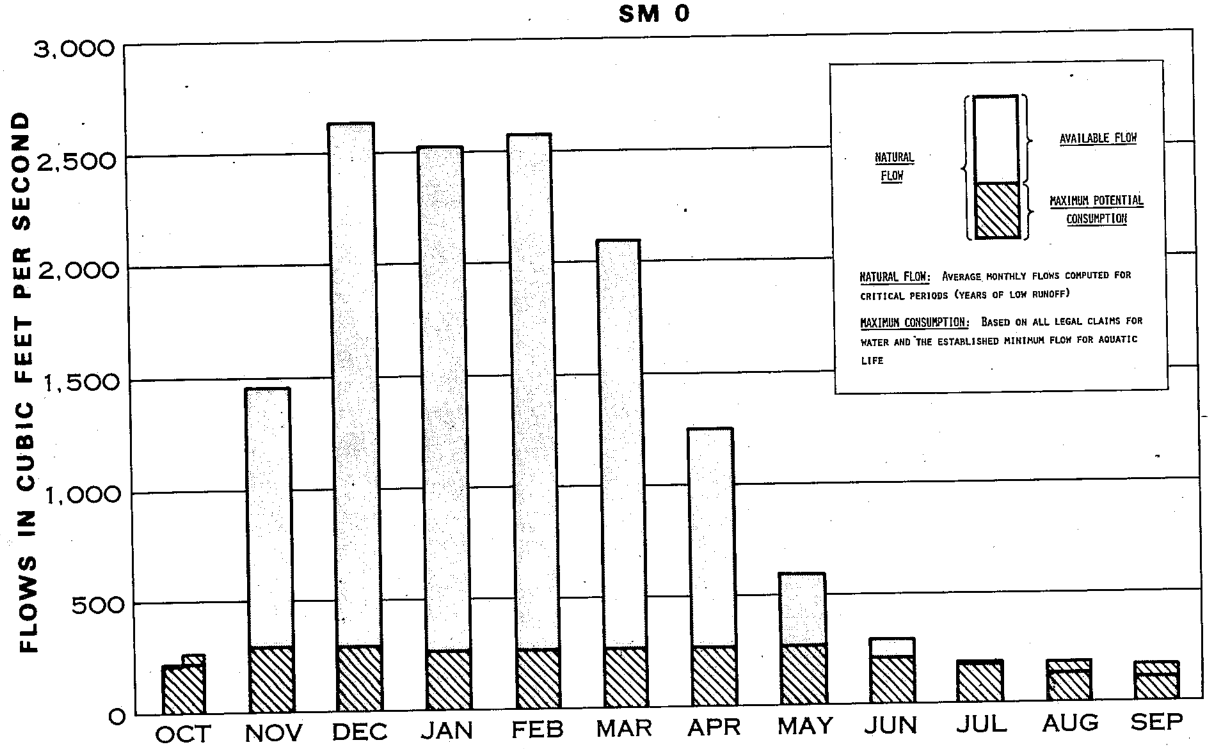
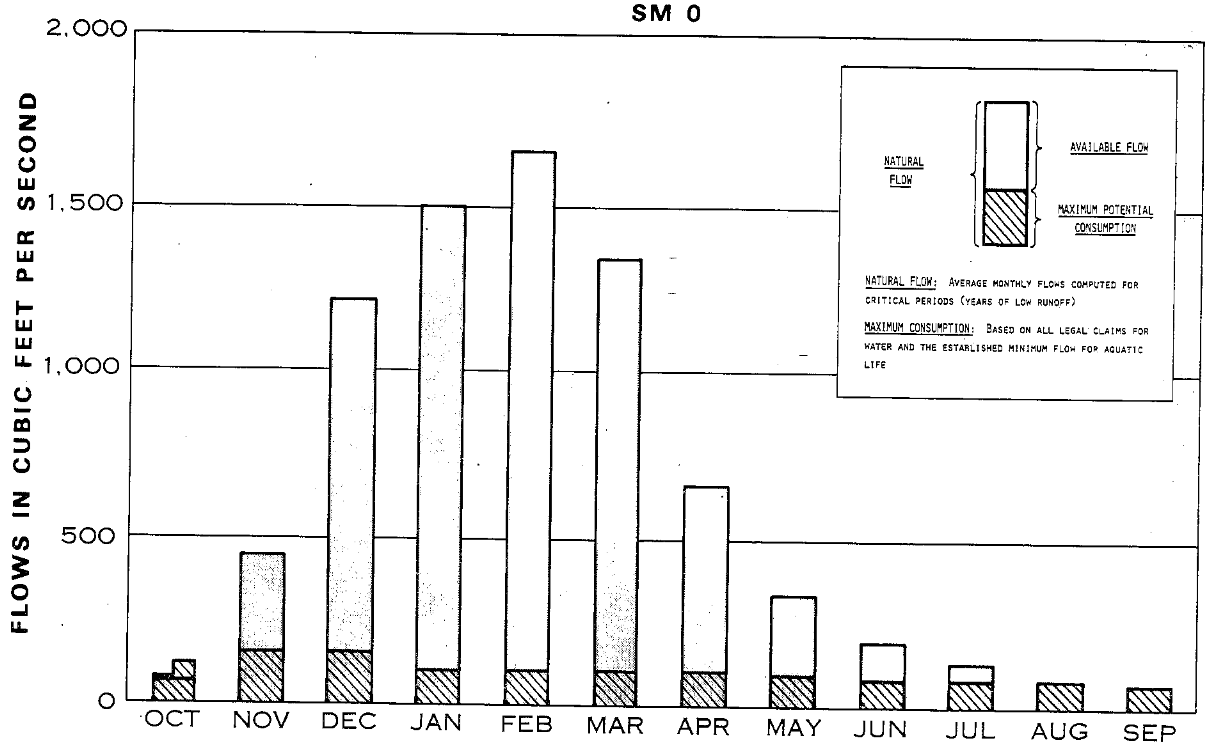


FIGURE 12. Water Resource Availability.

WATER RESOURCE AVAILABILITY
YAQUINA RIVER
SM 0



WATER RESOURCE AVAILABILITY
ALSEA RIVER
SM 0

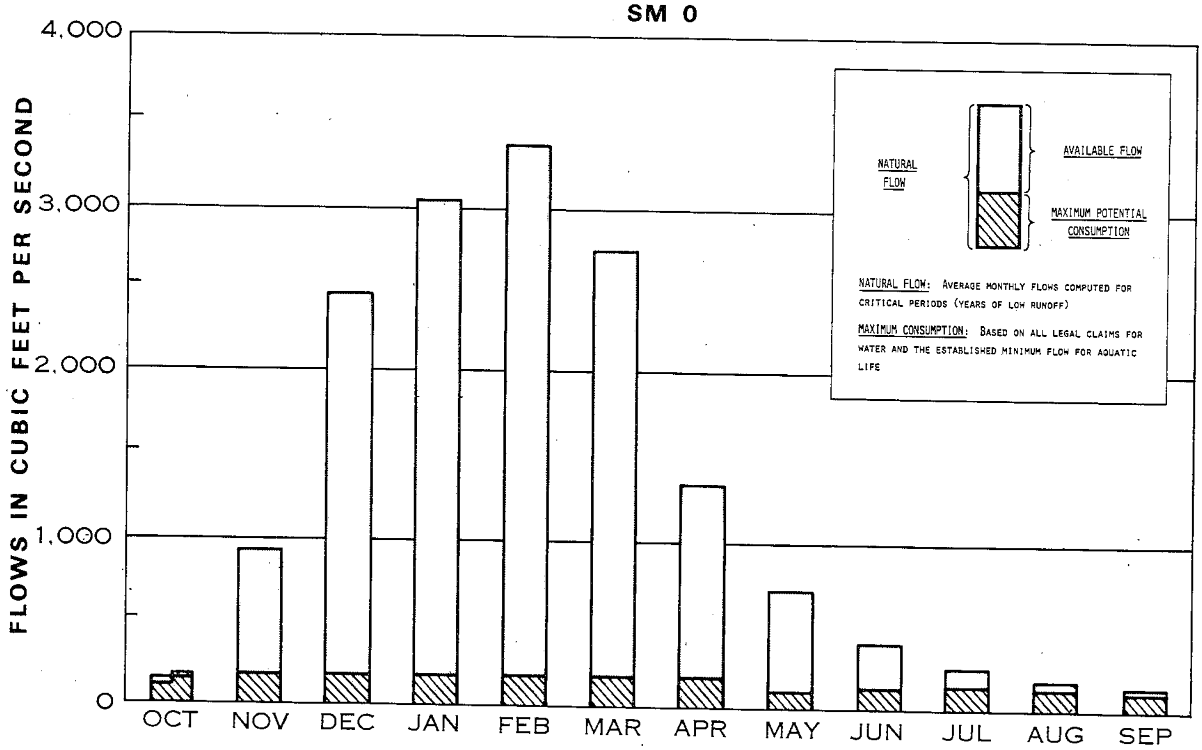
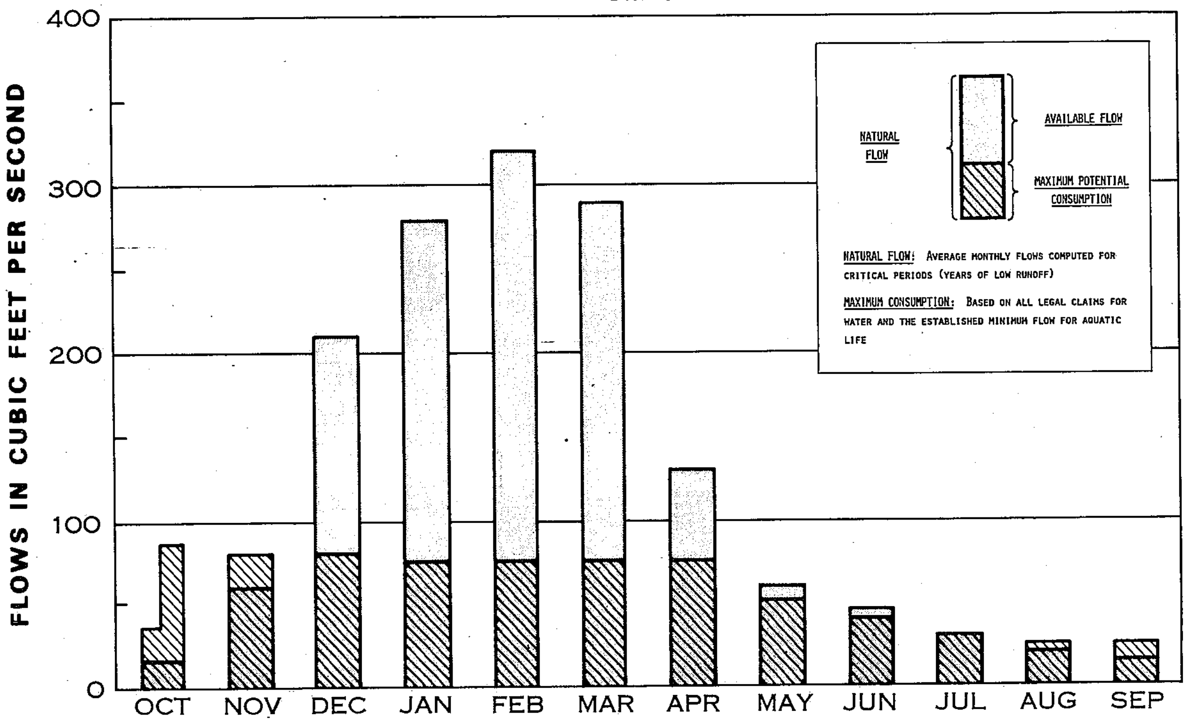


FIGURE 13. Water Resource Availability.

WATER RESOURCE AVAILABILITY

YACHATS RIVER
SM 0



WATER RESOURCE AVAILABILITY

SIUSLAW RIVER
SM 0

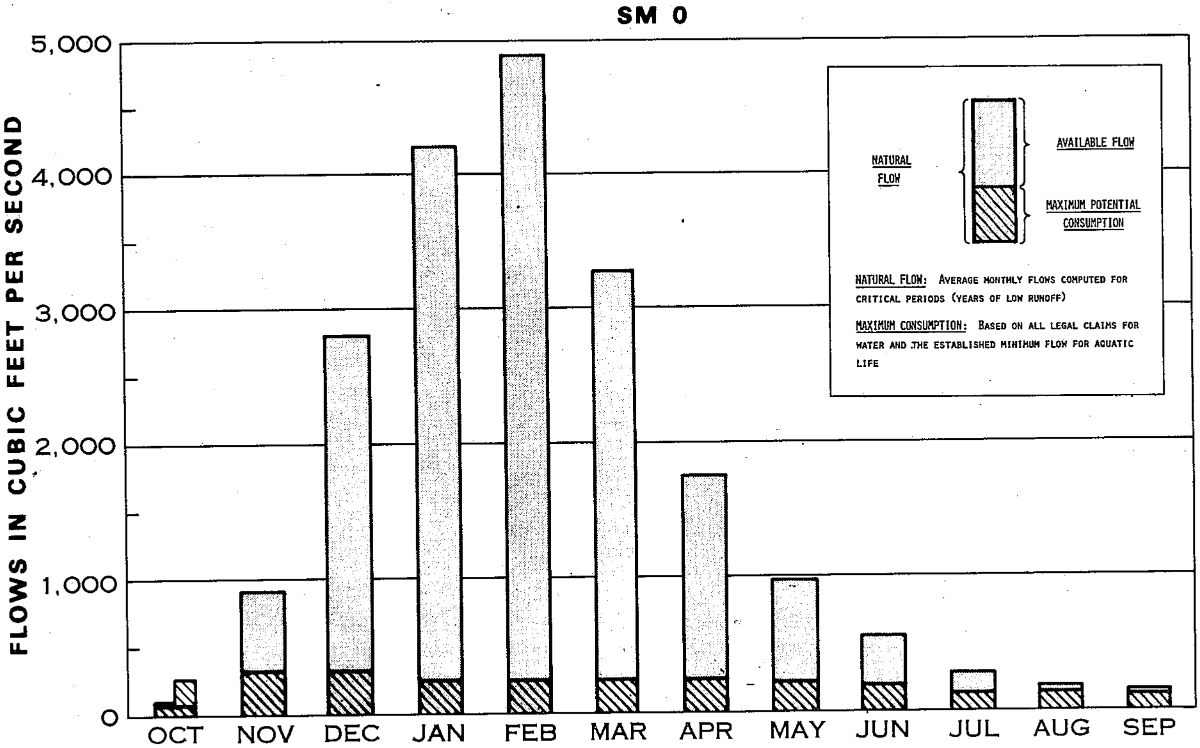
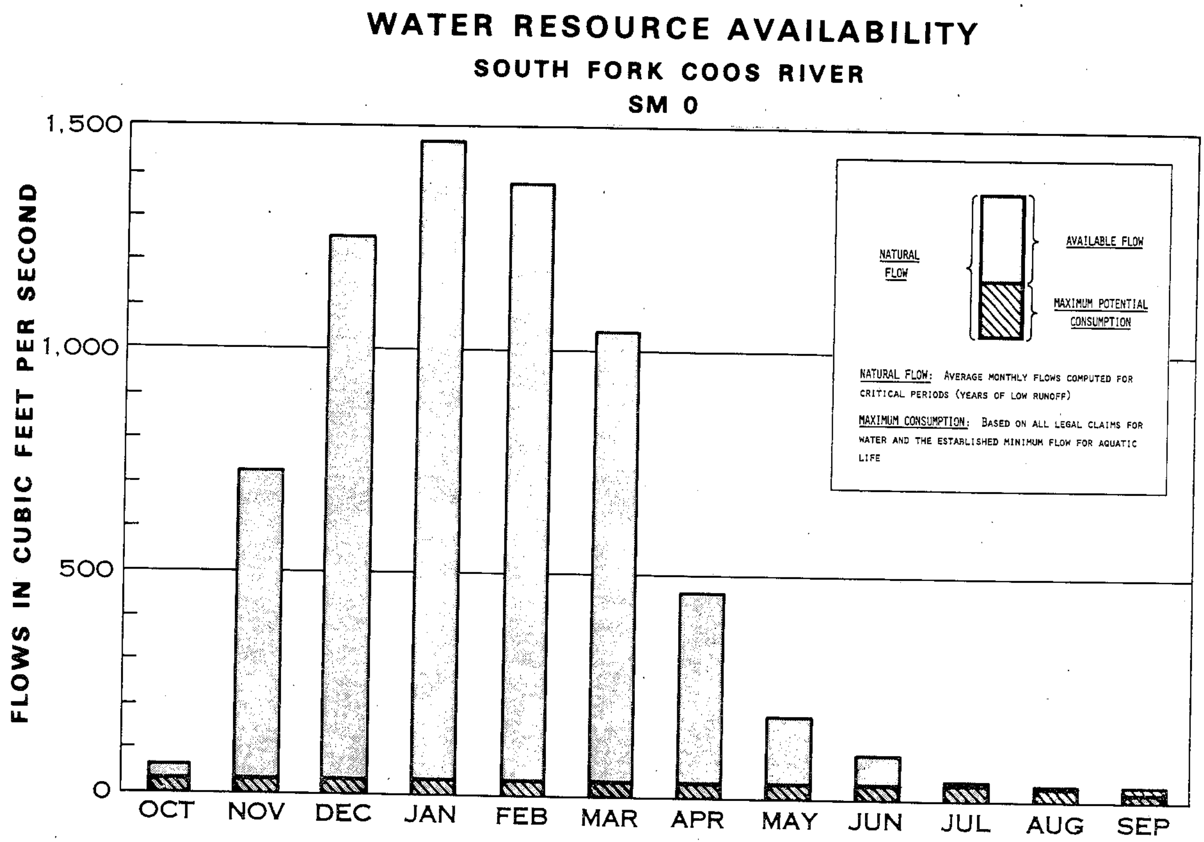


FIGURE 14. Water Resource Availability.



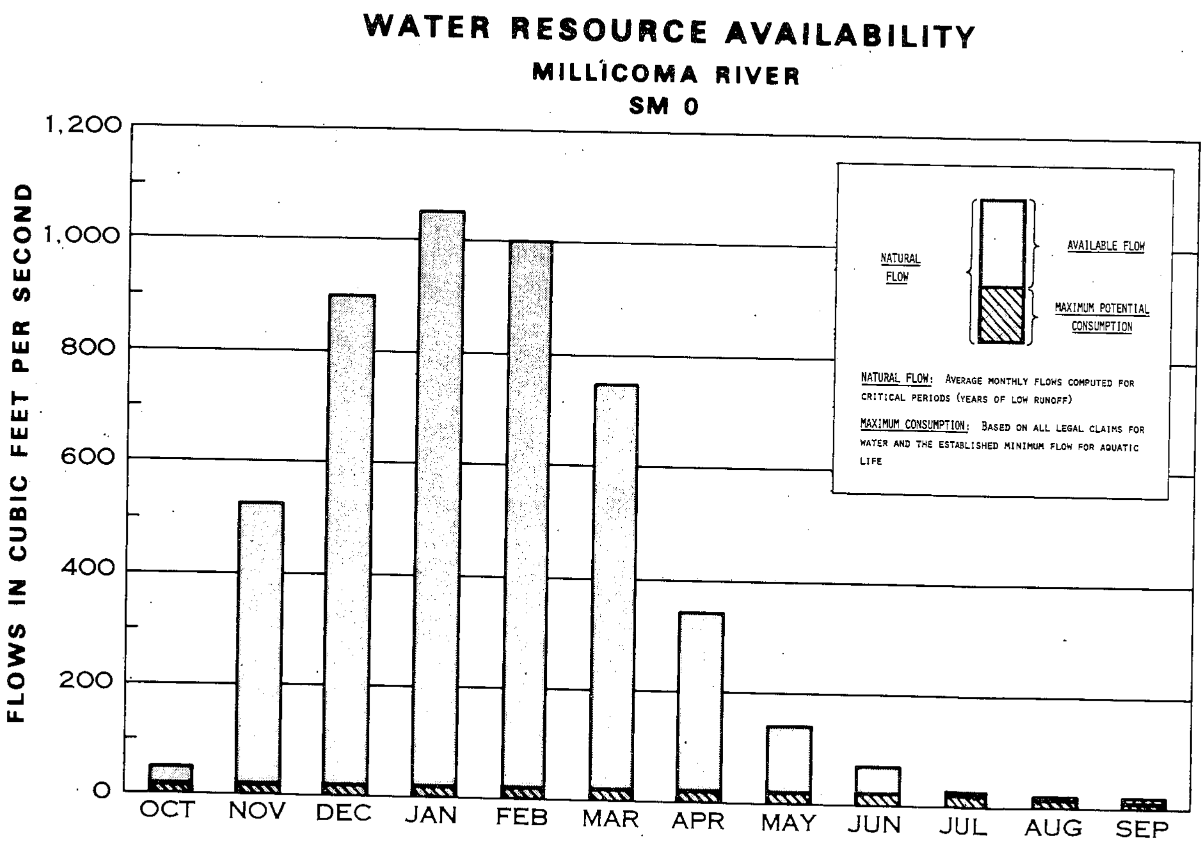
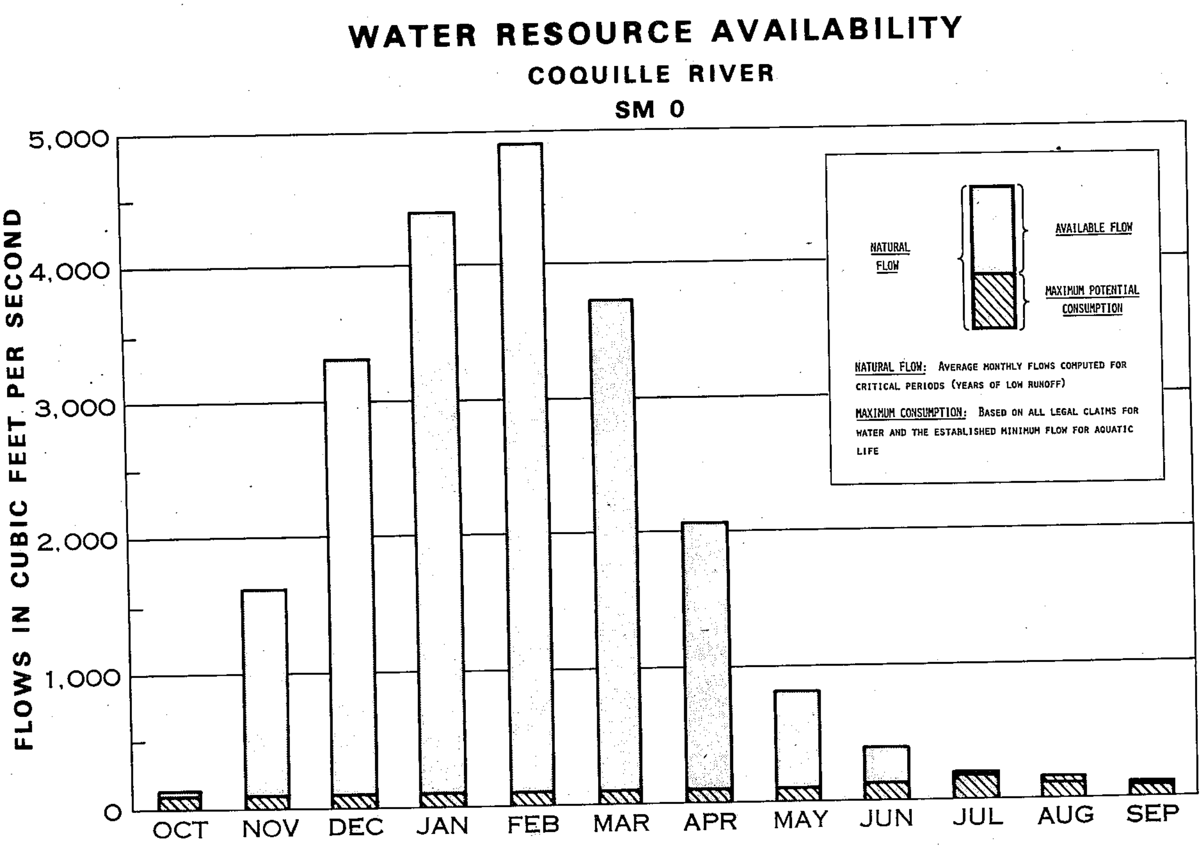


FIGURE 15. Water Resource Availability.



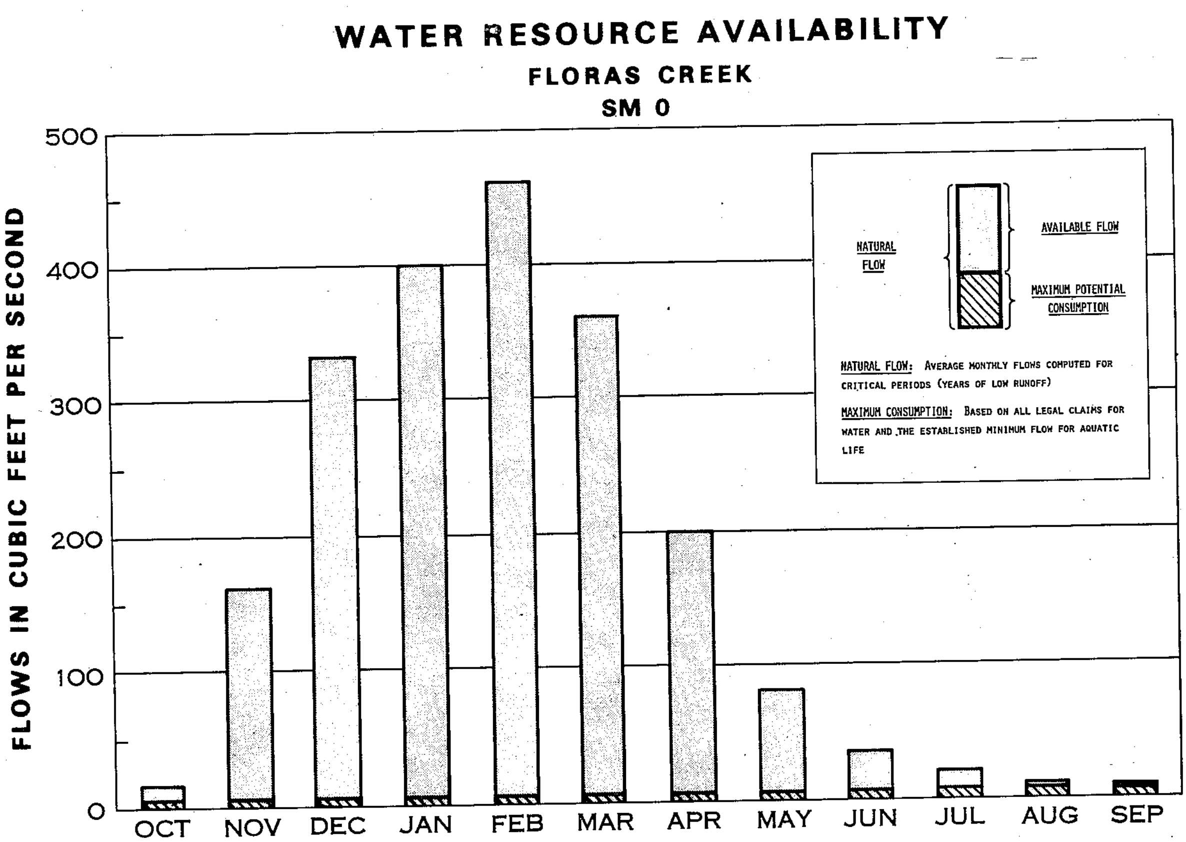
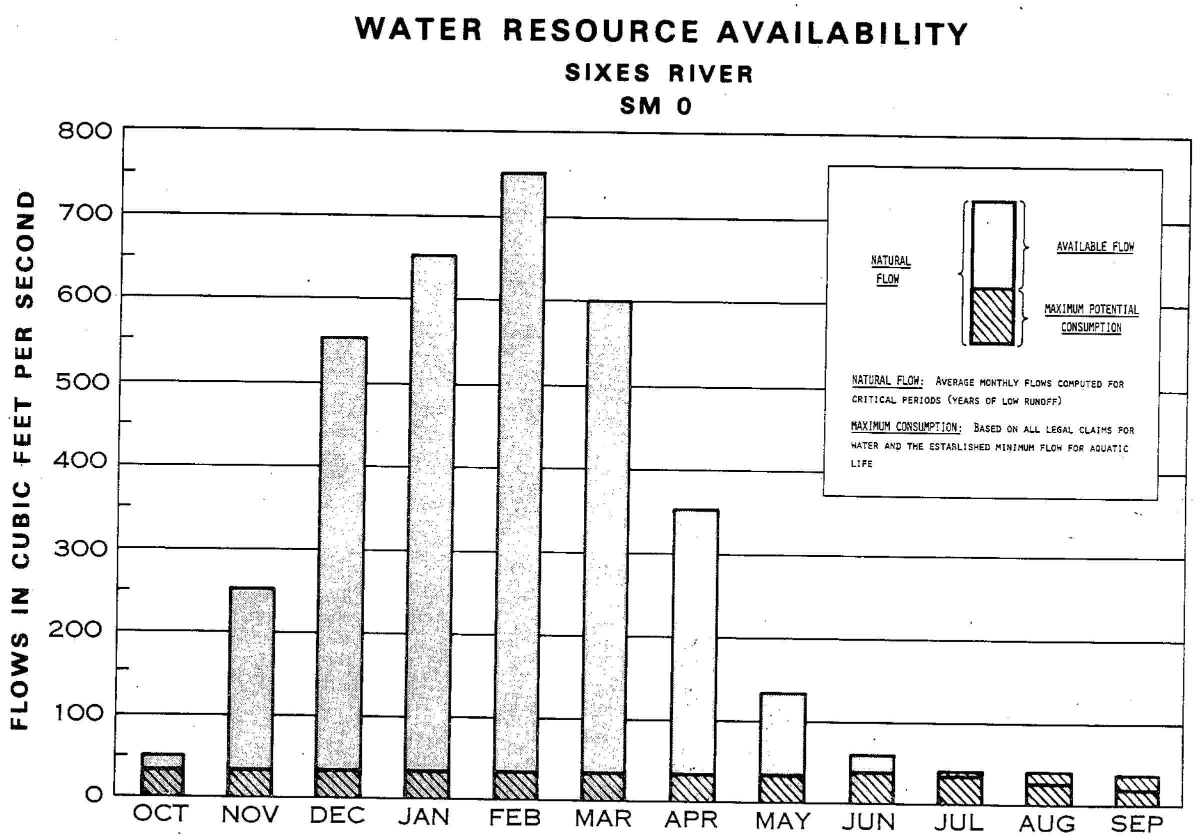


FIGURE 16. Water Resource Availability.



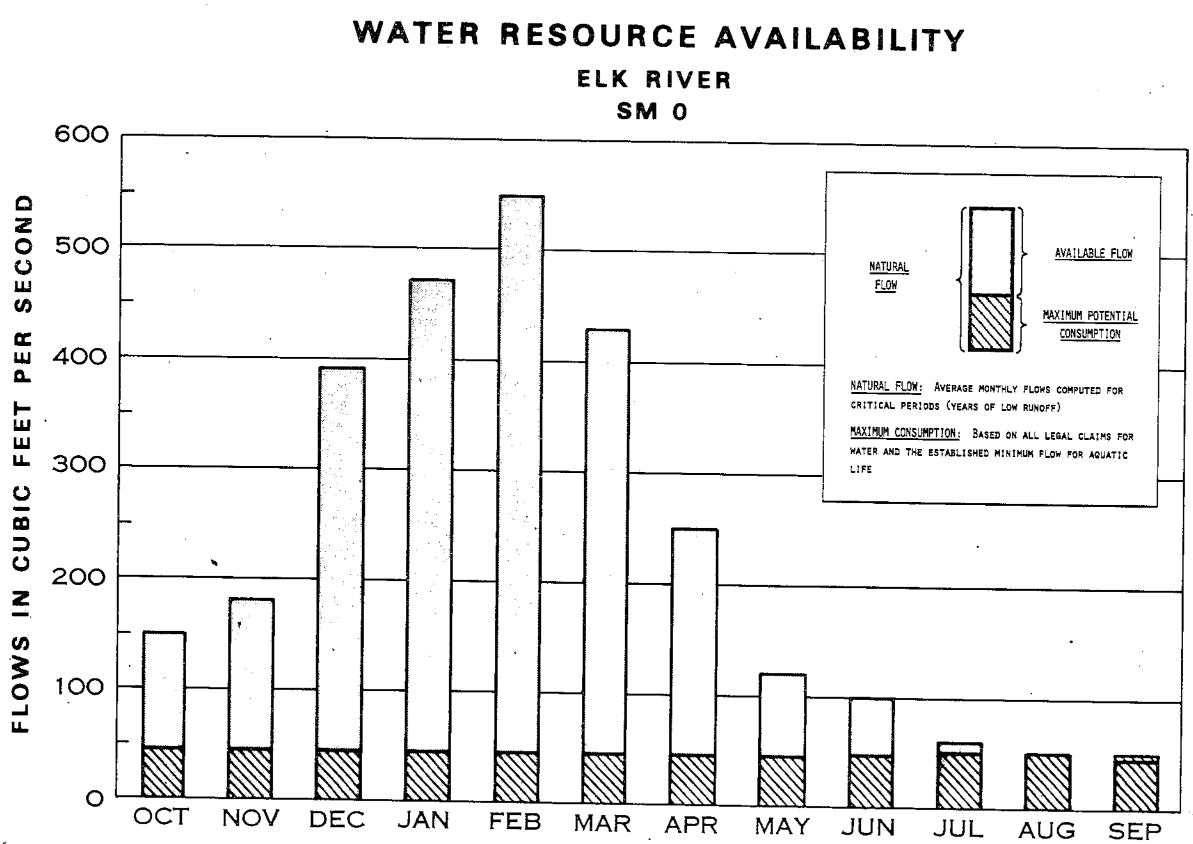
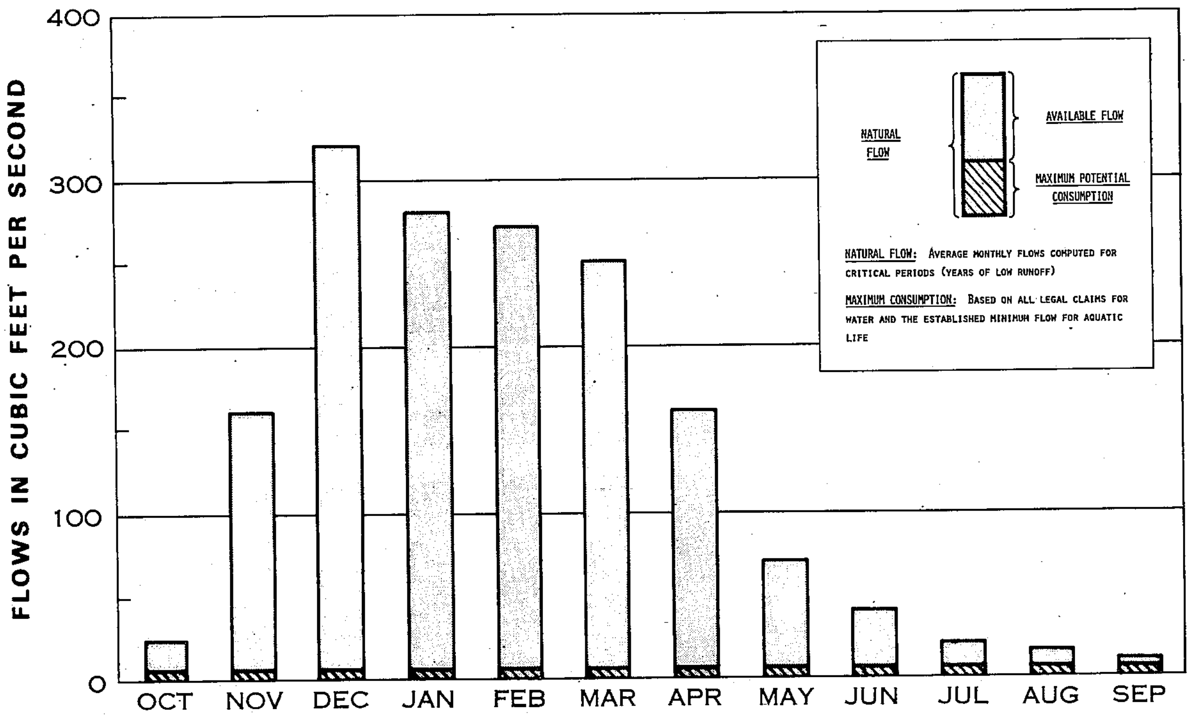


FIGURE 17. Water Resource Availability.

WATER RESOURCE AVAILABILITY

HUNTER CREEK

SM 0



WATER RESOURCE AVAILABILITY

PISTOL RIVER

SM 0

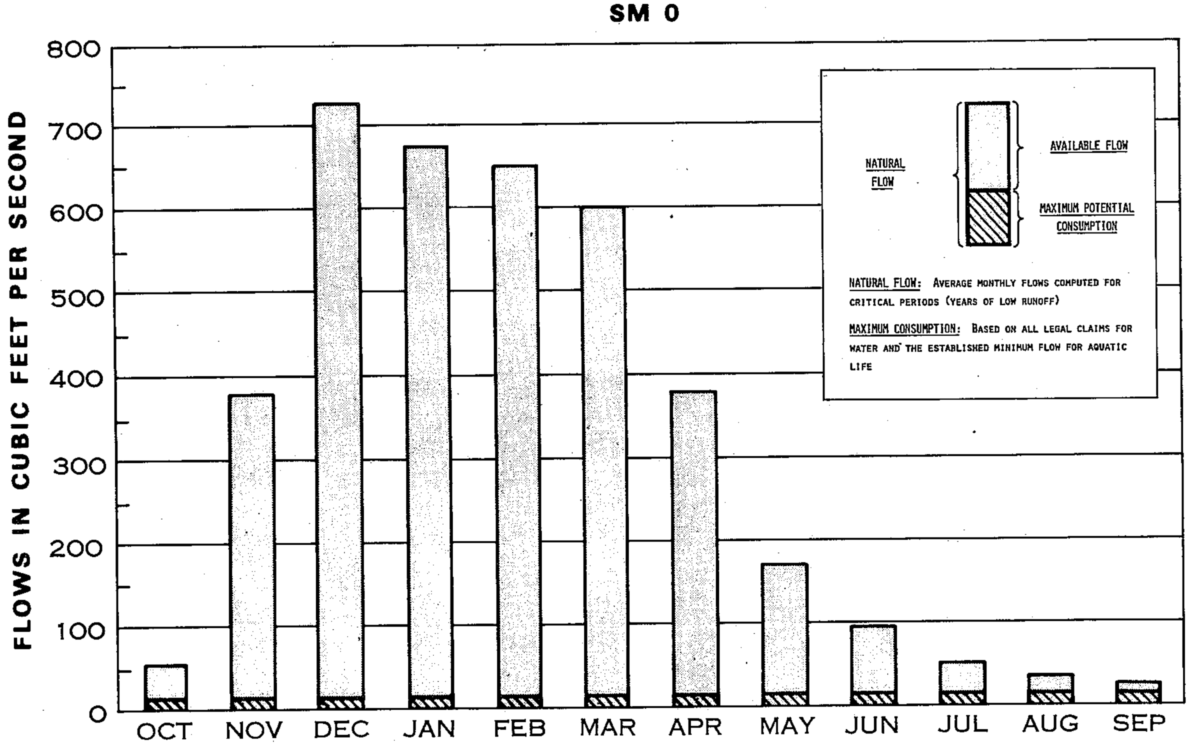
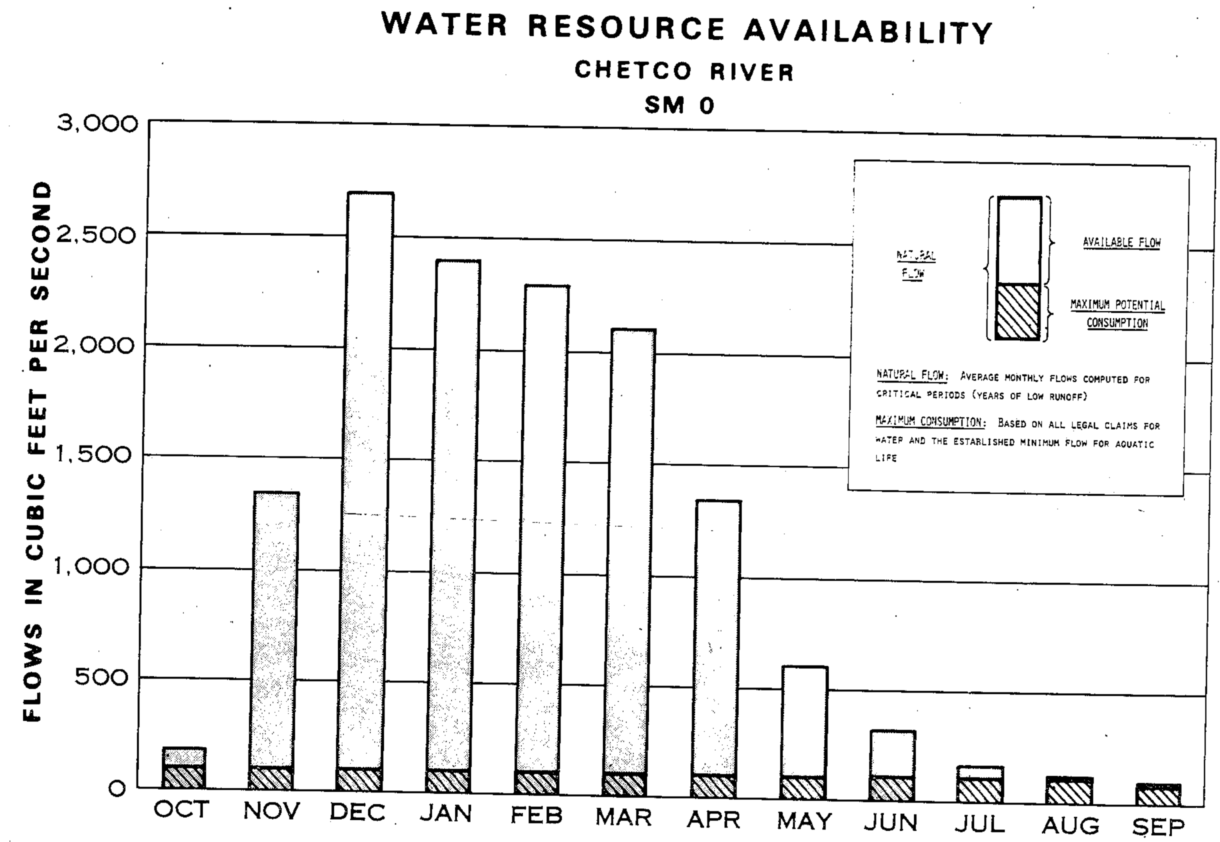


FIGURE 18. Water Resource Availability.



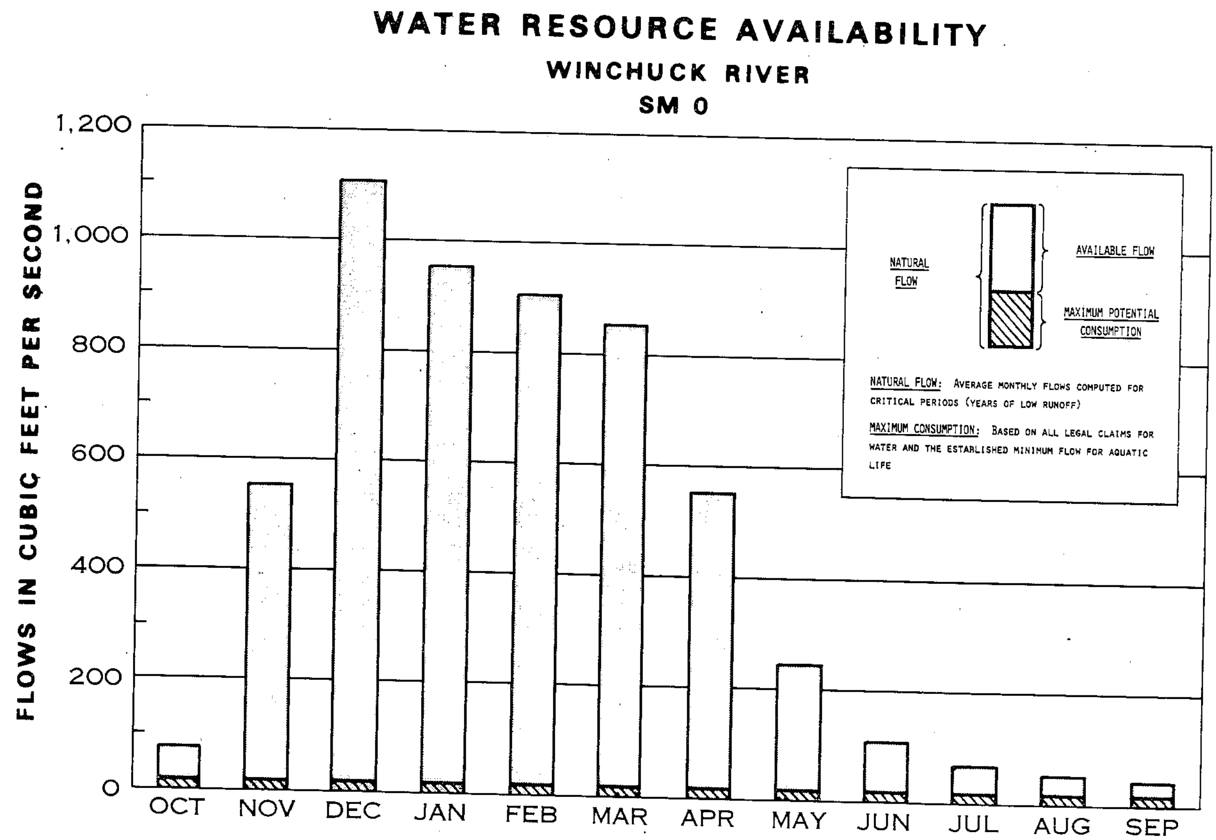
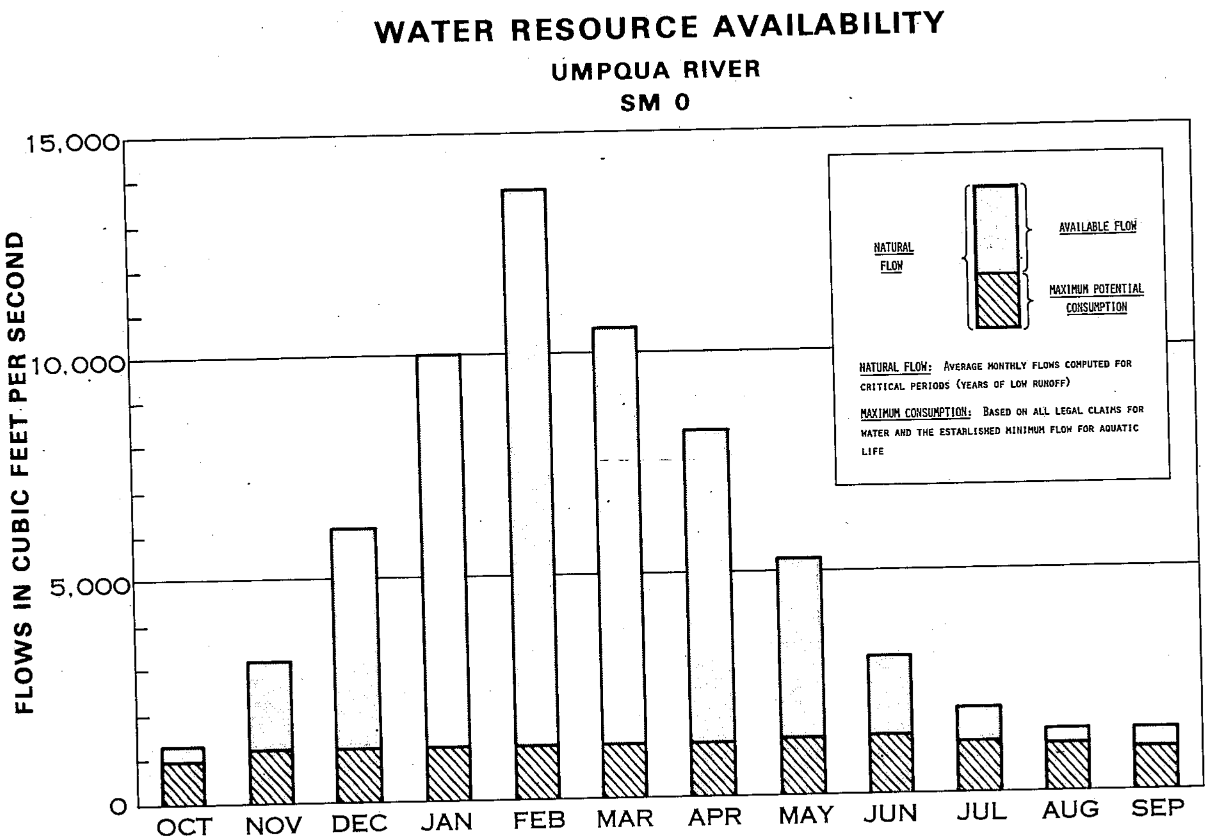


FIGURE 19. Water Resource Availability.



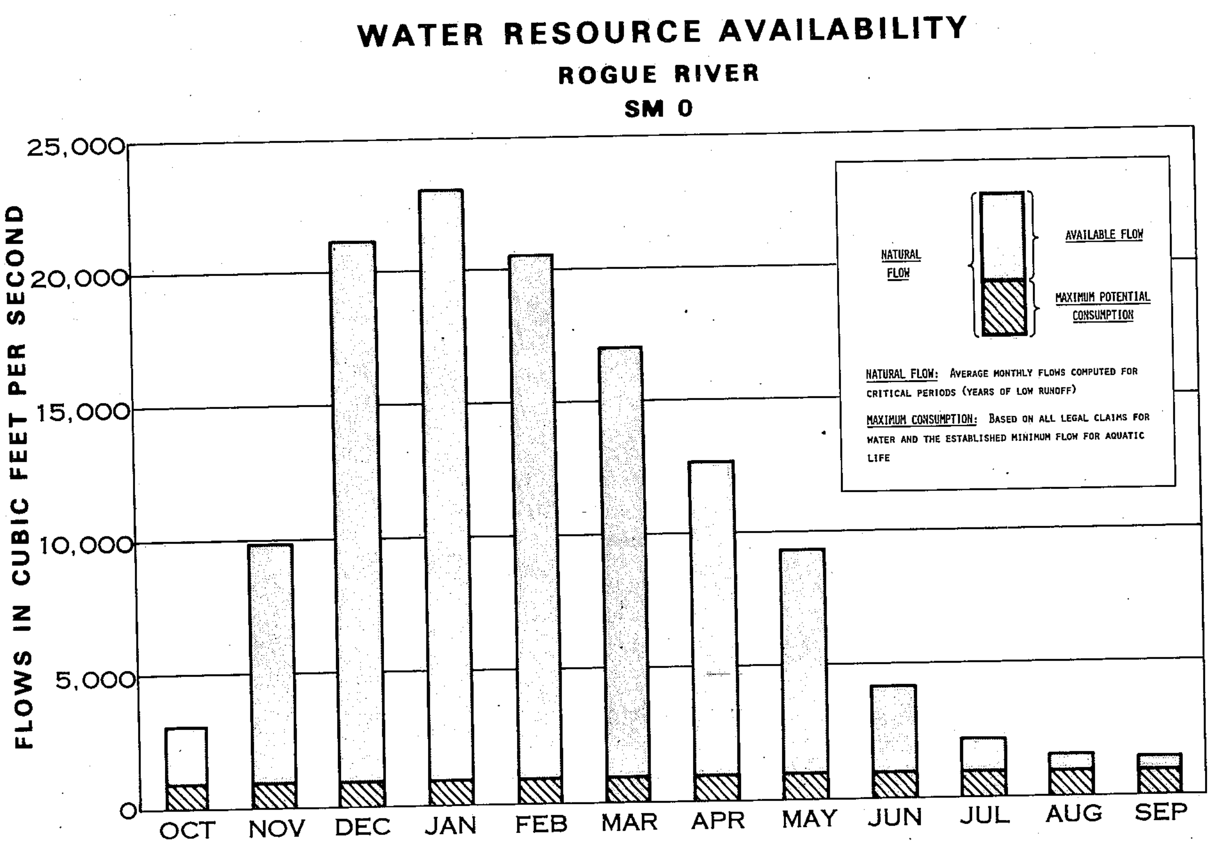


FIGURE 20. Water Resource Availability.

In the Mid-Coast Basin area, the situation is very similar. However, in several cases, the consumptive demand is approximately equal to the streamflow. For example, the Siletz, Salmon, Alsea, and Yachata Rivers have deficiencies in August and September. However, many streams are deficient in October because of increases in the minimum streamflow regime which occur on October 16.

In the South Coast Basin area, again the situation is similar for all streams except Hunter Creek, Pistol River, and Winchuck River.

It should be noted that the consumptive values for the streams in the South Coast Basin area include minimum streamflows established at points which do not extend to the mouth of the stream, the mouth being that point for which all of the flow values are calculated. It was felt, however, that the minimum streamflow point does call water down from the major portion of the watershed to the specific point set by the Water Resources Board and could be considered to be a part of the consumptive values at the mouth of the stream in question.

Both the Umpqua and the Rogue Rivers, which have their headwaters in the Cascade Range, have a sufficient amount of water throughout the year to meet the consumptive demand. While the summertime flows do drop appreciably in both rivers, flows remain high enough to satisfy existing uses.

Table 10 summarizes the data shown in Figures 6 through 20 and identifies that amount of water that would be available on a reliable basis for development or appropriation from each of the streams at stream mile 0 for July, August, and September. Available flows during both a dry year or critical period and an average year are shown. For the most part, in the North Coast Basin during a dry year, many of the streams have little or no available water. Yet in an average year there is a small block of available water. In the Mid-Coast and the South Coast, the situation is very similar.

To summarize, on an annual yield basis, there is sufficient water supply in the Coastal Zone to satisfy all existing and all contemplated future needs. However, because there is a seasonal distribution problem, there is an insufficient amount of water available in many of the streams during the critical low-flow months. When these low flows occur, there is an insufficient amount of water to meet the needs consisting of legal appropriations and the minimum streamflows recognized as

MANAGEMENT CONSIDERATIONS

TABLE 10

WATER-AVAILABILITY SUMMARY FOR THE COASTAL ZONE

STREAM	AVAILABLE FLOWS					
	JULY		AUGUST		SEPTEMBER	
	Dry	Ave.	Dry	Ave.	Dry	Ave.
NORTH COAST						
Big Creek	0	5	0	0	0	0
Youngs River	0	0	0	0	0	0
Lewis & Clark River	0	0	0	0	0	0
Necanicum River	0	5	0	0	0	0
Nehalem River (SM 5)	90	160	5	50	0	40
Miami River	10	20	5	10	0	10
Kilchis River	30	50	10	20	0	20
Wilson River	50	90	5	30	0	30
Trask River	40	90	0	25	0	5
Tillamook River (SM 4)	0	15	0	0	0	5
Nestucca River (SM 5)	70	140	10	50	0	50
Little Nestucca River	15	30	2	10	0	10
MID-COAST						
Salmon River	0	30	0	10	0	10
Siletz River	10	90	0	0	0	0
Yaquina River	45	70	5	20	0	10
Alsea River	120	160	30	60	20	50
Yachats River	0	5	0	0	0	0
Siuslaw River	160	230	50	100	30	70
SOUTH COAST						
S. Fk. Coos River	10	30	0	15	0	10
Millicoma River	0	25	0	5	0	10
Coquille River	20	120	0	5	0	40
Floras Creek	10	25	0	5	0	10
Sixes River	0	10	0	0	0	0
Elk River	10	60	0	50	0	75
Hunter Creek	10	15	5	10	0	5
Pistol River	35	55	20	25	10	15
Chetco River	60	120	10	30	0	5
Winchuck River	50	65	30	35	20	25
Umpqua River	1040	1400	770	970	850	990
Rogue River	1250		650		550	

Note: Flow data is at mouth of stream if stream mile is not indicated. Available flow situation may be more critical at or near tidewater, upstream from the point shown.

necessary to sustain aquatic life. To fully provide for the needs of human use and to meet the known flows required for aquatic life, augmentation of existing flows on the majority of the coastal streams will be necessary. As used here, augmentation of flows means increasing streamflows to desired levels for protection of aquatic life, maintenance of water quality standards, protection of recreation and esthetic values, and to satisfy water supply needs of designated water uses through water storage releases, efficient utilization of water resources and/or interbasin transfers.

Small Watersheds

In addition to the 30 major streams in the Coastal Zone, there are many small watersheds. These small watersheds occupy areas within three to five miles of the beaches. Streams are generally short with low watersheds which flow directly into the ocean. From an individual hydrologic viewpoint, these streams are insignificant in terms of the total annual water yield of the Coastal Zone. The flows in these small streams respond closely to the precipitation cycle, rising with the beginning of the rainy season, and reaching their maximum flow during midwinter, tapering off with a gradual let up as rainfall decreases. In many cases, these streams physically dry up during the low-flow, August and September, season because of the size of the watersheds and the lack of the base flow from ground water sources.

While these streams are insignificant from a hydrologic point of view, they are extremely important from a use point of view. Uses are generally confined to domestic or municipal use, as irrigation and industrial uses are nearly nonexistent in most of these watersheds. Astoria, Cannon Beach, Manzanita, Rockaway, Garibaldi, Lincoln City, Newport, and Port Orford are a few of the municipal systems that are diverting water from small, short-run streams in the Coastal Zone. There are many other smaller communities located up and down the coast that also divert water from these small watersheds. Since a large portion of the population of the Coastal Zone lies within these smaller watersheds, it is only natural that the populace has turned to them for their source of domestic or municipal water. As development pressures increase along the fringes of the coast, the pressures on these small watersheds are going to increase.

There is very little hydrologic data on these smaller streams and, for the most part, comparisons with major streams with gaged flows are not completely valid from a hydrologic point of view. However, the chances of obtaining a reliable amount of water from these small watersheds are "slim" at best.

Coastal Lakes

The lakes of the Coastal Zone are very important for fish life, wildlife, and recreation uses, as well as municipal and industrial water supplies. The State Water Resources Board's water-use policy statements for each of the basins in the Coastal Zone have recognized the natural lakes of the entire Coastal Zone for their domestic, livestock, recreation, wildlife, and fish life use purposes. However, uses established before Board policy such as the industrial use of Siltcoos Lake and Tahkenitch Lake for the International Paper plant at Gardiner, remain as legal water uses. In addition, the Board has established use reservations such as the municipal reservation on Clear Lake and Woahink Lake in the Mid-Coast and Clear Lake and Eel Lake in the South Coast.

Because of their importance as water supplies, recreational attractions, fish and wildlife habitat, and their sensitivity to misuse, the coastal lakes are of statewide concern. As "reservoirs" of water, the coastal lakes are "attractive" and "inexpensive" sources of freshwater for not only domestic and municipal uses, but also industrial and irrigation uses. However, their importance as fish and wildlife habitat is often forgotten and their recreation value overpublicized to the detriment of the resource.

The sensitivity of the coastal lakes is not readily apparent. However, lakes are constantly undergoing physical, chemical, and biological changes. Usually these changes are in response to some naturally or culturally initiated occurrence. For the most part, man plays the most dramatic role in the lake's life cycle. Unlimited use of the resource leads to increased nutrient enrichment which in turn accelerates lake eutrophication and thereby reduces the productivity and quality of the lake. Poor forestry or agricultural practices can lead to increased erosion of nutrient runoff which will affect the lake's natural cycle. The lake will begin to fill in, chemical nutrients will add to the biological character of the water, which in turn will alter the natural lake process destroying both aquatic life and waterfowl habitat.

Of equal importance is the risk of overuse of the lakes and/or the tributary watersheds, causing lower than normal water levels. Once the water table drops to a critical depth, salt water intrusion may occur and adversely affect the lake.

Flooding can also cause lake problems. Floodwaters can dilute and/or flush out the lake's water and nutrient supply causing a downward shift in the lake's bio-mass leading to less fish and other aquatic life production.

Since the lake's ecosystem is such a fragile and much abused resource, coastal lakes should be protected from all future uses until such time that additional study has shed light onto better management techniques.

Water-Availability Risk

While the date of each water right determines priority and dictates the order of obtaining water from a given stream, natural streamflows determine the extent to which the various rights will be satisfied. The combination of natural flow occurrence and level of use under legally established water rights determines the amount of water available for further use. Utilizing streamflow recurrence frequencies as determined from historic records and water-use estimates based on available information, an estimate has been made of the reliability of various flows occurring and the availability of these flows for future use.

Utilizing climatic records and water use data, streamflows that can be expected to occur 1 out of 2 years, or the 50 percent flows and the flows that can be expected to occur 8 out of 10 years, or the 80 percent flow, have been determined for most coastal streams. Most water users require a water supply with a minimum dependable flow exceeding the 80 percent recurrence level. The "risk" of economic loss from lack of water has been found to correlate with the 80 percent recurrence level for irrigation users. Municipal water supplies must be available 100 percent of the time, while industry varies between these limits.

Water-availability risk as shown in Figure 21 reflects possible use under existing water rights of record, minimum streamflows as established by the State Water Resources Board in its water use policy, and the resultant available flow. Instream minimum flows, as discussed earlier, are, in essence, water rights established by the State Water Resources Board to protect aquatic life and provide for maximum beneficial usage of public waters.

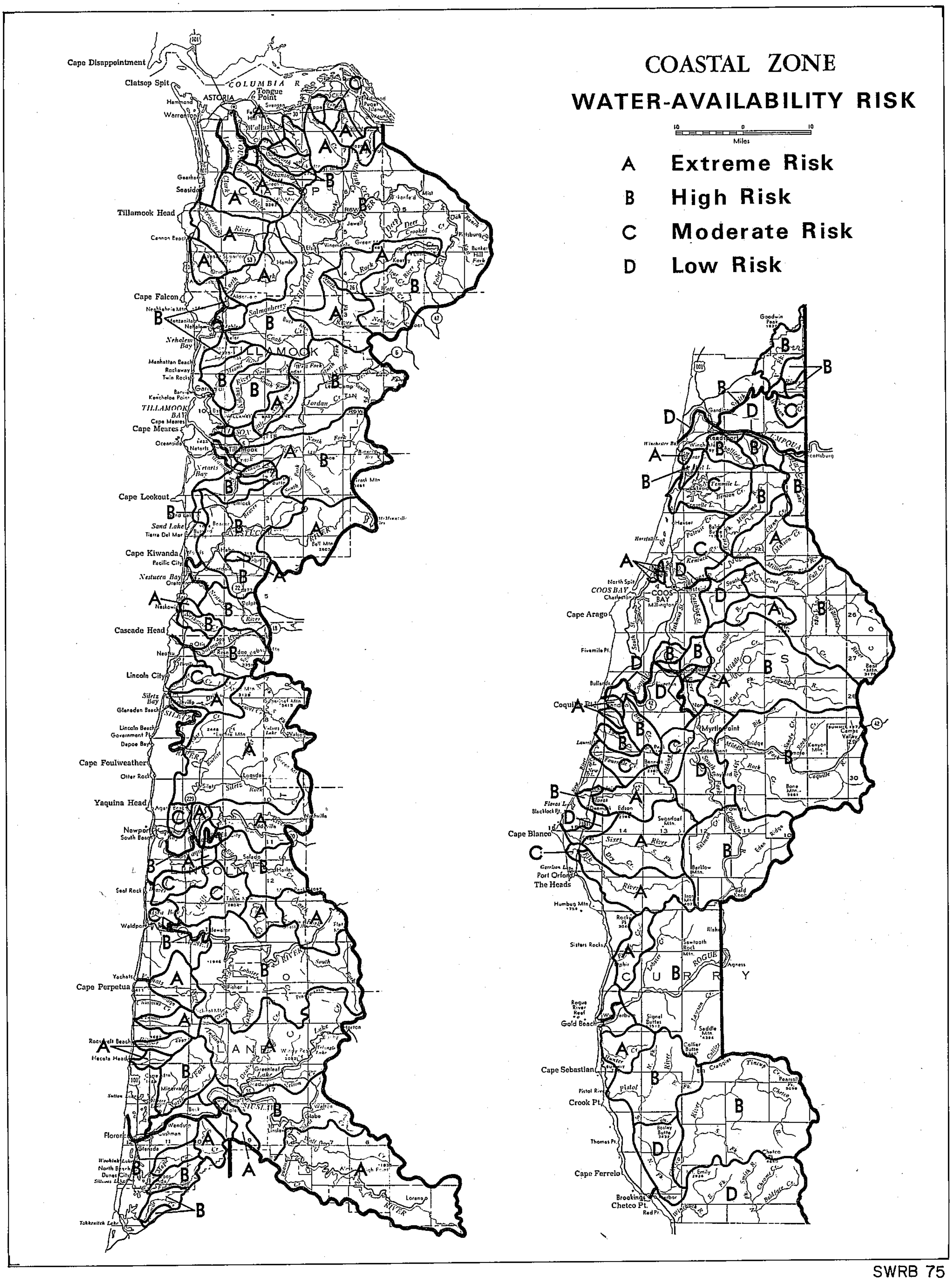


FIGURE 21. Water-Availability Risk.

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The coastal watersheds have been categorized or ranked to indicate water availability for direct diversion from natural streamflows. Those watersheds, where possible present demand[1] based on existing water rights together with established minimum flows exceed average monthly flows[2] 5 out of 10 years in September (the critical month)[3] , are considered to be in an extreme water-availability risk category. Watersheds in this category are shown as "A" in Figure 21.

Where possible present demand, including established minimum streamflows, exceeds the reliable monthly flows[4], but where a small amount of water would be available more than 5 out of 10 years in September, watersheds are considered to be in a high water-availability risk category. Watersheds in this category are shown as "B" in Figure 21.

Those watersheds with reliable monthly flows exceeding the possible present demand including established minimum streamflows by only a small amount annually, usually less than 10 cfs in September, are considered to be in a moderate water-availability risk category. Such watersheds are shown as "C" in Figure 21.

In a few watersheds in the Coastal Zone, the reliable flows exceed the possible minimum streamflows annually by substantial amounts, usually by more than 10 cfs in September. These watersheds rate a low water-availability risk categorization and are shown as "D" in Figure 21.

Reservoir Potentials

As discussed earlier in this report, it is recognized that coastal water management problems are primarily that of providing adequate municipal water supplies and protecting minimum streamflows for aquatic life. The water supplies necessary to meet growing coastal demands can no longer be obtained by the direct diversion of natural streamflows. The instream aquatic life needs and the climatic variations that control

1 Possible present demand - the monthly water withdrawal from streams that would occur if all existing water rights were exercised to their legal maximum.

2 Average monthly flow - that unregulated streamflow that can be expected to occur on an average monthly basis 50 percent of the time or 1 out of 2 years.

3 Critical month - that month of the year in which the reliable monthly flow is the lowest.

4 Reliable monthly flow - that unregulated streamflow that can be expected to occur on an average monthly basis 80 percent of the time or 4 out of 5 years.

the August-September streamflows highlight the need for flow augmentation from selected storage reservoirs. Dependable water supplies and aquatic life protection for the near and long-term future can only be achieved through compatible reservoir development.

The justification for multiple-purpose storage reservoirs in the Oregon Coastal Zone will rely upon water supply, recreation, fisheries, and flow augmentation to enhance water quality, as the primary benefits to be gained. The sites identified for study are generally exclusive of flood control benefits due to their headwater locations necessary to minimize adverse impact upon the anadromous fishery.

A majority of the potential reservoir sites have been eliminated due to a variety of reasons. These include an adverse impact on the anadromous fishery, inadequate storage capacities, unfavorable depth, volume and surface area relationship, geologic considerations of the coastal basins including landslide, erosion, and seepage, and foundation stability problems. Tables 11, 12, and 13 indicate the results of the reservoir site evaluation. Figure 22 shows suitable reservoir sites selected for further evaluation and documentation of need.

Preliminary reservoir studies suggest that Federal financing for the anadromous fishery, recreation, and water quality enhancement benefits are key factors for implementation. State financing to reimburse costs reflecting regional benefits is an emerging concern of the counties. Reimbursement from local water users, or county government, for water supply and allocated costs for resident fishery, recreation, plus lands, rights of way, water rights, and providing institutional leadership needs are local responsibilities gaining acceptance.

Generally 50 percent of development costs can be reimbursed by beneficiaries within the local jurisdiction receiving direct benefits. The remaining 50 percent of costs may require Federal-State revenue-sharing programs.

Implementation of selected multiple-purpose water storage developments, to meet water supply needs, preserve instream flows, and provide flow augmentation for enhancement of aquatic life and recreation values, may well depend upon State financing currently not available.

Political decision to reimburse costs for restoration and/or enhancement or environmental assets at both State and National

MANAGEMENT CONSIDERATIONS

TABLE 11

NORTH COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
1	Clear Cr.	X					X			
2	Elsie	X					X			
3	Cedar Cr.	X					X			
4	Ginger Peak	X					X			
5	Hollywood	X			X[4]		X			
6	Blaine	X			X[4]		X			
7	Miami R.				X	X				
8	Kilchis R.	X								
9	Kilchis R.	X								
10	Keyhole	X			X					
11	Clear Cr.	X					X			
12	Nehalem R.				X[4]				X[7]	
13	Elkhorn Cr.				X					
14	S. Fk. Trask R.								X[3]	
15	E. Fk. Trask R.				X					
16	E. Fk. Trask R.									Yes
17	Killiam Cr.				X					
18	Fawcett Cr.				X					
19	Bear Cr.				X					
20	Beaver Cr.				X					
21	Sutton Cr.				X					
22	Bewley Cr.			X						
23	Tillamook R.				X	X				
24	Beaver Cr.	X	X		X[4]	X	X			
25	E. Beaver Cr.				X		X			
26	E. Beaver Cr.				X		X			
27	Bays Cr.				X		X			
28	Moon Cr.	X			X		X			
29	East Cr.				X		X			
30	S. Fk. Necanicum R.				X	X				
31	Nestucca R.	X					X			
32	Nestucca R.	X			X		X			
33	Three Rivers						X			
34	L. Nestucca R.	X					X			
35	L. Nestucca R.	X					X			
36	God's Valley	X								
37	God's Valley									Yes
38	N. Fk. Nehalem R.	X								
39	N. Fk. Nehalem R.	X								
40	Humbug Cr.									Yes
41	Walker Cr.									Yes
42	Northrup Cr.								X[3]	
43	Lousignot Cr.			X						

TABLE 11

NORTH COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

(Continued)

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
44	Sager Cr.				X	X				
45	Buster Cr.[8]								X[3]	
46	Buster Cr.								X[5]	
47	Fishhawk Cr.				X	X				
48	Fishhawk Cr.								X[3]	
49	Fishhawk Cr.				X	X				
50	Deep Cr.								X[5]	
51	Deer Cr.									
52	Deer Cr.								X[6]	
53	Crooked Cr.			X						
54	Rock Cr.	X	X		X[4]	X				
55	Pebble Cr.									Yes
56	Nehalem R.	X			X[4]	X				
57	Camp McGregor	X	X							
58	Cook Cr.				X[4]	X		X		
59	E. Foley Cr.				X[4]	X		X		
60	Foley Cr.				X	X				
61	Tide Cr.		X		X[4]					
62	Green Cr.				X[4]			X		
63	Beaver Cr.				X[4]			X		
64	Lost Cr.				X[4]			X		
65	L. Clatskanie R.				X[4]	X		X		
66	Clatskanie R.				X[4]					Yes
67	Clatskanie R.	X	X		X[4]					
68	Big Cr.				X					
69	Klaskanine R.				X					
70	S. Fk. Klaskanine				X					
71	Youngs R. (Upper)									Yes
72	Youngs R. (Lower)								X[3]	
73	Walluski R.				X					
74	Heckard Cr.				X					
75	Hortill Cr.				X					
76	Klickitat Cr.				X					
77	Warrenton Dam									Yes
415	N. Fk. Nehalem R.				X					
416	Salmonberry			X	X[4]					
417	Beaver Cr.		X	X	X[4]					
418	Clatskanie R.				X					
419	N. Fk. Klaskanine R.			X	X[4]					
420	Bark Shanty Cr.	X			X[4]					
421	Big Cr.				X[4]				X[3]	
422	City of Forest Grove									Yes

TABLE 11

NORTH COAST RESERVOIR SITES
BASIS FOR ELIMINATION OF POTENTIAL SITES
(Continued)

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
423	Cook Cr.				X[4]			X		
424	Rock Cr.	X	X		X[4]					
465	Yellow Fir				X					
466	Pleasant Valley				X	X				
467	Joe Cr.				X					
468	Horn Cr.				X					
469	Fall Cr.									Yes
470	Deep Cr. II									Yes
471	Deep Cr. III				X					
472	Military Cr.	X	X		X[4]					
473	Ginger Cr.			X	X[4]					
474	Buster Cr. III								X[6]	
475	Walker Cr.				X					
476	N. Fk. Nehalem R.									Yes
477	L. Nestucca				X[4]					Yes
478	Angora Peak[8]				X[4]					
479	Nicolai Mountain[8]				X[4]					
480	Salmonberry	X			X[4]					
481	Nehalem Falls	X	X		X[4]					
482	Spruce Run	X	X		X[4]					
483	Wakefield	X	X		X[4]					
484	Stonehill	X	X		X[4]					
485	Enlargement of McMinnville supply				X[4]					Yes
486	Enlargement of Barney Reservoir				X[4]					Yes

1 Stream gradient in potential reservoir is too steep to provide a suitable reservoir basin.
2 Studies by Corps of Engineers.
3 Additional study required if storage need is identified.
4 Costs not estimated.
5 Alternative to more suitable site on same stream.
6 Too shallow to provide temperature control on Nehalem River.
7 Inadequate water supply.
8 Pumped storage sites.

TABLE 12

MID-COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
78	Beaver Cr.	X	X	X	X			X		
79	Beaver Cr.	X	X	X	X	X		X		
80	S. Fk. Beaver Cr.			X				X		
81	N. Fk. Beaver Cr.	X		X				X		
82	Depot Cr.			X				X		
83	Beaver Cr.			X		X				
84	Lower Elk Cr.	X	X					X		
85	Upper Elk Cr.	X	X		X			X		
86	Panther Cr.			X						
87	Treat R.									Yes
88	Salmon R.	X	X		X					
89	Schooner Cr.	X	X	X						
90	Drift Cr.	X		X	X					
91	Cedar Cr.	X		X				X		
92	Jaybird Cr.			X				X		
93	Euchre Cr.	X						X		
94	Sunshine Cr.	X		X		X				
95	Big Rock Cr.									Yes
96	Steere Cr.	X			X					
97	Sam Cr.	X	X							
98	S. Depoe Bay Cr.			X						
99	Rocky Cr.									Yes
104	Drift Cr.	X			X					
105	N. Fk. Alsea R.			X						
106	Crooked Cr.		X		X					
107	Peak Cr.									Yes
108	N. Fk. Yachats R.	X			X					
109	Yachats R.	X		X						
110	Cascade Cr.			X				X		
111	Green R.		X	X						
112	Preacher Cr.	X		X						
113	N. Fk. Indian Cr.		X					X		
114	Rogers Cr.	X						X		
115	Swamp Cr.			X	X					
116	Congdon Cr.			X					X[3]	
117	Swartz Cr.		X	X	X					
118	Big Cr.	X		X	X					
119	N. Fk. Siuslaw R.		X							
120	Porter Cr.			X						
121	Condon Cr.	X		X						
122	McLeod Cr.	X							X[3]	
123	Beaver Cr.	X		X				X		
124	Sweet Cr.	X							X[3]	
125	Chickahominy Cr.	X	X						X[3]	

TABLE 12

MID-COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

(Continued)

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
126	Eames Cr.			X				X		
127	Wolf Cr.			X					X[3]	
128	Farman Cr.	X		X				X		
129	Hawley Cr.	X	X	X				X		
130	Kelly Cr.	X		X						
131	S. Fk. Siuslaw R.	X						X	X[3]	
132	Letz Cr.	X							X[3]	
133	Maple Cr.	X		X				X		
134	Fivemile Cr.	X		X						
135	Lietel Cr.	X		X						
136	S. Fk. Alsea R.	X	X				X			
137	S. Fk. Alsea R.	X					X			
138	S. Fk. Alsea R.	X					X			
139	S. Fk. Alsea R.		X		X		X			
140	Eckman Cr.	X		X						
141	Gopher Cr.			X				X		
142	Fall Cr.			X				X		
143	Five Rivers	X		X				X		
144	Five Rivers	X								
145	Buck Cr.	X		X						
147	Lobster Cr.	X								
148	Lobster Cr.	X								
149	Lobster Cr.	X		X						
150	L. Lobster Cr.	X								
151	Lobster Cr.	X								
152	Five Rivers	X								
153	N. Fk. Alsea R.			X	X					
154	N. Fk. Alsea R.-Co. Line			X	X					
155	S. Fk. Alsea R.	X	X							
156	S. Fk. Schooner Cr.									Yes
157	N. Fk. Alsea R.									Yes
158	Trout Cr.	X						X		
159	Austa	X					X			
160	Elkhorn Cr.		X		X					
161	Arasmith	X			X					
162	Erickson Cr.			X		X				
163	Valsetz Falls #1	X								

1 Stream gradient in potential reservoir is too steep - inadequate storage capacity for water quality control.
2 Studies by Corps of Engineers or others.
3 Additional study required if storage needs identified

MANAGEMENT CONSIDERATIONS

TABLE 13

SOUTH COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
158s	Fourmile Cr.	X								Yes
159s	N. Fk. Floras Cr.			X						
160s	Guerin Cr.	X		X						
161s	Floras Cr.	X		X	X					
162s	N. Fk. Floras Cr.	X		X	X					
163s	E. Fk. Floras Cr.			X						
164	E. Fk. Floras Cr.		X	X						
165	Upper Sixes R.								X[3]	
166	Avery Ranch	X	X							
167	Bulter Cr.			X						
168	Dry Cr.	X		X					X[3]	
169	Bald Mountain Cr.	X		X						
170	Upper Euchre Cr.	X		X				X		
171	Euchre Cr.	X		X				X		
172	Fruin Cr.	X		X				X		
173	Woodward Cr.	X		X						
174	Unnamed Cr.			X				X		
175	Steele Cr.			X				X		
176	Caulfield Cr.	X		X				X		
177	Upper Beaver Cr.			X				X		
178	Beaver Cr.	X		X						
179	Intermittent Cr.	X		X						
180	Not Named			X				X		
181	Not Named			X				X		
182	Sevenmile Cr.	X		X			X			
183	Hatchet Slough	X		X						
184	Not Named			X				X		
185	Fat Elk Cr.			X				X		
186	Pulaski Cr.			X				X		
187	Fish Trap Cr.	X		X				X		
188	Hall Cr.	X	X	X				X		
189	Lampa Cr.		X	X				X		
190	Bear Cr.	X	X							Yes
191	Bill Cr.	X		X						
192	Johnson Cr.	X	X	X						
193	Crooked Cr.	X		X						
194	Bradley Lake		X	X						
195	Two Mile Cr.	X	X	X						
196	South Two Mile Cr.	X	X	X						
197	Ward Cr.	X		X				X		
198	Dement Cr.	X		X				X		
199	Upper Salmon Cr.	X		X	X					
200	Eden Valley								X[4]	
201	Rasler Cr.	X							X[5]	Yes
202	Myrtle Cr.	X		X	X					
203	Elk Cr.	X							X[5]	Yes
204	Big Cr.								X[5]	X[3]

TABLE 13

SOUTH COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

(Continued)

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
205	Upper Big Cr.	X		X						
206	Camas Cr.									
207	Lake Cr.		X	X					X[5]	Yes
208	Lang Cr.			X				X		
209	Deep Cr.		X	X						
210	Reed Cr.			X						
211	Boulder Cr.			X	X					
212	Dice Cr.			X	X				X[3]	Yes
213	North Slough	X		X				X		
214	North Slough	X		X				X		
215	Palouse Cr.	X		X				X		
216	Adams Cr.	X		X				X		
217	Johnson Cr.	X		X				X		
218	Benson Cr.	X		X				X		
219	Noble Cr.	X		X				X		
220	Big Cr.	X		X				X		
221	W. Fk. Millicoma R.	X		X				X		
222	Elk Cr.									
223	Coos-North Bend W. D.	X							X[5]	X[3]
224	Golden Falls									Yes
225	Matson Cr.								X[5]	Yes
226	E. Fk. Millicoma R.								X[5]	Yes
227	Fall Cr.								X[5]	X[3]
228	Bottom Cr.	X		X					X[5]	Yes
229	Cedar Cr.	X								
230	Upper Tioga Cr.	X		X	X				X[5]	Yes
231	Tioga Guard Station	X		X						
232	Marlow Cr.	X		X				X		
233	Daniels Cr.	X		X						
234	Boone Cr.	X		X				X		
235	Noble Cr.	X		X	X					
236	Jo Ney Slough	X		X						
237	Big Cr.	X								
238	Conn Cr.			X				X		
239	N. Fk. Chetco R.			X				X		
240	Jack Cr.	X		X				X		
241	Wheeler Cr.			X				X		
242	Fourth of July Cr.	X		X				X		
243	E. Fk. Winchuck R.	X		X				X		
244	Camas Valley		X		X		X	X		
245	Fairview	X	X		X		X			
246	Gravel Ford	X			X		X			
247	Lower Gaylord	X	X		X					
248	Bancroft	X	X	X						

TABLE 13

SOUTH COAST RESERVOIR SITES

BASIS FOR ELIMINATION OF POTENTIAL SITES

(Continued)

SITE NO.	SITE NAME	SITE DEFICIENCIES								SUITABLE SITES
		Adverse Impacts on Fish	Developments in Reservoir	Poor Storage[1]	Excessive Costs $500/A.F.	Failed Field Review	Infeasible by Previous Study[2]	Storage Need not Identified	Other	
249	Battle Cr.			X				X		
250	Upper Bear Cr.	X		X						
100	Bridge	X		X	X	X	X			
101	Catching Cr.	X		X				X		
102	Cawfield Cr.	X		X	X					
146	Laverne	X		X						
157s	Remote	X	X		X					
425	Rock Cr.			X						
426	Laverne Falls	X							X[5]	X[3]
427	Squaw Cr.	X		X	X					
428	Hunter Cr.			X		X	X			
429	Windy Cr.								X[5]	
430	Eden Ridge									Yes
431	Bandon Reservoir			X						
432	Sitkum	X	X	X	X	X	X	X		
433	Salmon Cr.	X							X[5]	
434	Remote	X							X[5]	
435	Okietown								X[5]	
	UMPQUA BASIN									
253	Railroad Cr.	X	X					X		
292	Loon Lake		X							
293	Upper Lake Cr.			X					X[3]	
296	Surprise Cr.		X						X[3]	
297	W. Fk. Lake Cr.								X[3]	
	ROGUE BASIN									
402	Lobster Cr.								X[3]	

1 Stream gradient in potential reservoir is too steep - Inadequate storage capacity for water quality control.
2 Studies by Corps of Engineers or others.
3 Additional study required if storage need is identified.
4 Eden Ridge site 430 is preferred site.
5 Geologic investigation, to confirm suitability required.

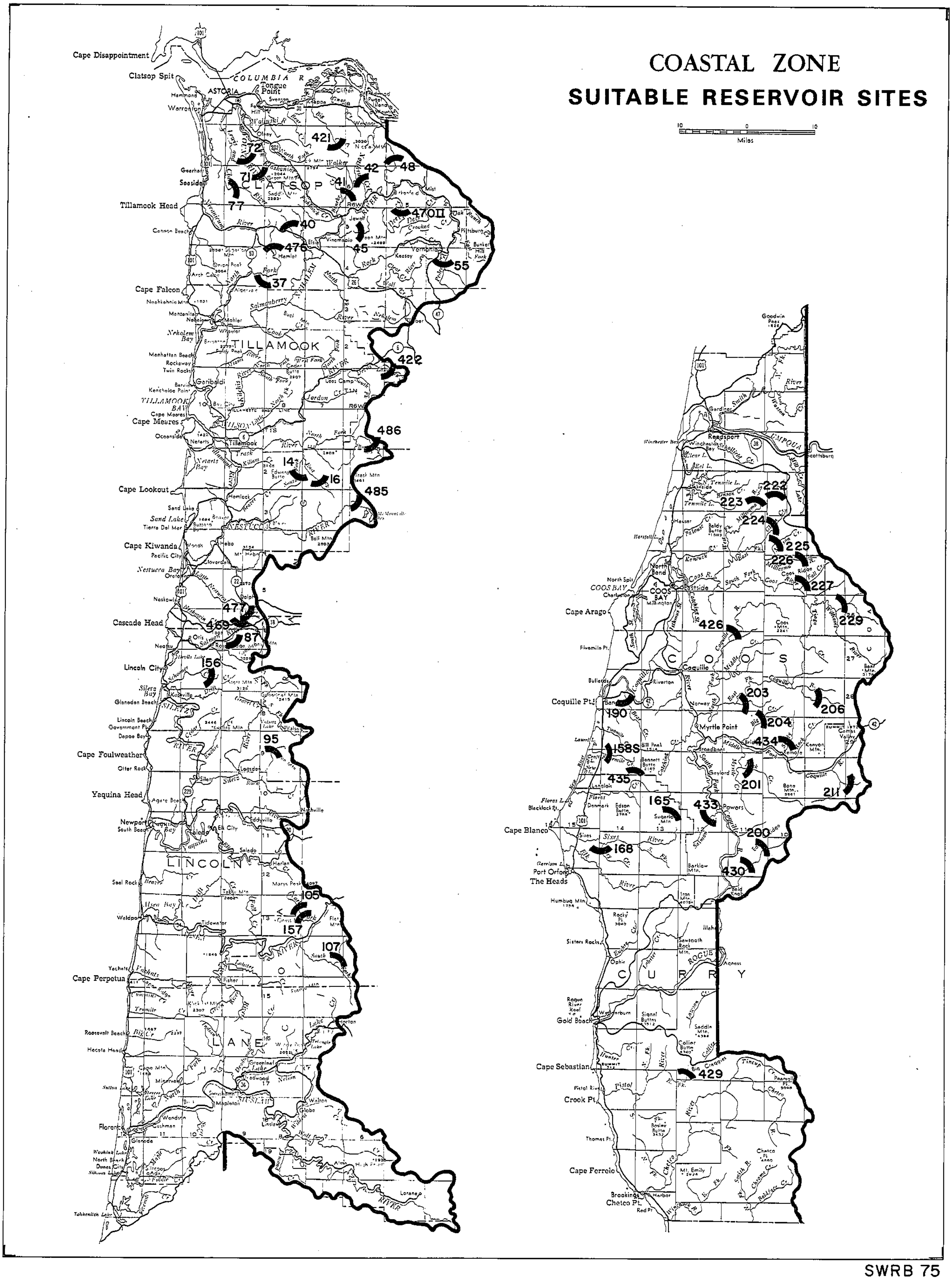

FIGURE 22. Suitable Reservoir Sites.

levels of government should be encouraged. State participation to match Federal funding and provide technical assistance for local water management programs is necessary.

Regional Water-Supply Potentials

With the water-availability risk considerations and results of the reservoir evaluation as presented in previous sections of this report as a background of potentially limiting factors, the following regional water-supply potentials or concepts have been developed. These regional water supply potentials are an attempt to solve water supply problems in the Coastal Zone in harmony with the water-resource capability and at the same time provide opportunity for growth, development, and protection of the existing fishery and other resources. Only a very cursory analysis has been attempted at this time of the municipal and domestic needs and alternatives for meeting these needs. The regional water-supply potentials discussed below are intended to be proposals for organizing the wholesale of water from common sources to individual districts which may continue the retail distribution of water in their local areas, and thus retain control of their districts. The unification of water-supply districts, while possibly desirable from an economic viewpoint, is not the intent of the proposals. However, the potentials are based on sound water-resource considerations. An analysis of land-use considerations was not attempted.

North Coast Basin Area

The Warrenton-Hammond-Clatsop Plains-Gearhart-Seaside service area can be related to the Lewis and Clark River as a water source with flow augmentation from the Lewis and Clark Reservoir.[1] Such a regional water supply system would offer gravity distribution and centralized treatment facilities. Future supplies could be assured by this proposal. The Lewis and Clark regional system may warrant study as an alternative for the Astoria service area. Comparison of capital investment, maintenance, and operation costs between the Columbia River pumping proposal and the Lewis and Clark regional system expanded to include Astoria may be a valid alternative.

The Cannon Beach to Arch Cape area utilizes natural springs. Future growth may depend upon usage of Elk Creek flows to meet peak summer demands.

1 Water Supplies and Sewerage of Clatsop County - Carl E. Green and Associates, September, 1968

Nehalem Bay water supplies may continue to rely upon small coastal drainages for limited water supply sources. Reorientation to a regional system concept utilizing North Fork Nehalem River augmented flows is an alternative. Water demands of the Nehalem Bay area do not appear to be capable of financing storage development and system improvements from water supply benefits alone. Multiple-purpose storage and a regional water system serving southward into the Tillamook Bay area may be a possibility.

Tillamook will continue to utilize Killam and Fawcett Creeks, with the alternative of obtaining additional water from the Trask River. Gravity distribution, moving water northward, augmented from ground water during peak summer demands, is a potential. Development of ground water near the mouth of both Kilchis (now under way) and Miami Rivers could augment the Nehalem and Tillamook surface water systems midway in such a regional water supply system. Study of water service for such a large area of Tillamook County through integrated water sources and systems may require county leadership.

The Nestucca Bay area from Neskowin to Tierra Del Mar could obtain water supplies from a centralized water treatment plant utilizing Little Nestucca River with augmented flows. Provision of sanitary disposal facilities may limit growth in this area reflecting nominal increase of water demands.

Mid-Coast Basin Area

Cooperative planning has identified regional water supply systems and water resources to be utilized in the Mid-Coast Basin for present and future water supply needs.

Lincoln County's northerly service area will utilize Salmon River and/or Schooner Creek with appropriate storage, plus expansion of Drift Creek (Siletz Bay) water usage under existing water rights.

The central area, south of Cape Foulweather to Alsea Bay, could be supplied from the Siletz River following implementation of the storage potential on Big Rock Creek. Near-term use of existing water sources are programmed to be in phase with regional development from the Siletz River, creating a regional water system that will utilize Big Rock Reservoir for augmentation to the Siletz River.

The southerly service area, Alsea estuary to Cape Perpetua, could utilize Alsea River water through augmentation from the North Fork Alsea River reservoir potential.

Western Lane County is divided by the Siuslaw River, an area to the north, and the Dunes City area, lying to the south. Provision of municipal water from Clear Lake and nominal withdrawal from Woahink Lake can satisfy near-term municipal needs. Monitoring of water quality within these natural lakes and recording the outflow therefrom may show that maximum allowable withdrawals cannot supply long-term future water supplies. Consideration of dunes ground water and/or stabilization of the lakes to gain storage capacity may be required to satisfy long-term water needs.

South Coast Basin Area

The Coos Bay-North Bend Water District supplies the major population center of Coos County adjacent to Coos Bay. Service to this region has historically been ground water from the dunes area north of Coos Bay and the Pony Creek development. Future sources of water supply have been studied. Increased withdrawal from the dunes ground water, West Fork Millicoma storage reservoir, and the Coquille River, are the basic potential sources of water. Recent studies have documented the potential of dunes ground water and geologic feasibility of the West Fork Millicoma damsite. Study of a regional water system utilizing the Coquille River to serve most population centers of Coos County has not been accomplished. Potential storage reservoirs within the Coquille River system could provide dependable water supplies, utilizing storage to meet long-term future needs. Institutional adjustments to create a county service district capable of implementing such a regional concept is an early consideration.

Joint storage development to meet the cranberry growers' late season water needs in the Bandon area has been identified. Curry County water supply needs are localized, and regional systems may only apply to the Port Orford area.

Flooding

Most of the major streams in the Coastal Zone have flooding problems. The most notable problem areas are the Tillamook Bay area, the lower Siuslaw River, and the Coquille valley. These problems are caused by a number of flood conditions including:

1. Flooding caused exclusively by high streamflows resulting from heavy rainfall or a combination of heavy rainfall and melting snow.

2. Flooding caused exclusively by oceanic phenomenon such as high tides and/or waves generated by winds or seismic activity (tsunami).

3. Flooding caused by a combination of high streamflow and oceanic phenomenon.

Flood damage and even flood conditions are often aggravated by man's activities in the flood plains and watersheds. Development in the watershed not only places damageable items in the path of floods, but may divert or restrict floodflows to the detriment of others. Flood damages in seven of the major coastal drainages average about 3½ million dollars each year.

Recent watershed activities and events including logging, forestry, road building, and fires, have left many of the watersheds in poor condition with respect to flooding. Damaged watersheds not only have less floodwater retention capability, thus increasing flood magnitudes, but can contribute large quantities of silt and debris which, during time of floods, clogs channels, renders agricultural lands unproductive, fills estuaries, and damages bridges and other facilities.

Numerous attempts have been made to reduce flood damages through various structural programs. The feasibility of providing dams, dikes, and flood channels has been investigated on most major streams by the U.S. Army Corps of Engineers. With few exceptions, these investigations have indicated that structural solutions were not economically feasible.

FLOODING

Most existing flood control measures consist of agricultural dikes, drainage and bank protection provided through diking and drainage districts, often with the assistance of the Corps of Engineers or Soil Conservation Service. Many of these facilities, however, do not receive adequate inspection and maintenance and are therefore in questionable condition.

More recently, many coastal governmental entities have begun to look at flood plain regulation as a viable flood damage reduction alternative. This scrutiny, as well as implementation, has been accelerated by recent legislation which requires flood plain regulations to be eligible for flood insurance; eligibility which is necessary in order to obtain financing for open space or other flood plain activities.

Recommendations

1. Flood plain management, a "blend" of various structural and nonstructural flood damage reduction alternatives, should be preferred over single alternative solutions.

2. Major water storage projects in the Coastal Zone should consider flood control as a project function.

3. Where there is a proliferation of drainage and diking districts in a comparatively small geographic area, consolidation should be considered to facilitate maintenance of flood control facilities.

4. Where flood problem areas are not included in an applicable district, consideration should be given to expansion of existing districts or creation of additional districts to include the problem area. This would facilitate the development of local flood control projects.

5. All local flood control facilities, e.g. dikes, drainage tidegates, pumping stations, etc., should receive annual inspection and maintenance to insure flood readiness.

6. Regulations should be developed and enforced to insure:

    a. Flood proofing of all structures to be built in flood plains.

b. Restriction of structures which would have adverse effects on flood flows.

c. Review and control of all land fill activities including dikes and roadfills.

d. Adequate precautions for construction in coastal (beach and ocean shore) areas subject to coastal flood hazard or shore erosion.

e. Control of storage of floatable or noxious materials in flood plains.

f. Review and control of watershed activities such as logging, forestry, recreation access, road construction.

The aforementioned items could be enforced through a variety of regulatory tools at various levels of government.

7. Detailed flood plain, flood damage, and watershed inventories should be developed for use in the preparation of comprehensive flood plain management programs.

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31. Water Resources Data for Oregon, Part 1, Surface Water Records, years of record for each gage in Coastal Zone.