# NATURAL RESOURCES ANALYSIS

# NATURAL RESOURCES ANALYSIS

## Introduction

The natural resource analysis is intended to be a physical inventory of the climate, topography, soils, geology, hydrology, wildlife and vegetation within the planning area. (Figure 1) In a separate section potential hazard areas will be inventoried and analyzed.

## Climate and Air Quality

The Cannon Beach climate is moderate in its temperature range, with wet winters and comparatively dry summers. Average annual rainfall is 90 inches. Rainfall in the mountains to the east and south is considerably greater and it is 120 inches at the headwaters of Elk Creek. Approximately 80 percent of the total precipitation occurs during the 6-month period of October through March. (Figure 2)

Snow is not common, and seldom remains on the ground longer than a few days. The average frost-free season is about 270 days. Mean monthly temperatures at Seaside, the nearest meteorogical station, range from 43°F in January to 60°F in August. Extremes of record are 12°F in December and January to 105°F in July.

During late fall and winter months the city is subjected to frequent, intense, flood-producing storms that usually sweep in from the southwest. Several inches of rain often fall in a 24-hour period. Such storm conditions may occur several times during the winter season in the Elk Creek basin. Also, any of these storms may be accompanied by high tides and strong winds.

During the summer and fall, winds tend to blow from the north or northwest, but prevail from the southwest and southeast during winter months. Occasional easterly winds create humidity conditions much below normal. Continuous wind velocities from 15 to 25 miles per hour are common, and gales occur during the winter season. Wind gusts in excess of 100 miles per hour have been experienced.

Air quality data for the Cannon Beach area are not presently available, but air quality generally is very good. No major sources of industrial pollution exist in Cannon Beach. Due to the absence of industrial sources and the common occurrence of steady winds, gaseous pollutants are estimated to occur at low concentrations and, compared to suspended particulates, are of. limited concern.

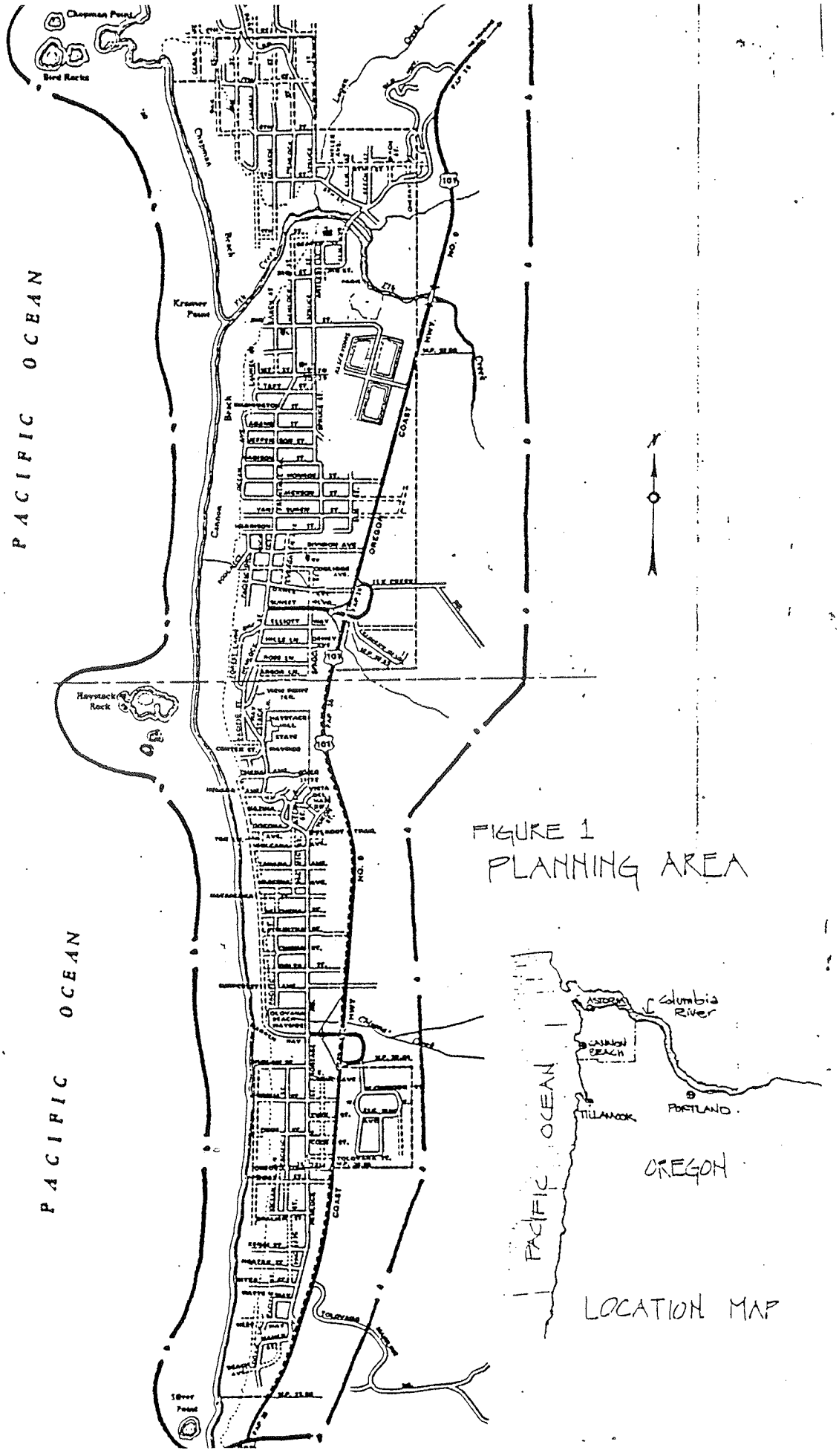
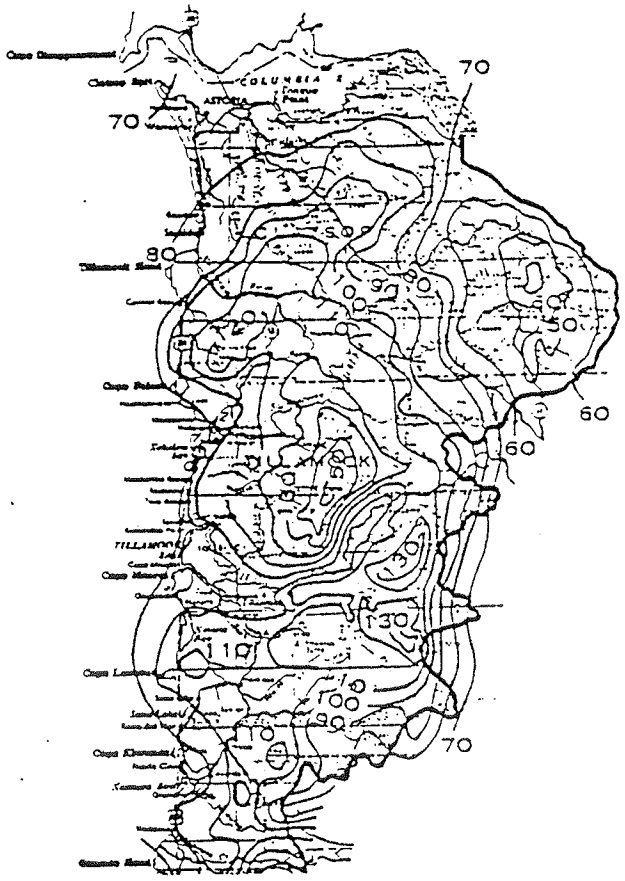



FIGURE 1
PLANNING AREA

LOCATION MAP

## AVERAGE ANNUAL PRECIPITATION




## PRECIPITATION CHART ASTORIA AIRPOR

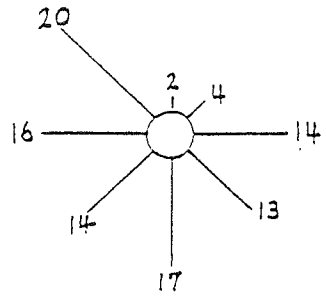
| Year | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1953 | | 5.33 | 6.48 | 2.68 | 4.11 | 2.90 | 0.65 | 3.12 | 3.90 | 4.30 | 12.68 | 12.20 | |
| 1954 | 18.94 | 9.54 | 4.17 | 4.70 | 1.68 | 3.68 | 1.77 | 2.24 | 2.30 | 4.44 | 10.10 | 10.22 | 75 |
| 1955 | 5.94 | 6.23 | 8.64 | 8.04 | 1.62 | 2.73 | 3.42 | 0.10 | 3.37 | 12.24 | 14.64 | 10.37 | 83 |
| 1956 | 17.09 | 9.33 | 13.47 | 1.23 | 1.43 | 4.44 | 0.18 | 2.13 | 3.78 | 11.37 | 2.37 | 9.03 | 76 |
| 1957 | 4.78 | 6.90 | 9.73 | 3.94 | 2.42 | 3.11 | 1.68 | 1.14 | 0.42 | 3.43 | 7.68 | 11.37 | 60 |
| 1958 | 9.61 | 10.94 | 6.62 | 7.02 | 1.03 | 2.40 | 0.09 | 0.52 | 1.94 | 7.39 | 14.14 | 12.17 | 72 |
| 1959 | 13.24 | 8.04 | 7.68 | 4.40 | 3.49 | 3.77 | 0.91 | 0.92 | 3.36 | 6.68 | 11.40 | 8.36 | 74 |
| 1960 | 10.09 | 8.43 | 7.40 | 5.82 | 6.40 | 1.67 | 0.31 | 1.64 | 1.69 | 7.32 | 13.91 | 8.12 | 71 |
| 1961 | 9.03 | 21.69 | 10.69 | 3.47 | 2.90 | 1.10 | 0.30 | 1.30 | 1.49 | 7.32 | 8.34 | 10.40 | 80 |
| 1962 | 8.53 | 5.41 | 3.18 | 7.44 | 2.88 | 1.47 | 0.34 | 2.44 | 3.50 | 7.40 | 14.21 | 6.78 | 66 |
| 1963 | 4.78 | 6.44 | 6.13 | 3.78 | 1.91 | 1.40 | 1.32 | 1.20 | 2.20 | 9.38 | 13.14 | 9.12 | 63 |
| 1964 | 18.50 | 4.08 | 7.41 | 3.59 | 2.27 | 2.70 | 2.39 | 2.21 | 2.73 | 2.61 | 11.15 | 13.67 | 73 |
| 1965 | 10.59 | 6.77 | 0.92 | 5.47 | 2.74 | 0.75 | 0.44 | 1.95 | 0.50 | 3.97 | 11.42 | 11.78 | 63 |
| 1966 | 9.61 | 5.33 | 8.79 | 2.50 | 2.18 | 2.13 | 0.34 | 1.01 | 2.18 | 3.43 | 10.00 | 14.07 | 63 |
| 1967 | 14.35 | 6.07 | 8.38 | 5.32 | 1.37 | 1.14 | 0.22 | 0.19 | 3.07 | 11.06 | 5.74 | 9.04 | 66 |
| 1968 | 9.37 | 9.37 | 10.42 | 4.22 | 3.91 | 4.43 | 1.23 | 3.22 | 4.40 | 8.03 | 11.96 | 13.43 | 87 |
| 1969 | 12.03 | 5.47 | 3.16 | 3.84 | 3.92 | 3.63 | 0.34 | 0.62 | 4.35 | 5.28 | 5.77 | 11.69 | 62 |
| 1970 | 10.44 | 9.25 | 4.26 | 7.74 | 1.92 | 1.19 | 0.31 | 0.08 | 3.65 | 3.80 | 9.44 | 15.93 | 70 |
| 1971 | 10.66 | 6.67 | 9.66 | 4.09 | 2.30 | 2.97 | 1.35 | 1.14 | 4.65 | 6.34 | 9.08 | 13.43 | 79 |
| 1972 | 10.62 | 8.38 | 10.04 | 6.82 | 1.22 | 0.92 | 2.01 | 0.37 | 4.72 | 1.38 | 6.90 | 13.28 | 67 |
| 1973 | 5.72 | 2.60 | 5.71 | 2.38 | 3.10 | 4.26 | 0.07 | 0.44 | 4.19 | 5.32 | 14.75 | 15.79 | 65 |
| 1974 | 12.47 | 8.38 | 10.73 | 4.48 | 4.37 | 2.33 | 4.20 | 0.29 | 0.67 | 1.65 | 6.95 | 13.24 | 72 |
| 1975 | 13.22 | 8.03 | 5.66 | 3.90 | 2.91 | 1.69 | 0.22 | 2.62 | 0.04 | 12.34 | 12.28 | 13.44 | 80 |
| 1976 | 11.62 | 7.84 | 7.17 | 3.35 | 2.20 | 1.27 | 2.44 | 2.35 | 1.38 | 2.98 | 1.45 | 4.20 | 46 |
| RECORD | | | | | | | | | | | | | |
| MEAN | 11.61 | 7.77 | 7.42 | 4.91 | 2.82 | 2.59 | 1.14 | 1.44 | 2.85 | 6.44 | 10.01 | 11.62 | 70 |

## AVERAGE TEMPERATURE ASTORIA AIRPORT

| Year | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1953 | | 43.3 | 44.4 | 47.7 | 52.4 | 55.0 | 60.4 | 61.1 | 59.4 | 54.2 | 49.4 | 43.4 | |
| 1954 | 40.2 | 43.1 | 42.8 | 46.5 | 52.3 | 54.2 | 57.7 | 59.7 | 58.6 | 52.6 | 50.4 | 43.6 | 50.4 |
| 1955 | 41.0 | 41.3 | 41.4 | 43.3 | 49.2 | 55.3 | 57.4 | 58.3 | 56.7 | 52.2 | 42.9 | 41.5 | 48.4 |
| 1956 | 41.9 | 38.4 | 42.8 | 46.3 | 53.4 | 55.2 | 60.4 | 59.8 | 57.2 | 50.5 | 46.2 | 42.4 | 49.7 |
| 1957 | 35.9 | 42.4 | 43.4 | 46.8 | 54.2 | 57.8 | 59.0 | 60.2 | 57.0 | 53.0 | 45.9 | 43.0 | 50.8 |
| 1958 | 48.9 | 49.3 | 49.2 | 48.5 | 55.4 | 60.5 | 62.4 | 62.0 | 58.9 | 55.1 | 46.4 | 47.6 | 53.1 |
| 1959 | 42.3 | 43.0 | 45.3 | 49.4 | 52.2 | 56.8 | 60.3 | 58.8 | 56.4 | 53.6 | 46.6 | 42.2 | 50.7 |
| 1960 | 40.3 | 43.3 | 44.8 | 48.1 | 51.0 | 56.3 | 59.3 | 59.8 | 57.3 | 53.5 | 46.9 | 43.5 | 50.3 |
| 1961 | 47.2 | 46.6 | 45.8 | 47.3 | 52.4 | 58.3 | 61.9 | 61.3 | 58.4 | 51.0 | 43.7 | 42.3 | 51.3 |
| 1962 | 40.2 | 43.3 | 43.3 | 46.3 | 50.3 | 54.9 | 58.2 | 60.3 | 58.4 | 53.4 | 48.6 | 44.6 | 50.6 |
| 1963 | 36.9 | 44.7 | 45.0 | 46.3 | 53.0 | 55.8 | 60.3 | 61.1 | 61.2 | 54.9 | 47.6 | 44.3 | 51.3 |
| 1964 | 42.3 | 42.3 | 44.3 | 45.6 | 49.3 | 53.2 | 59.2 | 59.3 | 57.4 | 53.8 | 46.6 | 40.5 | 49.6 |
| 1965 | 42.3 | 44.2 | 47.2 | 48.3 | 50.9 | 56.3 | 60.2 | 61.7 | 57.0 | 55.3 | 48.6 | 46.3 | 51.1 |
| 1966 | 42.3 | 42.6 | 43.7 | 46.0 | 50.5 | 56.3 | 59.4 | 60.3 | 59.2 | 51.7 | 47.6 | 45.9 | 50.7 |
| 1967 | 43.6 | 43.2 | 44.2 | 46.3 | 51.7 | 56.3 | 61.1 | 62.6 | 60.3 | 52.9 | 48.1 | 41.2 | 51.6 |
| 1968 | 42.0 | 47.3 | 46.7 | 48.1 | 52.2 | 58.1 | 61.2 | 60.1 | 57.9 | 50.6 | 47.1 | 39.9 | 50.6 |
| 1969 | 34.3 | 40.3 | 44.3 | 46.6 | 53.5 | 57.6 | 58.6 | 58.7 | 57.2 | 51.0 | 46.5 | 44.1 | 49.6 |
| 1970 | 41.6 | 46.3 | 46.9 | 45.3 | 51.4 | 56.6 | 59.3 | 60.2 | 56.0 | 51.0 | 47.1 | 40.6 | 50.1 |
| 1971 | 40.7 | 42.3 | 42.0 | 46.3 | 51.4 | 56.6 | 59.4 | 62.4 | 57.9 | 51.3 | 46.6 | 41.2 | 49.7 |
| 1972 | 40.0 | 43.3 | 47.2 | 46.6 | 54.7 | 58.3 | 62.2 | 63.4 | 57.6 | 52.3 | 47.3 | 38.6 | 51.0 |
| 1973 | 40.3 | 44.3 | 44.4 | 48.9 | 53.4 | 56.6 | 59.7 | 57.4 | 57.9 | 51.2 | 44.3 | 45.2 | 50.3 |
| 1974 | 38.9 | 42.1 | 44.7 | 46.0 | 50.3 | 56.1 | 59.3 | 62.1 | 60.6 | 51.9 | 48.0 | 45.4 | 50.7 |
| 1975 | 42.8 | 43.1 | 43.8 | 46.9 | 52.8 | 55.4 | 60.7 | 59.7 | 59.3 | 50.9 | 46.8 | 44.7 | 50.6 |
| 1976 | 44.3 | 42.6 | 43.7 | 46.7 | 52.6 | 55.9 | 61.1 | 61.7 | 60.6 | 53.2 | 48.0 | 43.5 | 51.3 |
| RECORD | | | | | | | | | | | | | |
| MEAN | 41.2 | 43.6 | 44.4 | 47.3 | 52.1 | 56.4 | 59.9 | 60.5 | 58.4 | 52.5 | 46.7 | 42.6 | 50.3 |
| MAX | 49.0 | 50.6 | 51.9 | 55.0 | 60.0 | 63.8 | 67.7 | 68.4 | 67.7 | 60.6 | 53.9 | 48.7 | 57.8 |
| MIN | 33.4 | 36.3 | 36.8 | 39.6 | 44.2 | 49.1 | 52.1 | 52.3 | 49.0 | 44.1 | 39.4 | 37.1 | 43.1 |

## WIND ROSE

## ASTORIA AIRPORT
## (24 Years of Data)




0 10 20 30 40 50 60 70 80 90

Scale of Wind Percentages

One or two days a year, depending upon the right climatic conditions, smoke and associated odors drift over the northern part of the city from the open-burning dump located northeast of town.

This practice of burning garbage was scheduled to be eliminated from the Cannon Beach disposal site in October, 1977, but is still being allowed under a permit extension from DEQ. The automobile is considered to be the major source of gaseous pollutants.

An unpleasant odor comes from the bird rocks located in the ocean west of Chapman Point. During the nesting season, on days with northwest winds, the smell of "rotten eggs" is readily apparent in downtown Cannon Beach.

The only available air pollution data pertinent to the area are for suspended particulate measurements taken in Astoria, 25 miles to the north. A significant source of that "pollutant" is the associated airborne salts from the Pacific Ocean. The background level of suspended particulates (the concentrations from natural sources only) is estimated at between 14 and 20 micrograins per cubic meter. This compares favorably with the primary Federal standard of no more than 75 micrograms per cubic meter.

Fireplaces and wood heaters also contribute to air pollution in Cannon Beach, although this is primarily particulate matter.

Geology

Two major basalt headlands, Cape Falcon and Tillamook Head, bracket the shorelands on which Cannon Beach is located. (See Figure 3) Cape Falcon to the south of Cannon Beach is a part of the headland complex that extends northward to Arch Cape and lies at the southern end of an extensive area of basalt. This is the mountainous terrain, southwest of the city, extending inland as far as the southern and eastern portions of the Elk Creek basin.

From Arch Cape north to Tillamook Head, the bedrock is almost continuously sedimentary. The lowland area is level where there is a marine terrace and irregular where ridges of the hills to the east project to the beach. The shore in front of the marine terrace is sand beach interrupted occasionally by small points of land (i.e. Humbug Point and Chapman Point), comprised of basalt and in some places, massive sand stone (i.e. Silver Point and Hug Point). North of Silver Point, Cannon Beach extends without interruption as far as Chapman Point. The beach segment north of Elk Creek to Chapman Point is sometimes referred to as Chapman Beach.

Besides the several small promontories of basalt along the beach, numerous basalt remnants in the form of rock knobs and sea stacks lie just off shore.

The most notable of these is Haystack Rock, located less than one mile south of the mouth of Elk Creek. That stack is principally fragmental basalt cut by numerous dikes. Near its base and in the satellite stack attached to the south side there is sedimentary rock intermixed with basalt, which suggests the rock is of submarine origin or of lava that poured into the sea.

Geological studies indicate that hard-ended or consolidated rock units ranging in age from one to 63 million years ago and unconsolidated units in age of one million or less years ago underlie the Elk Creek Basin and Cannon Beach areas. The consolidated units total over 20,000 feet in thickness and include basaltic lava flows, breccia and tuff, and marine siltstone, claystone and sandstone. Unconsolidated deposits include the marine terraces, flood plain alluvium and beach sand.

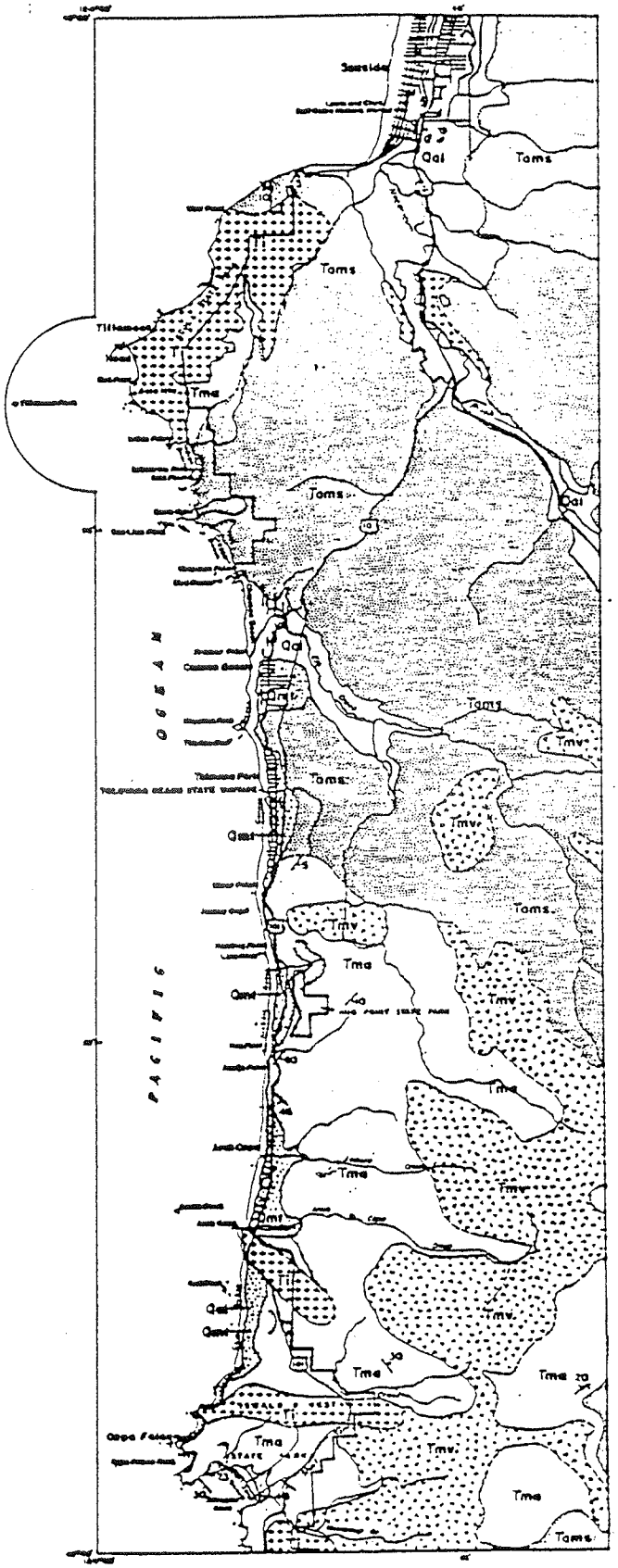
Elk Creek has removed much of the marine terrace at the northern end of the Cannon Beach area and formed an alluvial plain. The main business section of Cannon Beach is built on that plain. The plain also extends upstream from the Cannon Beach area as shown in Figure 3. The soil is largely dark brown silt loam, friable, and strongly acid. It is, or would be, well suited for agriculture but is limited by wetness and flooding in some areas. Soil borings in 1971 along the present city levee indicated soft deposits of peat and organic silt that overlay a dense fine sand.

Sedimentary rocks are the most widespread in the Elk Creek Basin (see Figure 3). They consist of thin-bedded to massive, tuffaceous siltstone and claystone with lesser amounts of sandstone and shale locally. The siltstone weathers to form thick residual soils.

Unstable zones of sedimentary rock masses exist along the coast between Tillamook Head and Cape Falcon. Where these zones are exposed to wave erosion there are sites of active and inactive landslides (see Figure 3). Slides have been particularly active within Ecola State Park and adjacent to Silver Point.

Landslides have helped shape the highly scenic indentations that lie between the points of land of the locality. The rocks that appear west of Chapman, Ecola and Silver Points, and Haystack Rock mark former positions of those promontories, and the points once extended seaward much farther than the exposed outermost rocks. As erosion continues the existing points will be destroyed, and their remnants will become additions of the reef as part of the very gradual but continuous change in the scene along the coast.

# Figure 3
# Cape Falcon to Tillamook Head




EXPLANATION

Qal — Alluvium and dune sand

Qmt — Marine terraces

UNCONFORMITY

Tmv — Miocene volcanic rocks
Localized accumulations of massive basalt breccia, basalt flows, palagonitic breccias and pillow basalts

Intrusive rocks
Middle to late Miocene basaltic intrusive rocks which include mick sills

Tma — Astoria Formation
Approximately 2,000 feet of consolidated to semi-consolidated, thick-bedded to thin-bedded, medium-grained, buff, micaceous, arkosic sandstone and interbedded siltstone of early Miocene age

UNCONFORMITY

Tams — Oligocene to Miocene sedimentary rocks
Over 5,000 feet of thin-bedded to massive, medium-gray to dark-gray, tuffaceous siltstone and claystone with subordinate amounts of sandstone and shale locally

Fault
Dashed where approximately located or indefinite, dotted where concealed
U, upthrown side; D, downthrown side

Contacts
Dashed where approximately located

Approximate strike and dip of beds or flow

Active landslide

181

## Soils and Topography

Unconsolidated soil types located in the Cannon Beach area include the marine terrace, floodplain alluvium, beach sand, and the dense clays and silty clays on moderate to steep slopes.

Numerous soil types have been mapped within the Cannon Beach area (See detailed soils map and descriptions in appendix). The following soil types are dominant in the hilly, upland areas (slopes up to about 60%), (Figure 4) underlain by consolidated, marine sedimentary rocks: Chitwood silty clay loam (slopes up to 12%), Walluski silt loam (slopes up to 20%), Tolovana silt loam (slopes up to 30%), and Ecola silt loam (slopes up to 60%).

The marine terraces are comprised of soils in the Chitwood and Walluski Soil Series. Slopes on these soils average from zero (0) to twenty (20) percent. The main locations for these soil types are between Taft and Ross Avenues and east toward the Pacific Power and Light Substation and all of Tolovana Park.

Coquille silty clay loam (slopes up to 7%) is the dominant soil type found on the flood plain of Elk Creek, upon which the main business district of Cannon Beach is located. Soil borings made in 1971 along the present city levee indicate that dense, fine sand underlies soft peat, organic silt and the soil of the flood plain. There alluvial soils are located (Figure 4) north of First Street to Elk Creek and east up the Elk Creek Basin. A smaller area is located north of Elk Creek in association with Logan Creek.

Beach sand is found extending the entire length of Cannon Beach along the ocean shore and the dune complex located from Breakers Point to Chapman Point. The beach sand is an accumulation of unconsolidated material of basalt and sandstone, generally identified by the extreme high water line and the start of vegetation. The beach itself slopes gently seaward (3% or less) but is steeper locally where it grades into adjacent sand dunes shoreward such as at Breakers Point and elsewhere where dunes are nested against sea cliffs. Soils of the Westport series occur on stabilized portions of dunes in the area.

The Breakers Point dune is the major sand dune system located in Cannon Beach. It is located north from Elk Creek to Chapman Point and west of Laurel and Larch Streets to the vegetation line (see Figure 4). This dune system is made up of an active foredune, conditionally stable dunes and a stable dune consisting of approximately 26 acres. The stable dune is evidenced by the beginnings of a soil profile along with such plant species as scotch broom, salal, spruce, pine and ivy. The dominant vegetation found along the foredune is European beach-grass, while in the conditionally stable

dune areas, additional plants species capable of survival include, lupine, vetch, strawberry and beach sedge.

Additional information about the Breakers Point dune system specifically and dune systems in general may be found in Terrain Sensitivity of the Proposed 'Breakers Point' Condominium Site, Cannon Beach, Oregon, 1976, by Charles L. Rosenfeld and Plants of the Oregon Coastal Dunes, 1969, by Wiedemann, Dennis, and Smith.

The appendix contains a list of native vegetation plus plants that grow well in the Cannon Beach area. Both this list and the documents listed above may be used as reference sources for vegetation needed for soil stabilization, buffering, landscaping and other purposes. The list has been divided into two classes of plants: those that grow well on the ocean front or vicinity of the ocean] and those that are not salt tolerant.

Many residents of Cannon Beach grow fine vegetable gardens. Vegetables that are most easily grown here include the cabbage family, broccoli, cauliflower, lettuce, root crops of all types, peas, squash and beans. The climate of the area precludes some hot weather plants such as tomatoes and corn, although some gardeners use hybrid species or special techniques to successfully raise these crops. Acid soil is sometimes a problem for new gardens; this is normally corrected by adding lime, dolomite or wood ashes. The shallow depth of soil to clay is typically corrected by deep rototilling and the addition of organic material such as compost, peat, or other conditioners. The Cannon Beach Community Questionnaire indicated that more than 100 persons would be interested in participating in a community garden. Many others mentioned that they had their own vegetable garden on their property.

## Hydrology

The City of Cannon Beach is traversed by Elk Creek in the northern part of the city. Logan Creek joins Elk Creek near its mouth and provides drainage for a major portion of the city north of Elk Creek. Numerous small intermittent streams traverse the city from Elk Creek south to Silver Point and provide a major portion of drainage for the city.

### a. Surface Water

Elk Creek is formed by two main tributaries, the North and West Forks, which join about 2 1/2 river miles southeast from Cannon Beach and the ocean. Each of the tributaries is several miles long, flowing from elevations well above 1,000 feet msl. The streams descend quickly (about 200 to 400 feet per mile) to lower elevations so that along the

last few miles to the ocean, the water moves slowly over its flood plain where its gradient averages less than 25 feet per mile.

Elk Creek's flow is directly related to the watershed precipitation pattern: high flows occur during October through March and low flows occur during July through September. Because of the small drainage area and the steep stream gradient of tributaries, Elk Creek rises quickly following periods of intense precipitation.

Stream flow gages were recently installed (1975) for Elk Creek, one on each fork, just above their confluence. On the basis of the 110-inch annual precipitation for Elk Creek Basin and a single year (1975) discharge record, the Elk Creek mean annual runoff was 95,750 acre feet for 1975 (October 1974 to October 1975). Approximately 85 percent of the annual runoff occurs during the period of November through April. Only about 2 percent of the annual runoff occurs during the period of July through September. Recorded mean monthly flows for Elk Creek at the forks are shown in the following tabulations:

TABLE 1

MEAN MONTHLY FLOWS IN C.F.S., FOR ELK CREEK AT THE FORKS (1975)

| OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11.3 | 185.5 | 274 | 366 | 245 | 198.0 | 111.1 | 94.S | 36.3 | 16.1 | 34.8 | 20.0 |

b. Ground Water

The occurrence, movement, quantity and quality of ground water are determined in larger part by the geology of the region it originates in and flows through. A continuing supply of ground water also requires a favorable climate to replace the water at an adequate rate. Most of the Elk Creek Basin is underlain by fine-grained marine sedimentary rocks and associated volcanic rocks of low porosity (capacity to store water) and permeability (capacity for water movement.) Consequently, ground water yields are generally low in Elk Creek Basin areas. Coastal dune areas and lowland areas such as the valley floor along Elk Creek store and deliver large quantities of water. Recharge occurs mainly in infiltration from rainfall.

The water table surface adjacent to Elk Creek and its lower reaches is 2 feet or less below the ground surface during the wet season. During the dry season, the water table drops several feet. A typical well in the Elk Creek area could be expected to yield 10 to 15 gallons per minute for each foot of drawdown. Existing well log data are located in the appendix.

c. Vegetation

According to Jerry F. Franklin and C. T. Dyrness, authors of Natural Vegetation of Oregon and Washington, the area comprised by northwestern Oregon and western Washington is the most densely forested region in the United States. Presently, 82 percent of that area is classed as forest land. The coniferous forest stands in the Elk Creek Basin are typically dense, tall and productive. Constituent tree species are Sitka spruce, western hemlock, western red cedar, Douglas fir, and Grant fir. Hardwood species occur on disturbed sites and also occupy the river-bottom lands. Major species there are red alder, big-leaf maple, black cotton-wood and Oregon ash. Under story species along the river include sword fern, various species of rushes and sedges, salmonberry and thimbleberry. Distinctive stands of pine and spruce, deformed by wind and salt spray, dot the beach-front areas.

Forest land dominates all of the area adjacent to the city. The majority of forest land is owned by the Crown Zellerbach Corporation. The Oregon Board of Forestry owns 160 acres of land along Elk Creek in the vicinity of the forks, while the City of Cannon Beach owns 60 acres along the south fork for its watershed.

The Oregon State Board of Forestry (OSBF) lands adjacent to the city are classified for commercial forest, recreation and wildlife uses. This site classification system along with appropriate maps are in the appendix.

Crown Zellerbach Corporation forest lands are site-class indexed the same as the OSBF lands and the classification system and maps are also in the appendix.

The particular community of wetland flora existing in the area between Elk Creek and the sewage lagoons is found only in small, isolated low areas along the streams on the Oregon and Washington coastline. The Elk Creek area supports several large Sitka spruce, Western hemlock, shrubby red alder and crabapple in the understory. Sedges, rushes and tussocks in the more low-lying portions, and grasses with some salal, salmonberry and twinberry make up the cover at ground level. (See Figure 5).

d. Wildlife

In the Cannon Beach area, the existence and management of vegetation is closely tied to the presence of wildlife, particularly those forms that have economic significance. How a road is constructed can determine the fate of a stream with regard to its population of salmon or trout. A clear cut has both detrimental and beneficial effects on wildlife habitat. A fire can be initially disastrous to all life forms, but the land given enough time re-establishes itself with flora and fauna.

The sparsely populated areas east of the city provide excellent habitat for many forms of wildlife: mammals and birds, reptiles and amphibians, microbes and marine organisms. The Oregon State Department of Fish and Wildlife is actively engaged in the management and protection of many forms of wildlife, while the Marine Region with the department is concerned with the management of commercial fish species and other marine organisms.

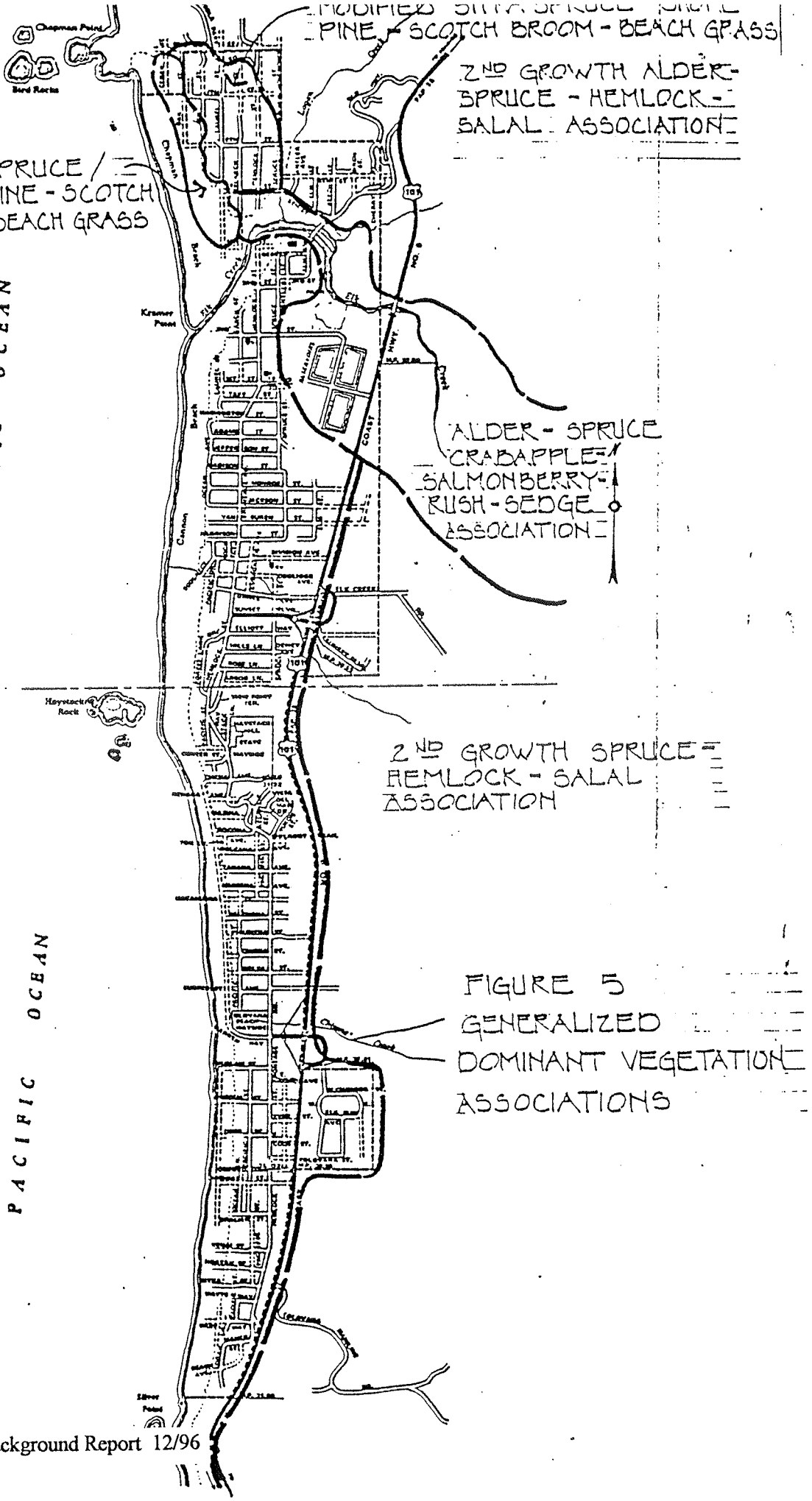



FIGURE 5
GENERALIZED DOMINANT VEGETATION ASSOCIATIONS

Some of the more common forms of wildlife found in and around the Cannon Beach area include:

Mammals

Roosevelt elk
Black-tailed deer
Black bear
Coyote
Wildcat
Muskrat
Mink
Rabbit
Raccoon
Weasel
Ground squirrel
Chipmunk
Beaver
Mole
Shrew
Meadow mouse
Otter
Opossum

Game Fish

Steelhead trout
Silver salmon
Chinook salmon (ocean)
Cutthroat trout
Rainbow trout

Birds

Grouse
Quail
Morning dove
Pigeon
Grebe
Phalarope
Sandpipers
Seagulls
Cormorant
Murre
Killdeer
Tufted puffin
Ducks
Merganser
Geese
Pidgeions
Shovelers
Teal

Owls
Peregrine falcon
(rare & endangered)
Hawks
Crows
Ravens

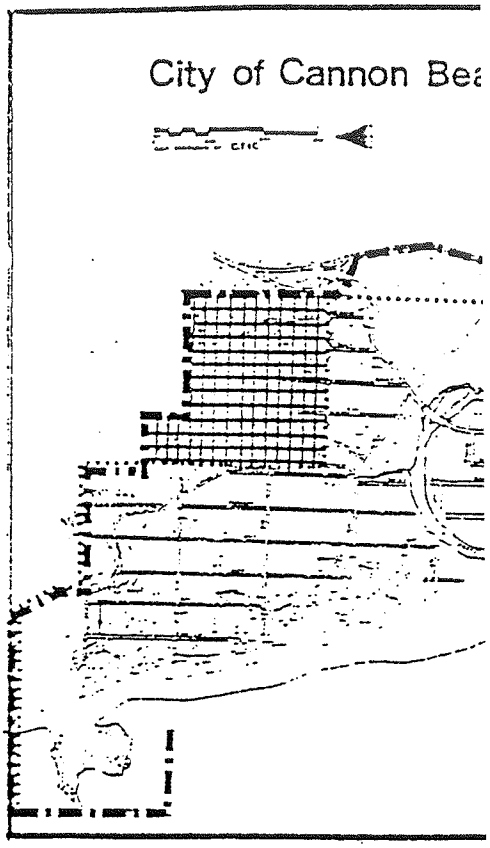
Water ouzels
Kingfisher
Great blue heron
Golden crowned ringlets
Woodpecker
Western fly catcher
Trails
Cowbirds
Golden pilated warbler
Goldfinch
Wrens
Swallows
Robins
Thrushes
Wren Tit, rush tit
Sparrows
Solitary vireo
Blackbirds

Jays
Oregon junco
Rufous-sided towhee
Starlings
Finches
Hummingbirds

e. Fish and Marine Life

Coastal streams contain habitat for Pacific salmon, steelhead, and sea-run cutthroat trout. Ecola Creek receives runs from three main species of these anadromous salmonids, which include the Pacific coho salmon, sea-run cutthroat trout and steelhead. The Oregon Department of Fish and Wildlife has surveyed the coho population of Ecola Creek since 1981. The attached table entitled, Standard Coho Survey 1981-1994, graphically displays the results of this survey and provides comparison data for the upper portion of the Necanicum River. The number of fish surveyed over the fourteen year period ranged from one in 1992 and 1993 to 76 in 1985. The median number of fish surveyed was between 16 and 19. Of the seven years with the lowest fish counts, four have been in the 1990's. Fish have been surveyed in the creek from the last week in October to the second week in February. Fish have been surveyed in each week of this 21 week period. According to the Department of Fish and Wildlife, having a wide range of time in which fish move into the river allows a greater chance for sustaining the fish population. In February of 1995, the Oregon Fish and Wildlife Commission determined not to list the coastal coho as a threatened or endangered species; coastal coho were listed as a sensitive species. This decision will be reviewed in one year. At the federal level, the process for considering the listing of coastal coho as an endangered species has been initiated. The National Marine Fisheries Service has proposed listing the coastal coho as a threatened species (1995). Resident cutthroat and resident steelhead inhabit Ecola Creek in its upper reaches. Their numbers have not been estimated, but of the two species cutthroat trout are more abundant and widespread.

The Cannon Beach area contains no large estuaries or extensive breeding areas for marine animals. However, there are several headlands and points, rock promontories and seastacks along the coast that provide habitats for a wide variety of marine flora and fauna. Tillamook Head, Ecola Point, Chapman Point, Haystack Rock, Jockey Cap Rock and Hug Point provide intertidal habitats for


City of Cannon Bea

many saltwater organisms. A limited amount of surf fishing from the beach and points goes on during the summer.

Common species in the area are:

| | |
|---|---|
| Sponge | Gumboot chiton |
| Nudibranch | Ribbon worm |
| Leather chiton | Sea lemon |
| Green anemone | Chiton |
| Leather star | Anemone |
| Lined chiton | Blood star |
| Tube worm | Finger limpet |
| Ochre star | Goose-neck barnacle |
| Bishop's hat limpet | Slender-rayed star |
| Acorn Barnacle | Leafy horn mouth |
| Six-rayed star | Pill bug |
| Black turban snail | Twenty-four-rayed star |
| Hermit crab | Keyhole limpet |
| Porcelain crab | Periwinkly snail |
| Red sea cucumber | Oregon cancer crab |
| Blue-top shell | White sea cucumber |
| Purple shore crab | Dire's whelk |
| Purple sea urchin | Kelp crab |
| Snails | Red sea urchin |
| Solitary ascidian | Colonial ascidian |

Limited amounts of silver and chinook salmon and various species of bottom fish are caught off the coast of Cannon Beach.

## Ecola Creek Estuary

According to the Estuarine Resources of the Oregon Coast, by the Oregon Coastal Conservation and Development Commission, 1974, Ecola Creek may qualify as a Type III or "Conservation" Estuary (areas to be designated for long-term uses of renewable resources and that do not require major alteration of the estuary, except for the purposes of restoration). But due to its minimal estuarine characteristics, Ecola Creek might also be considered a "drowned tidal creek".

Tidal influence extends to just above the U.S. 101 bridge, a total distance of ½ of a mile. Ecola Creek is a well-mixed tidal creek having very low marine biological and moderate terrestrial biological value. Ecola Creek has no definable eel-grass beds or tidelands. According to the Cannon Beach Wetland Study, the Ecola Creek estuarine area consists of forested wetlands, estuarine emergent wetland and estuarine/shrub-scrub wetlands. The forested wetland vegetation is described as a "multi-layered canopy dominated by Sitka spruce, red alder, Hooker's willow, salmonberry, skunk cabbage, slough sedge and lady fern". The vegetation found in the estuarine emergent wetlands consists of Pacific silverleaf, Lyngbye's sedge and beachgrass. The vegetation in the estuarine shrub-scrub is similar to that of the emergent vegetation but the area is being invaded by Hooker's willow.

Ecola Creek has sediments of mixed sand, gravel and mud. These sediment types combined with low salinities limit Ecola Creek to small anadromous fish runs of coho and steelhead trout. But for its size Ecola Creek sustains a fairly large stable run of native searun cutthroat trout; and for this reason the Oregon Department of Fish and Wildlife recommends that Ecola Creek be left in its natural state of providing a "wild stock" anadromous fishery.

Ecola Creek is an important natural resource for Cannon Beach. It serves as a recreation area for swimmers, fishermen, hikers, canoeists and bird watchers. In a relatively short distance, it flows from a completely natural setting into a dense downtown area. (Information on the hydrology, tidal characteristics and wildlife are contained in the background data.) Ecola Creek has been identified by the Oregon Department of Fish and Wildlife as one of the most productive native searun cutthroat trout streams on the Oregon Coast. Numerous species of birds, small mammals and other animals inhabit the wetlands area east of U.S. Highway 101. This area is also noted as an important elk wintering habitat. Although there have been no recent sightings of rare and endangered species such as the bald eagle and peregrine falcon in the Ecola Creek area, these raptors have been known to inhabit Ecola Park area and feed on fish and waterfowl at the mouth of the creek.

As development of the City has occurred, Ecola Creek wetlands have been filled and diked. The City's downtown area sits on approximately 20 acres filled tidelands and wetlands. Of the approximately 100 acres of wetlands on the east side of U.S. Highway 101, about 5 acres have been filled. Approximately 16

acres west of U.S. Highway 101 remain in somewhat natural condition around the city park.

Although flooding has occurred recently (1967) and caused some damage, the City has raised the level of the dike and is in the process of adopting flood protection controls under the Federal Flood Insurance Administration Program. A proposal (in 1975) by the U.S. Army Corps of Engineers to extensively dike the area was rejected as being too costly. Clatsop County adopted an exception to the requirements of the Estuarine Resources Goal and the Coastal Shorelands Goal to permit the construction of a wetland treatment component to the city's wastewater treatment system, east of Highway 101. This system has been in operation, in conformance with the requirements of the city's NPDES Waste Discharge Permit, since 1984.

The ownership of the estuary and its shorelands is both public and private; uses such as the elementary school, Les Shirley Park, the wetlands area east of the dike and a small area of city property east of the Hemlock Street Bridge constitute the public property. Private holdings on the estuary consist of the Breakers Point development, homes situated along the mouth of the creek, a recreational vehicle park which incorporates a seasonal horse rental operation, and a conference center. East of U.S. Highway 101, the estuary is essentially undeveloped, with the exception of the wetlands treatment portion of the city's wastewater treatment facility

The U.S. Army Corps of Engineers has jurisdiction in the estuary under the "404" Wetlands Protection Program. The Oregon Division of State Lands regulates estuarine areas under provisions of the Fill and Removal Law. A schematic of the Ecola Creek estuary and the permit responsibilities of the various agencies is as follows:

Although the handbook mentioned here is useful in obtaining a general idea of the jurisdictions and concerns of the permit agencies, it is considered important by the agencies that any proposal must be examined on a site-specific, or case-by-case basis.

Portions of the Ecola Creek estuary, east of U.S. Highway 101, lies in unincorporated Clatsop County, within the city's urban growth boundary and within the city limits.